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Indoor physical activities, eating and sleeping habits among school adolescents during COVID-19 pandemic

Atividades físicas internas, hábitos alimentares e dormir entre escolares adolescentes durante a pandêmica de COVID-19

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ABSTRACT

Social isolation is a strategy to avoid contracting and spreading the coronavirus. This study aimed to evaluate physical activities (PA) performed indoors and other habits among adolescents during social isolation due to the coronavirus pandemic (COVID-19). A cross-sectional study including 342 adolescents, aged 12 to 17 years, all students from a public school who regularly participated in sports activities during the school day. An online questionnaire was sent to the students via a web link with 18 questions about eating habits, sleep, virus protection and PA. The average age of the students was 15 ± 1.36 years, 41.5% of them live with three people at home, 77.5% live in houses, 95% answered that they were following the recommended care for COVID-19. Two thirds of the family members worked outside their homes and 65.2% of them were working in direct exposure to COVID-19 (essential services). More than half (53.2%) of adolescents eat up to three meals a day and 80% meet the recommended hours of rest per night. Most of the day was on social networks and only 27% met the recommendations for PA; 29.8% reported weight gain and among them, 54.9% reported exercising at times and 27.4% no exercise at all ($p < 0.001$). We concluded that despite recommendations, there were reduction in daily PA and increase in screen time among adolescents during social isolation due to COVID-19. There is an urgent need to review strategies to encourage adolescents to maintain indoor PA in addition to a healthier habit.

Keywords: Vírus; Pandemia; Adolescents; Athletes; Exercise; Brazil.

RESUMO

O isolamento social é estratégia para evitar o contágio e transmissão do coronavírus. Este estudo teve como objetivo avaliar as atividades físicas (AF) realizadas em ambientes fechados e hábitos de saúde entre adolescentes durante o isolamento social devido à pandemia de COVID-19 (COVID-19). Estudo transversal com 342 adolescentes, de 12 a 17 anos de idade, estudantes de escola pública e participantes de atividades esportivas escolares. Um questionário on-line foi enviado para os estudantes com 18 perguntas sobre hábitos alimentares, sono, comportamentos de proteção ao COVID-19 e AF. A idade média dos estudantes foi de 15 ± 1,36 anos, 41,5% vivem com três pessoas, 77,5% moram em casas, 95% responderam que estão tomando as medidas de proteção recomendadas. Dois terços dos familiares trabalham fora de casa sendo que 65,2% deles em exposição direta ao COVID-19 (serviços essenciais). Mais da metade (53,2%) dos adolescentes fazem até três refeições por dia e 80% cumprem as horas de descanso recomendadas por noite. A maior parte do dia é usada em redes sociais e penas 27% atenderam às recomendações para AF e 29,8% relataram ganho de peso. Entre os adolescentes que relataram ganho de peso, 54,9% relataram fazer exercícios às vezes e 27,4% não fazem nenhum exercício ($p < 0,001$). Concluímos que, apesar das recomendações, houve redução nas AF diárias e aumento no tempo de tela entre adolescentes durante o período de isolamento social. Faz-se necessária reavaliação das maneiras de incentivar os adolescentes a manter a AF em ambientes fechados e hábitos de saúde mais saudáveis.

Palavras-chave: *Vírus; Pandemia; Adolescentes; Atletas; Exercício físico; Brasil.*

Introduction

The coronavirus pandemic (COVID-19) raised great concern in scientific health as well as in the education and occupational sectors, affecting well-established processes in everyday life around the world. The greatest impact of COVID-19 is its fast spread, reaching all continents in short time, which differentiates from other viral outbreaks[1,2]. In many countries, the installation of social isolation occurred drastically, as a strategy to avoid contracting and spreading the virus. The proposal for

social isolation aimed at a better distribution of serious cases over time. The mortality by COVID-19 was associated with people who were more debilitated in terms of health, with predominance in elderly people, smokers, presence of obesity and metabolic comorbidities[3].

