Association between social isolation, level of physical activity and sedentary behavior in pandemic times

Associação de isolamento social, nível de atividade física e comportamento sedentário em tempos pandêmicos

Asociación entre el aislamiento social, el nivel de actividad física y la conducta sedentaria en tiempos de pandemia

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ABSTRACT

Objective: To analyze the association between social isolation (SI), physical activity level (PAL) and sedentary behavior in the university community in pandemic times. **Methods:** A cross-sectional epidemiological study was carried out from May 7 to June 4, 2020, with 194 participants linked to the Federal University of Jataí (*Universidade Federal de Jataí – UFJ*), in Goiás, Brazil. Data were collected using a form created on Google Forms® and sent to the email addresses of the academic community of UFJ to assess socioeconomic characteristics, lifestyle, body composition, physical activity level, and sedentary behavior, taking into account the periods prior to and during SI. Data were analyzed using descriptive and inferential statistics, with $p<0.05$ considered significant. **Results:** The study participants were predominantly women (n=141; 72.6%), 18-27 years old (n=100; 71%), single (n=96; 68%), students (n=110; 78%), and had no pre-existing diseases (n=94; 67%). Increases in the body mass and body mass index (BMI) ($p<0.05$) were observed during SI, and physical activity downtime increased for all participants, regardless of sex ($p<0.05$). **Conclusion:** SI recommended by health managers due to the pandemic caused by COVID-19 was responsible for inducing an increase in body mass and BMI accompanied by an increase in screen time during the week, as well as a decrease in the PAL of individuals belonging to the community of university students of UFJ.

Descriptors: Coronavirus Infections; Sedentary Behavior; Motor Activity.

RESUMO

Objetivo: Analisar a associação de isolamento social (IS), nível de atividade física (NAF) e comportamento sedentário na comunidade universitária em tempos pandêmicos. Métodos: Estudo epidemiológico transversal realizado no período de 7 de maio a 4 de junho de 2020 com 194 participantes vinculados à Universidade Federal de Jataí (UFJ), Goiás, Brasil. Para coleta de dados, foi enviado ao e-mail da comunidade acadêmica da UFJ um formulário criado no Google Forms® para avaliar as características socioeconômicas, os hábitos de vida, a composição corporal, o nível de atividade física e o comportamento sedentário, levando em consideração o período anterior e durante o IS. Os dados foram analisados por estatística descritiva e inferencial, com p<0,05. Resultados: Os participantes do estudo foram, predominantemente, mulheres (n=141; 72,6%), na faixa etária de 18-27 anos (n=100; 71%), solteiras (n=96; 68%), discentes (n=110; 78%), com ausência de doenças pré-existentes (n=94; 67%). Durante o IS ocorreu aumento da massa corporal e do índice de massa corporal (IMC) dos indivíduos (p<0,05). Além disso, o tempo de inatividade física aumentou para todos os indivíduos, independente do sexo (p<0,05). Conclusão: O

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IS proporcionado pelos gestores de saúde em decorrência da pandemia ocasionada pela COVID-19 foi responsável por induzir um aumento da massa corporal e do IMC, acompanhado pela elevação do tempo de tela durante a semana e a diminuição do NAF dos indivíduos pertencentes à comunidade universitária da UFJ.

Descritores: Infecções por coronavírus; Comportamento sedentário; Atividade motora.

