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Physical activity, screen time, and sleep duration of adolescents before and during COVID-19

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Abstract

The social isolation associated with the COVID-19 pandemic, including school closures, directly impacted the daily habits of adolescents. Thus, the present study aimed to analyze the level of physical activity, screen time, and sleep duration of adolescents before and during COVID-19. Therefore, a cross-sectional, quantitative study was carried out with 85 adolescents aged 14 to 18 years, students at a Federal Institute. Participants answered questionnaires on sociodemographic data, physical activity level, screen time, and sleep duration. Data were analyzed using the paired Student's T-Test. The significance level adopted was $p<0.05$. The results revealed that there was a significant increase in sleep duration on weekdays for girls ($p=0.001$) and boys ($p=0.001$) and in screen time during the pandemic for girls ($p=0.028$) and boys ($p= 0.004$). There was a decrease in the level of physical activity of girls ($p=0.025$). It is concluded that, among the students at this Federal Institute, the COVID-19 pandemic increased the sleep duration and screen time of male and female adolescents and decreased the level of physical activity of girls.

Keywords: Physical inactivity. Sedentary behavior. Sleep habits. Healthy lifestyle.

INTRODUCTION

In December 2019 a new genetic code of the Coronavirus (SARS-CoV-2) was discovered in Wuhan, China, which led to a respiratory syndrome in humans, called COVID-19[1]. On March 11, 2020, the World Health Organization (WHO) officially announced that COVID-19 was a pandemic[2]. As this disease became a public health emergency and a worldwide threat, governments ordered citizens to stay at home, closed schools and took other measures to prevent the spread of the virus[3]. In this scenario, behaviors related to lifestyle, such as physical activity (PA), sedentary behavior, and sleep duration of children and adolescents may have undergone changes that are harmful to health[4,5].

The initial restrictions associated with COVID-19, such as closing schools and parks, canceling organized sports practice and leisure activities, affected the daily habits of children and adolescents[6]. Lifestyle changes related to sleep[7], moderate to vigorous physical activity (MVPA)[8], and screen time[9] may be associated with outcomes related to the physical, social, and mental health of children and adolescents[8,10].

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With the aim of contributing to the healthy development of young people, Canadian researchers[11] and the WHO[12] developed 24-hour movement guidelines to guide the population about the importance of being physically active. These recommendations, based on scientific evidence, resulted in a series of systematic reviews that assessed the impact of each behavior (PA, sleep duration, and sedentary behavior) on health-related outcomes[7,8,10].

Decreased PA, sleep deprivation, and increased screen time have been associated with worse physical and mental health outcomes, including obesity, impaired glucose metabolism, cardiovascular disease, depression, anxiety, and poor academic performance[10,13]. Analyzing the context of the COVID-19 pandemic, a better understanding of the physical activity level (PAL), screen time, and sleep duration of children and adolescents could help create public policies and promote efficient interventions with the aim of minimizing the decrease in movement in this population.

In this context, taking into account the changes in the daily routine of adolescents, due to the COVID-19 pandemic, especially due to social distancing, and considering that the recommendations for PA practice, sleep duration, and screen time are probably not being followed, the present study aimed to analyze the PAL, sedentary behavior (through screen time), and sleep duration of adolescents before and during the pandemic.

METHODS

This study is characterized as descriptive, quantitative and cross-sectional[14], with an initial sample of 99 adolescents aged 14 to 18 years, students at a Federal Institute located in the city of Presidente Dutra, in the state of Maranhão. All students within the aforementioned age group were invited to participate in the study. Those who returned the Informed Consent Form (signed by parents or guardian) and the Informed Assent Form (signed by the participant) were included. This study complies with the Declaration of Helsinki, Resolution 466/2012 of the National Health Council, and was approved by the Research Ethics Committee of the Federal University of Vale do São Francisco (UNIVASF), under CAAE number 20875019.0.0000.5196 and protocol number 3.770.141, on December 13, 2019.

Data collection was carried out in two stages. The first took place in early March 2020, before COVID-19 was declared a pandemic, and the second stage took place four months later, while the population was in social isolation. The instruments used for data collection were questionnaires with questions about sociodemographic profile, activity level, screen time, and sleep duration.