Brazil's first COVID-19 case was confirmed on February 26th 2020. After evidence of local transmission, social isolation began on March 19th. Brazilian social isolation (Federal Decree 4230) determined the closing of schools, universities, gyms as well as limited access to stores and shopping. Further restrictions for use of parks for the practice of outdoor physical activities or leisure were made, according to the recommendations of the World Health Organization (WHO)[3].

Given the recommendation of social isolation[3], it is essential to encourage physical activity indoor, in addition to a healthy lifestyle routine. However, since the establishment of social isolation, sedentary habits related to leisure activities, work and school settings increased. Individuals tend to adopt sedentary habits, neglecting their food, change their sleep habits, and stay in front of the computer or cell phone for a long time. In addition, isolation decreases time spent in physical activity[4]. The interruption of physical activities and prolonged time in sedentary behavior may be associated with psychosocial disorders, weight gain and cardiovascular risk[4-7].

Therefore, the aim of this study was to evaluate the indoor physical activities and other health habits (eating, sleeping and virus protection) during social isolation due to the coronavirus pandemic in a sample of adolescents who were active before isolation in the city of Curitiba, Brazil. In Curitiba, emergency situation was declared on March 16, 2020 and school activities were gradually suspended from March 17 to 20. The classes were broadcast on television channels, YouTube and Google classroom. Moreover, only essential commerce was allowed in the city with a limited number of people. The use of masks and alcohol gel became obligatory. Home-working and reduced working hours were recommended. Therefore, the aim of this study was to evaluate the indoor physical activities and other health habits (eating, sleeping and virus protection) during social isolation due to the coronavirus pandemic in a sample of adolescents who were active before isolation in the city of Curitiba, Brazil.

Methods

This was an observational, cross-sectional study conducted with 342 adolescents from a group of 450 adolescents who regularly participated in sports activities during the school day and who agreed to take part in the study. All were from the sixth grade of elementary school to the third year of high school, from a public school in the municipality of Curitiba, Parana, south region of Brazil. Inclusion criterion was to be enrolled in any sport in 2020 at the school. The participants were selected by convenience, using the non-probabilistic sampling process. The G *Power software was used to determine the study's sample size. A power of 0.80, 95% confidence level and 5% sampling error was assigned, with an estimated sample size of 208 participants and with 10% error, totaling 228 participants. The exclusion criterion was no answer to the open questions in a consistent manner.

A questionnaire with 18 questions was sent to all adolescents via a web link by their sport coach during the second half of April 2020. Together the students received the Invitation Letter, the Informed Consent Form and the Term of Assent. The questionnaire consisted of closed (13), multiple choice (1) and open questions (4). The first section had questions on modality of physical activity/sport, characteristics of the environment, housing type, number of people in the house, number of people working outside the home, and number of people with risk factors for COVID-19. The second section included three questions related to physical activity and time active during the week. In addition, it was asked whether the student received some assistance from the government or the community and the necessity of any emergency help. The questions were based on recommendations about physical activity[3], eating[8] and sleeping[9] according to the age group and the answers were mandatory. In case of positive answer to the physical activity question, the student needed to answer the next questions: type, intensity, with whom (open question) and place at home used to exercise (room, corridor, covered outdoor area, uncovered outdoor area or garden, common area of the condominium). In addition, there was one question related to eating (recommended number of meals and eating habits, irregular feeding) and sleeping (adequate and inadequate) behaviors. The participants had 48 hours to answer the questions.

Box 1 shows the activities guided by teachers via mobile application, in the form of videos and photos, for the five sports performed for most adolescents during the first month of social isolation.

Data were expressed as mean and standard deviation (SD), absolute and relative frequencies. The chi-square test was used to determine the differences in the proportion between individual and collective modali-

ties with physical activity variables, sleep, eating habits. The chi-square test was used to analyze the difference between individual and collective modalities in physical activity variables, sleep, eating habits. Analysis of variance (ANOVA) one way was used for age. All analyses were performed in the Statistic software, version10.0.

Box 1 – Specific activities guided by teachers during social isolation by sport, Curitiba, Paraná, 2020 (n = 342).