RESUMEN

Objetivo: Analizar la asociación entre el aislamiento social (AS), el nivel de actividad física (NAF) y la conducta sedentaria de la comunidad universitaria en tiempos de pandemia. *Métodos:* Estudio epidemiológico transversal realizado entre el 07 de mayo y el 4 de junio de 2020 con 194 participantes de la Universidad Federal de Jataí (UFJ), Goiás, Brazil. La recogida de datos se dio a través de un formulario del Google Forms® que ha sido enviado para el correo electrónico de la comunidad académica de la UFJ para la obtención de las características socioeconómicas, el estilo de vida, la composición corporal, el nivel de actividad física y la conducta sedentaria en el periodo antes y durante el AS. Se ha utilizado la estadística descriptiva e inferencial para el análisis de datos con p<0,05. *Resultados:* Los participantes del estudio eran predominantemente mujeres (n=141; 72.6%), entre 18 y 27 años de edad (n=100; 71%), solteras (n=96; 68%), estudiantes (n=110; 78%) sin enfermedades anteriores (n=94; 67%). Durante el AS ha sido observado el aumento en la masa corporal y en el Índice de Masa Corporal (IMC) (p<0.05) y la inactividad física ha aumentado para todos los participantes, independientemente del sexo (p<0.05). *Conclusión:* El AS proporcionado por los gestores de salud debido a la pandemia de la COVID-19 ha sido responsable por inducir el aumento en la masa corporal y en el IMC asociado con el aumento del tiempo de tela durante la semana así como la disminución del NAF de los individuos de la comunidad de estudiantes universitarios de la UFJ.

Descriptores: Infecciones por Coronavirus; Conducta Sedentaria; Actividad Motora.

INTRODUCTION

In view of the pandemic caused by the coronavirus disease 2019 (COVID-19), which was declared on March 11 2020, by the World Health Organization (WHO), several restrictive measures had to be taken to reduce/prevent the rapid spread of the virus. One of the preventive strategies adopted was social distancing and social isolation (SI), which was the main non-pharmacological measure against the disease known as COVID-19. People were instructed to stay at home[1]. The reason behind that was that studies have shown that the main route of transmission across individuals occurs through physical contact, via the exchange of salivary secretions and/or respiratory particles released into the environment by people infected by the virus[2].

Although it is a preventive public health strategy considered effective to reduce the spread of coronavirus, the period of social isolation (SI) has been altering the daily routine and promoting significant changes in people's lifestyles[3]. Several epidemiological studies are being carried out with the purpose of clarifying these changes in habits and checking their impact on public health[4-6].

It has been identified that SI significantly increased sedentary behavior, alcohol consumption and smoking, and there was a worsening of eating habits in Italian citizens[4]. A study carried out with Brazilian adults demonstrated that old age, presence of chronic diseases and physical inactivity significantly influenced sedentary behavior during SI[5]. A global study showed lifestyle changes during social isolation in individuals with different body mass index classifications and found that sedentary behavior increased and the time spent doing physical activity decreased among obese individuals[6].

Physical inactivity and sedentary behavior are associated with reduced energy expenditure, excessive weight gain, and, consequently, the emergence of noncommunicable diseases, which have a negative impact on health and lead to early mortality[7]. A 5-year study conducted with 7735 men in the UK found that for every additional 30 minutes of sedentary behavior, the death rate rises by 17%[8]. In addition, SI has made the population more sedentary and both the prevalence and incidence of overweight and obesity have increased, even though these conditions are independently considered global public health problems[9].

In addition to sedentary behavior and obesity, it is known that COVID-19 is even more lethal in older individuals and/or those with associated chronic diseases such as hypertension, diabetes, and respiratory diseases. Thus, these population groups are considered to be at risk[2]. In that regard, awareness of the great potential virulence of COVID-19 and the hospital limitations caused by the attendance of a large number of patients at the same time has

led the WHO to strongly suggest that governments put in place SI and, in some cases, the total shut-down of non-essential activities, known as *lockdown*, a stricter strategy of social distancing with a mandatory recommendation[10].

Thus, although the older population is one of the groups most exposed to sedentary behavior and non-compliance with WHO recommendations for the practice of physical activity (PA)[11,12], the literature has pointed out that young university students are also affected by restrictive measures[13]. Therefore, SI arising from the COVID-19 pandemic may promote changes in lifestyle and, it seems, deleterious effects on human health, thus making it important to investigate how physical activity level (PAL) and sedentary behavior can be modified by long periods of exposure to SI[14].