In the first stage of data collection, the questionnaires were answered in the school environment, in classrooms, under the supervision of the researchers. In the second stage, on the other hand, the questionnaires were answered virtually, using the Google-Forms® platform. In both stages, the same questionnaires were used.

The sociodemographic questionnaire was applied only in the first stage and addressed questions related to gender, age, race, body mass, height, and online physical activity (use of active video games or exercise through online platforms). For the level of physical activity, the Physical Activity Questionnaire

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for Adolescents (PAQ-A)[15] was used. This questionnaire was translated, adapted, and validated for the Brazilian context by Guedes and Guedes[16] and assesses physical activity in free time (outside school) and during Physical Education classes. The instrument consists of eight items that have a 5-point response scale, which allows for establishing a score equivalent to the level of physical activity (from 1 to 5). The final score is determined by calculating the average of the responses. According to Benítez-Porres *et al.*[17], the PAQ-A is a useful tool and a score of 2.75 can be used as a cutoff point to characterize adolescents as "physically active" and "insufficiently active".

Sedentary behavior was estimated by screen time. To this end, questions about screen use (TV, video games, tablets, cell phones, and computers/notebooks) as leisure were asked in order to estimate screen time during weekdays and weekends. These questions were adapted and validated for young Brazilians by Guedes and Lopes[18]. To calculate screen time, screen hours on weekdays were initially multiplied by 5, and screen hours on weekends by 2. These values were added and then divided by 7. participants were divided into the following two groups: 2 or more hours of screen time per day; and up to 2 hours of screen time per day.

Sleep duration was determined through an adaptation of the Pittsburgh Sleep Quality Index, by Hayes *et al.*[19]. This adaptation is composed of four items that refer to the time that adolescents go to sleep and wake up on weekdays and weekends. Canadian 24-hour movement guidelines recommend that teenagers ages 13 to 18 get an average of 8 to 10 hours of sleep each night. In this context, participants were divided into the following two groups according to sleep duration: eight or more hours of sleep; and up to eight hours of sleep.

Statistics were initially performed using descriptive analysis (mean, standard deviation, absolute frequency, and relative frequency). The Kolmogorov-Smirnov test and Levene's Test of Homogeneity of Variance revealed that the variables had a normal distribution. Thus, to compare the values before and during the COVID-19 pandemic, the paired Student's T-Test was used. The effect size was calculated using Cohen's d according to the following classification: small (0.20), medium (0.50), and high (0.80)20. The significance level adopted was $p<0.05$ and the software used in the analyzes was SPSS version 22.0 for Windows®.

The sample calculation was performed using the G*Power 3.1.9.4 software, and revealed a necessary sample of 71 participants to reach an analysis power of 0.80, considering an effect size of 0.30 and a sampling error of 0.05 when using the paired Student's T-Test.

RESULTS

Of the 99 adolescents who participated in the first stage of the study (before the pandemic), 11 were excluded for not participating in the second stage and three more were excluded for not fully responding to the questionnaires. Thus, the final study sample consisted of 85 adolescents. Of the total number of participants, 54.1% were female. Mean age was 15 ± 0.79 years old and mean body mass index (BMI) was 20.31 ± 2.99 kg/m^2.

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With regards to race, 65.6% defined themselves as brown, 19.2% as white, and 15.2% as black.

Table 1 presents the prevalence of adolescents in each category according to the cutoff points used for PAL, screen time, and sleep duration before and during the COVID-19 pandemic. An increase in the prevalence of insufficiently active participants can be observed, as well as an increase in screen time and sleep duration during the pandemic.

When asked about the practice of online physical activity (use of active videogames or exercising through online platforms), most participants (60.25%) answered that they did not practice any. Of those who exercised with this modality, the frequency and duration response most obtained was three times a week, for 30 minutes. However, this information was only collected in the initial moment, before the pandemic.

Table 2 presents the comparison of the means of the variables according to gender in the two stages of data collection. Female participants showed a significant decrease in the PAL score. There was an increase, for both females and males, in weekly screen time and in weekday sleep duration. According to Cohen's d, changes in PAL and screen time had a small to medium effect size, while changes in sleep time during the week were considered high.