Rhythmic gymnastics	
	stretches, rhythmic gymnastics exercises, strength exercises
Indoor soccer	
	abdominal, plank, squat, push-up, strength training, specific indoor soccer exercises, running, jumping jumper
Volleyball	
	aerobic exercises (running and walking), strength exercises (abdominal, push-up, squat), specific volleyball exercises with ball, high intensity interval training
Athletics	
	dance, abdominal, push-up, squat, circuit, stretching, running, coordination, jumping, walking, up and down stairs
Field Soccer	
	kick ball, ball mastery, speed exercises, rope, abdominal, push-ups, squats, walking, running, skating
Others	
	aerobic exercises (running and walking), strength exercises (abdominal, push-up, squat), ride a roller bike, skate, jump rope, Pilates

The study was approved by the Ethics Committee on Human Research of the Federal University of Paraná under protocol CEP 4.018.525/2020 and CAAE:08389212.6.0000.0096. The consent form was checked by the parents or legal guardians.

Results

The 342 adolescents represent 76% of eligible ones. Mean age was 15 ± 1.36 years, 42% male. The sports they used to play before social isolation were athletics (n = 28, 8,2%), basketball (n = 4, 1.2%), indoor soccer (n = 58, 17%), field soccer (n = 28, 8.2%), handball (n = 33, 9.6%), rhythmic gymnastics (n = 21, 6.2%), swimming (n = 15, 4.4%), cycling (n = 28, 8.2%), badminton (n = 12, 3.5%), table tennis (n = 4, 1.2%), canoeing (n = 2, 0.6%), pilates (n = 3, 0.9%), volleyball (n = 96, 28%) and chess (n = 10, 3%).

With regard to the pandemic, 95% (n = 324) of the students answered that they and their families were following the recommended care for the prevention of COVID-19 and 49.5% had a family member (n = 169) in a group at risk for serious events. Most of them live in houses (77.5%, n = 265) and 96.5% of the participants did not receive financial assistance from the government (n = 330) until the moment they answered the questionnaire. Table 1 shows other socioeconomic and health-related answers. It is important to note that the majority of students live with three or more people at home and that most of them have a family member working outside their homes, despite the recommendation for social isolation.

Table 1 – Absolute and relative frequency of sociodemographic, socioeconomic and health-related behaviors variables of families and adolescents from Curitiba, Paraná, 2020 (n = 342)

Variables	n (%)
Sociodemographic and socioeconomic	
Number of people live in your home besides you	
1 person	14 (4.0)
2 people	67 (19.6)
3 people	142 (41.5)
4 people	74 (21.6)
More than 4 people	45 (13.3)
Number of people that are working outside the home	
1 person	131 (38.3)
2 people	81 (23.7)
More than 2 people	11 (3.2)
Work from home	119 (34.8)
Family members who live with you, are working, and are exposed to COVID-19	
Cousins and uncles	6 (1.8)
Brothers	10 (3.0)
Parents	110 (32.1)
Grandparents	4 (1.1)
Nobody	212 (62.0)
You and your family have taken care of COVID-19	
No	3 (0.9)
Yes	325 (95.0)
Maybe	14 (4.1)
Health-related behaviors	
Number of meals you eat a day	
1-3 meals a day	182 (53.2)
4-6 meals a day	127 (37.1)
Several meals	33 (9.7)
Your weight in social isolation this past month	
Increased	102 (29.8)
kept	200 (58.5)
I'm not interested	13 (3.8)
I lost weight	27 (7.9)
Number of hours have you been sleeping a night	
6-10h	275 (80.4)
Less than 6h	18 (5.2)
Sleep for several hours' day and night	21 (6.1)
Have no sleep and little sleep and sleep during the day	28 (8.3)
Time in physical activity per week	
I do it every day >420min/week	92 (27)
Some time	183 (53.5)
I haven't been exercising	63 (18.4)
Other reasons	4 (1.1)

Figure 1 shows how the adolescents replied about their time at home. Most of the day was on social networks.