Knowledge of behavioral changes and establishing the basis for the development of appropriate recommendations for lifestyle changes during the pandemic are fundamental for individual health[15]. Thus, the present study aimed to analyze the association between SI, PAL and sedentary behavior in the university community in pandemic times.

METHODS

This is a cross-sectional epidemiological study that targets the community of the Federal University of Jataí (*Universidade Federal de Jataí – UFJ*), located in the municipality of Jataí, Goiás, Brazil. The population of UFJ consists of 4,501 people, with 3,789 students, 368 professors, and 344 administrative technicians[16].

We asked the UFJ communication sector to send the questionnaire by email to the entire university community. The invitation was sent in two moments within a 15-day interval (May 7 and May 21, 2020).

The sample was estimated using a sample size simulator (G * Power®, version 3.1.9.2; Institute for Experimental Psychology in Dusseldorf, Germany), with type I and II errors set as $\alpha = .05$, $\beta = .05$, respectively, in order to obtain an effect size equal to or greater than 0.50. The calculation determined collecting data from 225 people, equivalent to 5% of the sample.

The questionnaire was answered by 194 individuals (4.31% of the population), totaling 141 women (72.6%) and 53 men (27.3%). There was no exclusion of participants, as the questionnaire could only be sent when all responses were completed. According to the UFJ communication sector, all the participants registered at the institution received an invitation to fill out the survey form.

The following inclusion criteria were adopted: belonging to the UFJ community and signing the informed consent term. Exclusion criteria were being under 18 years of age and not completing the research instrument in full.

For data collection, a form was created using Google Forms® and sent by email to the UFJ community. As previously mentioned, the same questionnaire was sent twice to the email addresses of the UFJ community. During this period, the questionnaire was open to receive responses from participants from May 7 to June 4, 2020.

The instrument addressed the following variables: age, sex, marital status, position at UFJ, presence of diseases and COVID-19 in the municipality (Table I); income, tobacco and alcohol use, body mass index[17] (BMI) and PAL (before and during isolation, Table II); body mass (before and during isolation, Figure 1); and sedentary behavior.

PAL was measured using the International Physical Activity Questionnaire – Short Form (IPAQ-SF). The IPAQ-SF classified participants as very active, active, insufficiently active, or sedentary[18]. To run the association tests, individuals were classified as active (very active + active) and inactive (insufficiently active + sedentary).

Sedentary behavior included information about screen time (up to 2 hours or more) on weekdays and the weekend in terms of use of television (TV), video games/cell phones, and computers/similar devices[19].

Initially, the data on socioeconomic profile, lifestyle habits, body composition, PAL, and sedentary behavior were tabulated and submitted to descriptive statistics (mean, standard deviation, absolute and relative frequency). After that, the data on socioeconomic profile, lifestyle habits, body composition, PAL, and sedentary behavior were submitted to the Shapiro-Wilk normality test. The data considered normal were analyzed using parametric statistics and those that did not present normality were submitted to non-parametric analysis. Quantitative data (age and body composition) were compared using ANOVA or the Student's t test. The associations of SI (before and during) with sedentary behavior, BMI, and PAL of participants in relation to sex (Table III) and associations of the level of physical activity (before and during SI) with sedentary behavior, BMI, age, and presence of disease (Table IV) were submitted to the Chi-squared test and the chance of the event occurring was verified by Odds Ratio (OR). GraphPad Prism 6 and BioEstat5.3 were used for statistical analysis and plotting of figures. The significance level adopted was $p < 0.05$.

This study was approved by the Human Research Ethics Committee of the Federal University of Jataí (Approval No. 4.012.158).

RESULTS

The data are initially presented in a descriptive manner (Tables I and II). Then, comparisons between groups (Figure 1) and association tests (Tables III and IV) are shown.

Table I presents the distribution of participants by age range, marital status, position at UFJ, any self-reported diseases, and number of registered cases of COVID-19 in the municipality where they live. Study participants were predominantly women aged 18 to 27 years (n=100; 71%), single (n=96; 68%), students (n=110; 78%), and had no pre-existing diseases (n=94; 67%). As the study was conducted at the beginning of the pandemic, most cities from where the participants were had less than 100 cases of COVID-19.