Table 1 – Characterization of participants' physical activity level, screen time, and sleep time before and during the COVID-19 pandemic (n=85). President Dutra, Maranhão, 2020.

Variables	Before COVID-19 n (%)	During COVID-19 n (%)
Insufficiently active	73 (85.8%)	77 (90.5%)
Active	12 (14.2%)	08 (9.5%)
Screen time ≥ 2hr/d	69 (81.2%)	78 (91.8%)
Screen time < 2hr/d	16 (18.8%)	7 (8.2%)
Sleep time ≥ 8 hr/d	31 (36.5%)	75 (88.2%)
Sleep time < 8 hr/d	54 (63.5%)	10 (11.8%)

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Table 2 – Comparison of physical activity level, screen time, and sleep duration before and during the COVID-19 pandemic according to gender (n=85). President Dutra, Maranhão, 2020.

Variables	Sex	Before COVID-19	During COVID-19	p-value	Cohen's *d*
Level of physical activity	Female (n=46)	1.89 ± 0.68	1.64 ± 0.61	0.025*	0.38
	Male (n=39)	2.18 ± 0.54	1.97 ± 0.63	0.058	0.37
Weekly screen time (hours)	Female (n=46)	3.91 ± 2.06	4.90 ± 2.77	0.028*	-0.40
	Male (n=39)	4.12 ± 2.28	5.43 ± 2.58	0.004*	-0.53
Sleep duration per week (hours)	Female (n=46)	7.52 ± 1.53	9.53 ± 1.70	0.001*	-1.24
	Male (n=39)	7.14 ± 1.26	9.01 ± 1.22	0,001*	-1.50
Weekend sleep duration (hours)	Female (n=46)	9.15 ± 1.50	9.53 ± 1.76	0.148	-0.23
	Male (n=39)	9.24 ± 1.36	9.05 ± 1.11	0.526	0.5

*p<0.05. Paired Student T-Test. Cohen's d: 0.20 (small); 0.50 (average); 0.80 (high).

DISCUSSION

The present study aimed to analyze the PAL, sedentary behavior (screen time), and sleep duration of adolescents before and during the COVID-19 pandemic. Results demonstrated that there was a significant decrease in PAL in female participants, and an increase in screen time and weekday sleep duration in both male and female participants.

These findings agree with those of Pietrobelli *et al.*[21], who identified, in children and adolescents in Italy, that the time spent practicing sports decreased, and screen time and sleep duration increased significantly during the pandemic. Additionally, a Canadian study with a similar population showed that, during the restrictions imposed by the pandemic, PAL decreased while sedentary behavior (including screen time) and sleep duration increased[22].

When analyzing the results according to gender, after the restrictions imposed by the pandemic, female participants had a 13% decrease in PAL, while male participants

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showed a decreasing tendency (p=0.058). These findings are in line with those found by Moore *et al.*[22], who pointed out changes in the practice of physical activity and leisure activities during the COVID-19 pandemic. Furthermore, this significant decrease found only among female participants may be associated with the fact that girls use more social media and sleep more than boys[22]. Also, female adolescents are usually less physically active than their male peers[23,24].

According to the National School Health Survey (NSHS)[25], only 38.5% of boys and 18.0% of girls aged between 13 and 17 years accumulated 300 or more minutes of physical activity per week, as recommended by the Guidelines for Physical Activity for the Brazilian Population[26]. In adults, the scenario is similar. According to the Surveillance of Risk and Protective Factors for Chronic Diseases by Telephone Survey (SRPFCDTS)[27] program, the practice of activity in free time was more than 150 minutes for 43.1% of men and 31.3% of women.

The results of the present study also revealed that sedentary behavior related to recreational screen time increased during the pandemic for both sexes. This is an expected behavior, since, due to the restrictions caused by the pandemic, it is plausible that screen time would increase. It is important to emphasize that, if used correctly, screen time can be positive for educational and socialization purposes[28]. However, most studies point out that excessive screen time is associated with health problems, including sleep deprivation, cardiovascular disease, and anxiety and depression[9,29,30] that can contribute to a decrease in quality of life[31]. In this scenario, it is important to point out that, even before the pandemic, 81.2% of the participants in the present study already had excessive screen time (Table 1).