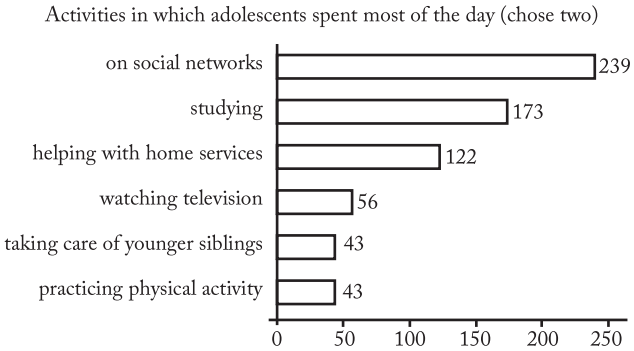

Figure 1 – Frequency of activities in which adolescents spend most of the day, Curitiba, Paraná, 2020 (n = 342)

Among the 27% (n = 92) of adolescents who maintained daily physical activity during the first month of social isolation, 27.7% practiced indoor soccer (n = 25), 21.7% volleyball (n = 21), 10.8% rhythmic gymnastics (n = 10), 8.7% field soccer (n = 8) and 8.7% athletics (n = 8).

Figure 2 shows the distribution of adolescents who maintain these physical activities. There were differences in the maintenance of training between the sports (p = 0.003; chi-squared = 17.80). The adolescent groups who were more active were indoor soccer (p < 0.05) and rhythmic gymnastics (p < 0.05), when compared with other sports. Field soccer and athletics had similar frequencies.

Most of the adolescents reported exercising with parents and siblings (27%, n = 92). Most of the adolescents reported to exercise with parents and siblings (27%, n = 92). Te spaces most used to practice physical activities were the rooms in the house (56.4%, n = 193), covered areas (15.2%, n = 52), and garden or outdoor areas (16.9%, n = 57). Few trained on the street or on the roads (11.5%, n = 40). Table 2 displays the indoor physical activities, eating and sleeping habits organized by individual and team sports and by sex. However, in the analysis between sexes, a trend towards more participation in physical activities by girls compared to boys in individual sports was found (p = 0.07). Among participants of team sports, boys showed more regular eating habits compared to girls (p < 0.001).

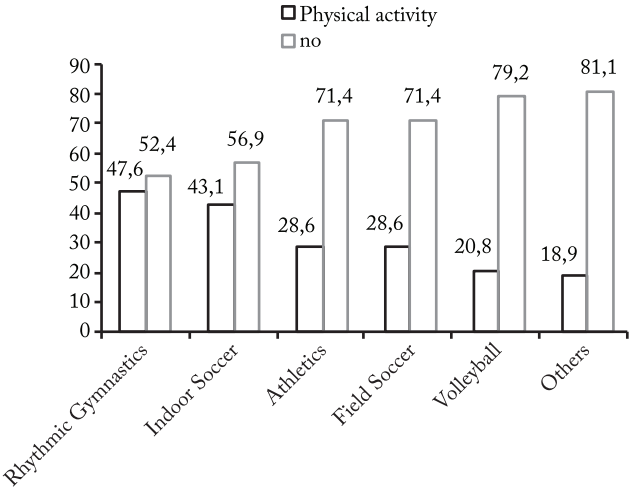

Figure 2 – Relative frequency by sport of adolescents who practiced or not some physical activity during social isolation in Curitiba, Parana, 2020 (n = 342).

Discussion

After the emergence of the first case of COVID-19 in Brazil, one of the first steps was the closure of schools, providing additional assistance to children and adolescents and their families in various aspects, mainly regarding healthy habits of physical activity, food and sleep[3]. Our study demonstrated that the majority of the adolescents did not maintain daily physical activities, despite claiming to be motivated.