Table I - Distribution of socioeconomic and demographic variables in relation to COVID-19, Jataí, Goiás, Brazil, 2020. (n=194).

Variables	Male		Female	
	n	%	n	%
Age				
18 – 27	20	38	100	71
28 – 37	16	30	16	11
38 – 47	10	19	18	13
48 – 57	6	11	5	4
58 – 67	1	2	2	1
Marital status				
Married	27	51	38	27
Divorced	1	2	7	5
Single	25	47	96	68
Position at UFJ				
Student	28	53	110	78
Professor	20	38	26	18
Administrative technician	5	9	5	4
Presence of disease				
Yes	16	30	47	33
No	37	70	94	67
COVID-19 in the municipality				
≤100 cases	49	92	129	91
>100 cases	5	8	11	9

UFJ: Universidade Federal de Jataí (Federal University of Jataí)

Presentation of the participants' descriptive information before and during SI in relation to income, smoking, drinking, classification of body mass index and PAL is shown in Table II. Most individuals did not show changes in income, smoking and drinking in the analyzed periods. However, obesity rates increased by 100% among men (6 to 12) and almost 30% among women (22 to 28). More alarming values were observed as for the increase in the number of sedentary people – 1100% for men (1 to 12) and 150% for women (12 to 30).

Figure 1A compares the mean values for age of women (n=141; mean: 26.8 ± 9.7 years; minimum: 18 years; maximum: 63 years; p<0.001) with the age of men (n=53; mean: 31.1 ± 10.9 years; minimum: 18 years; maximum: 61 years). Regarding age, it was observed that men had a higher mean age when compared to women (p=0.001).

In addition, it was observed that the body mass of women increased during isolation (n=141; 65.0±15.2 vs 66.6±15.9 kg; p<0.001), and so did the BMI (n=141; 24.5±5.4 vs 25.2±5.9 kg/m^2; p<0.001). The same profile was observed in men in relation to body mass (n=53; 79.7±14.3 vs 81.3±15.4 kg; p=0.002) and BMI (n=53; 25.4±4.0 vs 25.9±4.2 kg/m^2; p=0.002) (Figures 1B and 1C).

Complementing the information presented in Table III regarding the level of physical activity, Figure 1D presents the percentage variation (Δ%) in physical inactivity from before to during social isolation for men (12 to 30; 150%) and women (45 to 82; 82%).

Table II - Distribution of income, smoking, drinking, body mass index, and level of physical activity before and during social isolation. Jataí, Goiás, Brazil, 2020. (n=194).

Variables	Before Isolation		During Isolation	
	M	F	M	F
	n (%)	n (%)	n (%)	n (%)
Income*				
<1	02 (04)	05 (04)	02 (04)	10 (07)
1 to 2	12 (22)	39 (27)	12 (23)	36 (26)
2 to 3	04 (08)	30 (21)	05 (09)	29 (21)
3 to 4	04 (08)	18 (13)	05 (09)	16 (11)
4 to 5	06 (11)	07 (05)	04 (08)	07 (05)
> 5	24 (45)	41 (29)	24 (45)	41 (29)
NI	01 (02)	01 (01)	01 (02)	02 (01)
Smoking				
Yes	06 (13)	11 (08)	06 (13)	10 (07)
No	47 (87)	130 (92)	47 (87)	131 (93)
Drinking				
Yes	28 (53)	71 (50)	28 (53)	66 (47)
No	25 (47)	70 (50)	25 (47)	75 (53)
BMI				
Low weight	02 (04)	11 (08)	02 (04)	08 (06)
Normal weight	23 (43)	71 (50)	20 (38)	72 (51)
Overweight	22 (42)	36 (25)	19 (36)	31 (22)
Obesity	06 (11)	22 (16)	12 (22)	28 (20)
NI	00 (00)	01 (01)	00 (00)	02 (01)
PAL				
Very active	20 (38)	43 (31)	08 (15)	16 (11)
Active	21 (40)	53 (38)	15 (28)	43 (31)
Little active	11 (20)	33 (23)	18 (34)	52 (37)
Sedentary	01 (02)	12 (08)	12 (23)	30 (21)