Knowing that screens can also be used for the practice of physical activity, through active videogames and online platforms for performing exercises, the present study found that 39.85% (n=35) of the participants used these media to practice physical activity. The reported activities were dancing, aerobics, and exercises in general, with an average frequency of three times a week lasting for 30 minutes. The WHO and the Guidelines for Physical Activity for the Brazilian Population recommend that adolescents practice physical activity for at least 60 minutes a day at a moderate to vigorous intensity, and that screen time be limited to the minimum possible[26,32]. Therefore, it can be observed that the use of online platforms can be an alternative to increase the population's PAL. However, the frequency and duration of activities must meet the recommended amounts.

The new digital and social media are able to promote social interaction. However, the effects are multifactorial and depend on the type of media, mode of use, time of use, and user characteristics[33]. A more acceptable and sustainable option, regarding the use of the screen for physical activity, is active videogames, or “exergames”. According to Williams and Ayres[34], these types of games can be efficient tools to increase PAL in adolescents.

With regards to the participants' sleep duration, the results revealed a 26.5% increase in the number of adolescents who slept at least 8 hours, with a higher prevalence for females. Even if these data do not discriminate the participants' sleep quality, it is possible that an increase in hours of sleep may be related to a better quality of sleep[35]. Furthermore, this increase in sleep duration is probably associated with the fact that the participants are not physically attending schools, but with online classes at different

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times than usual. Other studies have shown that sleep duration, in adolescents, is strongly associated with school hours[36] and other biological factors[37].

Considering everything discussed above, it can be said that the consequences of COVID-19 go beyond viral infection. In addition to the impact on health and the economy, the pandemic has significantly changed lifestyle behaviors that are extremely important for children and adolescents, such as physical activity, screen time, and sleep duration[21,22]. Furthermore, it is possible that the long-term consequences of COVID-19 involve an increase in the prevalence of overweight[3].

Although the present study brings important information about PAL, screen time, and sleep duration of adolescents before and during the COVID-19 pandemic, some limitations must be considered. First, data were collected using a self-reporting instrument (questionnaires). Although these tools are widely used and validated, they are more prone to bias. However, considering the social distancing measures adopted, the use of such methods becomes perfectly understandable. Additionally, the pandemic had waves of contagion of different magnitudes, causing periods with more or less restrictions. Another limitation of the present study was the recruitment of the convenience sample. In this scenario, the results found here may not reflect the general behavior of adolescents, especially when considering different races and social strata.

Despite the limitations mentioned above, the present study has, as its greatest contribution, the discussion on the effects of the COVID-19 pandemic on the health of adolescents. Furthermore, data were collected at two different times (before and during the pandemic), reducing participants' memory bias. Thus, the findings of the present study can help to better understand the behavior of adolescents in atypical situations and help to build the prevention of deleterious behaviors (decreased PAL and increased screen time) in future situations.

CONCLUSION

It is concluded that, for the studied Federal Institute population, the PAL of female adolescents decreased, and screen time and sleep duration during weekdays increased in both sexes during the COVID-19 pandemic.

Author Statement CREdiT

Conceptualization: Moura, ARLI; Moraes, JFVN. Methodology: Moura, ARLI; Moura, MN; Moraes, JFVN. Validation: Moura, ARLI; Moura, MN; Cabral, PUL; Carvalho, FO; Moraes, JFVN. Statistical analysis: Moura, ARLI; Moraes, JFVN. Formal analysis: Moura, ARLI; Moura, MN; Cabral, PUL; Carvalho, FO; Moraes, JFVN. Research: Moura, ARLI; Moura, MN; Moraes, JFVN. Resources: Moura, ARLI; Moura, MN; Moraes, JFVN. Elaboration of the original text: Moura, ARLI; Moura, MN; Moraes, JFVN. Writing-revision and editing: Moura, ARLI; Moura, MN; Cabral, PUL; Carvalho, FO; Moraes, JFVN. Visualization: Moura, ARLI; Moura, MN; Cabral, PUL; Carvalho, FO; Moraes, JFVN. Supervision: Moura, ARLI; Moraes, JFVN. Project management: Moura, ARLI; Moura, MN; Moraes, JFVN.

All authors read and agreed with the published version of the manuscript.

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