Table 2 – Indoor physical activities, eating and sleeping habits between individual and team sports and by sex. Curitiba, Paraná, 2020 (n = 342)

	Individual sports			Team sports		
	All n (%)	Male n (%)	Female n (%)	All n (%)	Male n (%)	Female n (%)
Age (years)	15.00 ± 1.00	14.90 ± 1.00	13.90 ± 1.60	14.80 ± 1.50	14.90 ± 1.40	14.50 ± 1.60
Physical activities						
420 min/week	34 (27.2)	2 (14.3)	15 (40.5)	58 (26.5)	20 (32.2)	23 (34.8)
Did not meet the recommendation	91 (72.8)	12 (85.7)	22 (59.5)	161 (73.5)	42 (67.8)	43 (65.2)
Eating habits						
4-6 meals/day	43 (34.4)	5 (35.7)	11 (29.7)	85 (38.8)	32 (51.6)*	17 (25.8)
Inadequate	82 (65.6)	9 (64.3)	26 (70.3)	134 (61.2)	30(48.4)	49 (74.2)
Sleeping habits						
6-10 hours/night	96 (76.8)	11 (78.6)	28 (75.7)	179 (81.7)	50 (80.6)	58 (87.9)
Inadequate	29 (23.2)	3 (21.4)	9 (24.3)	40 (18.3)	12 (19.4)	8 (12.1)

*p < 0.01 male versus female teams sports, using chi-squared test.

Before social isolation they had a routine with intense training with a frequency of four to six times a week for two hours on average, in addition to competitions on weekends. With COVID-19, three quarters of them reduced or stopped their activities. The sports that concentrated most active adolescents were those in which the trainer could guide the exercises and the adolescents had adequate sleep and eating habits. In a Brazilian study carried out in the State of Ceará evaluating the behavioral and beliefs of the population in face of the pandemic, it was demonstrated significant differences in beliefs when comparing gender, age, education and place of birth, and residence[10].

It is well known that less space makes exercises difficult. Our study demonstrated that only 27% of the adolescents could maintain indoor physical activities, mainly those guided by technical teachers. Indoor soccer and rhythmic gymnastics were the sports with high proportion of active adolescents, also the ones with younger adolescents. Time spent in sedentary activities and the use of electronic equipment increased in all age groups, in accordance with reports from this habit during the past 15 years[11]. In a study conducted in China, first country with COVID-19, Xiang et al.[12] concluded that governments, schools, health and exercise professionals and parents need to be aware of the serious situation during social isolation and implement more effective interventions for physical activity, to minimize the negative impact of the COVID-19 on health of children and adolescents.

When prescribing physical exercise at home, an initial challenge is to adapt the level of difficulty of the proposed exercises to individual's ability. This process is difficult, given the distance between students and coaching in this period of social isolation[13,14]. It is possible that individual sports are easier to assimilate in times of isolation, as they do not depend on the same variables of team sports[15].

In the present study some adolescents reported the use of a roller or treadmill bicycle and exercise bike. In addition, some adolescents also practiced other exercises to improve performance. The World Health Organization (2010)[16] recommends 60 minutes of moderate to vigorous physical activity daily and the ACSM (2020) recommends all children and adolescents should do at least 60 minutes a day of moderate-to-vigorous intensity physical activity, including activities that strengthen muscle and bone, at least 3 days per week. In face of the COVID-19 pandemic, the intention is the maintenance of some activity and improvement of the population's health[17]. However, if social isolation remains in place for a long time, this performance tends to decrease[15].

Another major concern during this period is the mental health of these adolescents. Many factors may have affected adolescents' self-esteem, such as family members working directly with COVID-19, changes in body weight and abrupt changes in lifestyle. In addition, our study indicated the need for social action with the families. Approximately 5% of the adolescents reported the necessity of economic assistance paid by the government from the 17th of April. In the study by Chen et al.[18], they concluded that good mental health is essential to better control infectious diseases. During pandemic in China, health workers stayed at the work and hospitals guarantee food and essential supplies and helped them to share their routines at the hospital with their families alleviating the concerns of family members[18]. However, in many hospitals around the world, including Brazil, employees who work in areas at risk for coronavirus return to their homes and have contact with their families.

A limitation of this study is that it was carried out on a convenience sample, which limits the external generalization of the findings. In addition, we used self-reported questionnaires. However, the relevant aspect of this research was to show the profile and routine of adolescents caused by quarantine of COVID-19, with new information added, where three quarters of adolescents did not practice compensatory indoor physical activities and a third of them gained weight within a month of quarantine.