*Income was distributed into number of minimum wages, which was R$ 1045.00 in the period analyzed; M: male; F: female; NI: not informed; BMI: body mass index; PAL: physical activity level
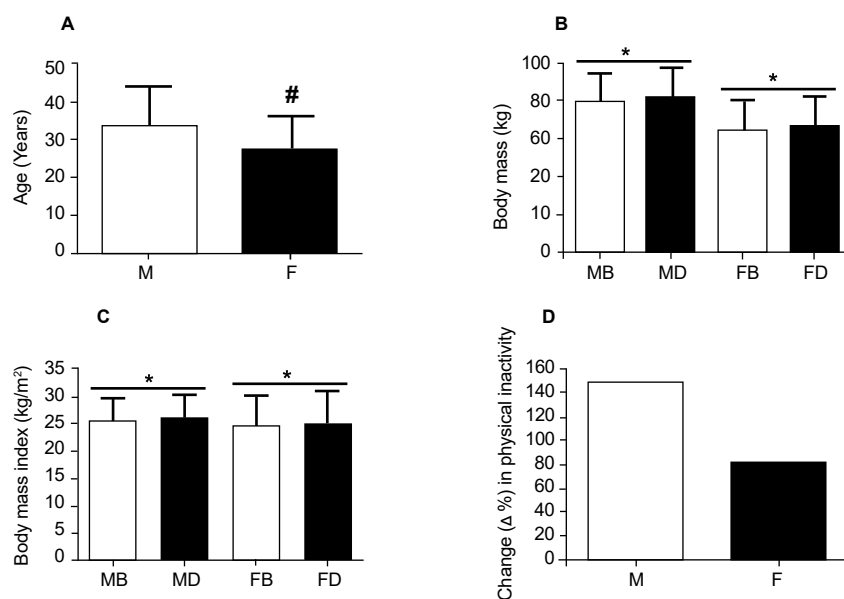

Figure 1 - Evaluation of age, body mass, body mass index, and physical inactivity of individuals before and during social isolation.

Figure 1A: comparison of the groups in relation to the mean age (Student's t test); Figure 1B: comparison of body mass in the groups before and during isolation (ANOVA test); Figure 1C: comparison of body mass index in groups before and during isolation (ANOVA test); Figure 1D: presentation of the percentage variation (Δ%) in physical inactivity from before to during isolation. M: male; F: female; MB: male before isolation; MD: male during isolation; FB: female before isolation; FD: female during isolation. #: Different from M; *: Difference between before and during isolation. Significance index of $p<0.05$

Table III presents the association of SI (before and during) with sedentary behavior, BMI, and PAL of participants in relation to sex. There was an association of female sex with TV (p<0.001) and video game/cell phone (0.022) time on weekdays. In that regard, SI increased by 2.77 times the chance of spending more than 2 hours on TV and 1.93 times the chance of using video game/cell phone. In addition, both male (p=0.007) and female (p<0.001) sexes were associated with SI and PAL, that is, men increased the chance of becoming inactive by 4.46 times and women by 2.97 times.

Table III - Association of social isolation with sedentary behavior, body mass index, and physical activity level. Jataí, Goiás, Brazil, 2020. (n=194).

	Male				Female			
	B	D			B	D		
Variables	n (%)	n (%)	p	OR	n (%)	n (%)	P	OR
TV – weekdays								
<2 hours	39 (74)	31 (58)	0.151	---	104 (74)	71 (50)	<0 .001	2.77
≥2 hours	14 (26)	22 (42)			37 (26)	70 (50)		
TV – weekend								
<2 hours	24 (45)	21 (40)	0.694	---	77 (55)	62 (44)	0.095	---
≥2 hours	29 (55)	32 (60)			64 (45)	79 (56)		
V/C – weekdays								
<2 hours	26 (49)	20 (38)	0.327	---	47 (33)	29 (21)	0.022	1.93
≥2 hours	27 (51)	33 (62)			94 (67)	112 (79)		
V/C – weekend								
<2 hours	20 (38)	18 (24)	0.839	---	38 (27)	28 (20)	0.205	---
≥2 hours	33 (62)	35 (66)			103 (73)	113 (80)		
C/S – weekdays								
<2 hours	13 (25)	8 (15)	0.329	---	52(7)	49 (35)	0.803	---
≥2 hours	40 (75)	45 (85)			89(63)	92 (65)		
C/S – weekend								
<2 hours	17 (32)	13 (25)	0.517	---	60 (43)	62 (44)	0.904	---
≥2 hours	36 (68)	40 (75)			81 (57)	79 (56)		
BMI								
Normal	23 (45)	20 (39)	0.688	---	71 (55)	72 (55)	0.910	---
High	28 (55)	31 (61)			58 (45)	59 (45)		
PAL								
Active	41 (77)	23 (43)	0.007	4.46	96 (68)	59 (42)	<0.001	2.97
Inactive	12 (23)	30 (57)			45 (32)	82 (58)		

B: before social isolation; D: during social isolation; TV-weekdays: television time on weekdays; TV-weekend: television time on the weekend; V/C- weekdays: video game/cell phone time on weekdays; V/C-weekend: video game/cell phone time on the weekend; C/S-weekdays: computer/similar time on weekdays; C/S-weekend: computer/similar time on the weekend; BMI: body mass index; PAL: physical activity level. OR: Odds Ratio. Significance index of p<0.05

Table IV demonstrates the association of PAL before and during social isolation with sedentary behavior, body mass index, age, and presence of diseases. It was observed that before SI, 70.6% (n=137) of the individuals were classified as active and 29.4% (n=57) as physically inactive. However, during SI, this frequency was inverted in that the rate of active individuals decreased (n=82; 42.3%) and the rate of inactive individuals increased (n=112; 57.7%). In addition, it is noted in Table IV that before SI, PAL was associated with video game/cell phone time on weekdays (p=0.049), that is, active participants were 1.97 times more likely to spend more than 2 hours on these devices. We found a negative association of PAL with time spent on computer/similar devices on the weekend (p=0.019) and with BMI (p=0.034) during SI. Thus, inactive individuals were 2.1 times more likely to spend more than 2 hours in front of the screen and 1.98 times more likely to have high BMI.

Table IV - Association of the level of physical activity before and during social isolation with sedentary behavior, body mass index, age, and presence of disease. Jataí, Goiás, Brazil, 2020. (n=194).

| | Before Isolation | | | | During Isolation | | | |
| | Act | Inact | | | Act | Inact | | |
Variables	n (%)	n (%)	p	OR	n (%)	n (%)	P	OR
TV – weekdays								
<2 hours	100(73)	43 (75)	0.862	---	47 (57)	55(49)	0.324	---
≥2 hours	37(27)	14 (25)			35 (43)	57(51)		
TV – weekend								
<2 hours	69(50)	32 (56)	0.564	---	35 (43)	48(43)	0.902	---
≥2 hours	68(50)	25 (44)			47 (57)	64(57)		
V/C – weekdays								
<2 hours	45(33)	28 (49)	0.049	1.97	20 (24)	29(26)	0.943	---
≥2 hours	92(67)	29 (51)			62 (76)	83(74)		
V/C – weekend								
<2 hours	35 (26)	23 (40)	0.060	---	18 (22)	28(25)	0.747	---
≥2 hours	102 (74)	34 (60)			64 (78)	84(75)		
C/S – weekdays								
<2 hours	43(31)	22 (39)	0.422	---	27 (33)	30(27)	0.442	---
≥2 hours	94(69)	35 (61)			55 (67)	82(73)		
C/S – weekend								
<2 hours	52(38)	25 (44)	0.545	---	40 (49)	35(31)	0.019	2.10
≥2 hours	85(62)	32 (56)			42 (51)	77(69)		
BMI								
Normal	69(53)	25 (50)	0.838	---	48 (60)	44(43)	0.034	1.98
High	61(47)	25 (50)			32 (40)	58(57)		
Age								
≤30 years	94(69)	38 (67)	0.923	---	59 (72)	73(65)	0.399	---
>30 years	43(31)	19 (33)			23 (28)	39(35)		
Presence of diseases								
Yes	42(31)	21 (37)	0.503	---	24 (29)	39(35)	0.508	---
No	95(69)	36 (63)			58 (71)	73(65)		