We concluded that there were significant changes in the routine of the adolescents during social isolation due to COVID-19 with reduction in daily physical activities and an increase in screen time. There is an urgent need to design strategies to encourage adolescents to maintain indoor physical activity and healthy habits.

Conflict of interest

The authors declare no conflict of interest.

Authors' Contributions

Brito LMS, conceived of the study, participated in the statistical analysis, participated in its design and coordination and to draft the manuscript. Mota J & Boguszewski MCS critical analysis of the manuscript. Souza MTR & Martins F carried out the data collections and critical analysis of the manuscript. Leite N conceived of the study, and participated in its design and coordination and critical analysis of the manuscript.

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References

1. Kelvin AA, Halperi S. COVID-19 in children: the link in the transmission chain. Lancet Infect Dis. 2020.
2. Munster VJ, Koopmans M, Van Doremalen, N, Van Riel D, Wit E. A novel coronavirus emerging in china — key questions for impact assessment. N Eng J Med. 2020;382(8):692-4.
3. World Health Organization. Coronavirus disease (COVID-19) outbreak. Geneva: World Health Organization. 2020.
4. Ferreira MJ, Irigoyen MC, Consolim-Colombo F, Saraiva JFK, De Angelis K. Physically Active Lifestyle as an Approach to Confronting COVID-19. [published online ahead of print, 2020 Apr 9]. Vida Fisicamente Ativa como Medida de Enfrentamento ao COVID-19 [published online ahead of print, 2020 Apr 9]. Arq Bras Cardiol. 2020.
5. Ornell F, Schuch J, Sordi AO, Kessler FHP. "Pandemic fear" and COVID-19: mental health burden and strategies. Braz J Psychiatry. 2020.
6. Sahu P. Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. Cureus. 2020;12(4):e7541.f.
7. Goodie LJ, Wilfong K, Krok, P. Chapter 10 - The influence of health behaviors upon the association between stress and depression and cardiovascular disease. Cardiovascular Implications of Stress and Depression. Academic Press; 2020. p.225-54.
8. Sichieri R, Coitinho DC, Monteiro JB, Coutinho WF. Recomendações de alimentação e nutrição saudável para a população brasileira. Arq Bras Endocrinol Metab. 2000;44(3):227-32.
9. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. Sleep Heal1.2015;1(1):40-3.
10. Lima DLF, DIAS AA, Rabelo RS, Cruz ID, Costa C, Nigri FMN et al. COVID-19 no Estado do Ceará: Comportamentos e crenças na chegada da pandemia. Cien Saúde Colet. 2020;25(5):1575-86.
11. Oman RF, King AC. Predicting the adoption and maintenance of exercise participation using self-efficacy and previous exercise participation rates. Am J Heal Promot. 1998;12(3):154-61.
12. Xiang M, Zhang Z, Kuwahara K. Impact of COVID-19 pandemic on children and adolescents' lifestyle behavior larger than expected. Prog in Cardiovasc Dis. 2020; S0033-0620(20):30096-97.
13. Vries H. An Integrated approach for understanding health behavior: The I-Change Modelas an example. Psychol Behav Sci Int J. 2017;2(2):555-85.
14. Picha KJ, Lester M, Heebner NR, Abt JP, Usher EL, Capilouto G, et al. Self-efficacy for home exercise program scale. Orthop Sports Phys Ther. 2019;49(9):647-55.
15. Guthold R, Stevens AG, Riley ML, Bull CF. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. The Lancet Chil Adolesc Health. 2019;4(1):23-35.
16. WHO. Global Recommendations on Physical Activity for Health. Geneva: World Health Organization, 2010. Available from: https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf?sequence=1.
17. American College of Sports. (ACSM). Staying active during the coronavirus pandemic. [Internet]. [Cited in 2020 Mar 16] Available from: https://www.exerciseismedicine.org/assets/page_documents/EIM_Rx%20for%20Health_%20Staying%20Active%20During%20Coronavirus%20Pandemic.pdf
18. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L, et al. Mental health care for medical staff in China during the COVID-19 outbreak. [Internet] 2020. [Cited 2020 April 2]. Available in: https://doi.org/10.1016/S2215-0366(20)30078-X.

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