Act: active; Inact: inactive; TV-weekdays: television time on weekdays; TV-weekend: television time on the weekend; V/C-weekdays: video game/cell phone time on weekdays; V/C–weekend: video game/cell phone time on the weekend; C/S-weekdays: computer/similar time on weekdays; C/S-weekend: computer/similar time on the weekend; BMI: body mass index. OR: Odds Ratio. Significance index of $p<0.05$

DISCUSSION

The analysis of the lifestyle habits of participants before and during SI, such as smoking and drinking, demonstrated no significant changes. In a way, smoking continued among those who already had this habit, while those who did not, in turn, did not develop it. A study on knowledge and behaviors related to the COVID-19 pandemic conducted with 2125 students from three Italian universities presented similar results in relation to this habit[20].

On the other hand, our study found a slight decrease in the consumption of alcoholic beverages. This result corroborates[14] an online study carried out in several countries on the effects of SI caused by COVID-19 on eating behavior and PA. The study found that of the deleterious lifestyle habits of the participants only excessive alcohol consumption decreased significantly, but so did physical activity, with an increased sitting time.

Regarding the PAL of the participants in the current study, there was an increase in the number of people considered physically inactive. In addition, there was an increase in the number of individuals considered obese as measured by BMI. The majority of people classified as inactive and with obesity were female, which has also been

observed in other studies, thereby highlighting that the female participants show greater sedentary behavior and hence are less physically active than men[13,21-23]. Added to this is the high frequency of university students in the present study, suggesting that this population comprises one of the groups most vulnerable to sedentary and low PAL behavior, especially women, thus corroborating the literature[13,22].

In addition, this trend is also reported in a study[24] carried out with 1098 people in Canada. The researchers observed that SI reduced the time assigned to PA in that population. Thus, it is noted that social isolation can influence people's lifestyles, including participation in sports and regular physical activity aimed at prevention of disease and health promotion[25].

One of the reasons for this reduction in PA is the increase in sedentary behavior, which is one of the unintended consequences of SI observed in the pandemic generated by COVID-19[24]. In the present study, we found that during SI the time spent sitting and without performing PA increased. This fact can be observed by the increase in the number of hours spent by participants in front of the TV or video game/cell phone on weekdays caused by SI. These findings have also been observed in other studies, in which individuals undergoing SI presented an increase in sedentary behavior. This fact occurs mainly due to the longer time spent using electronic devices[26].

Accordingly[14], one of the effects of the COVID-19 pandemic was a 28.6% increase in the number of hours/day that people sit. That time was five hours and increased to eight hours during SI. The explanation for this increase was the greater time spent using electronic devices, such as cell phones, television, and computers[14]. This increase in sedentary time and physical inactivity results in an increase in the chance of premature mortality from various hypokinetic diseases[8].

The included sedentary behaviors, therefore, favor and are associated with the increase in body mass observed in the current study and, consequently, the increase in BMI, factors which are related to a greater risk of the individual developing obesity, arterial hypertension, and glucose intolerance, as well as having a negative impact on mental health[26-28].

In addition to sedentary behavior, weight gain may also be associated with changes in the eating habits of these individuals and an unhealthy pattern of food consumption. Accordingly(14), during SI individuals change their eating behavior by consuming a greater volume of food with low nutritional value and high caloric value and rich in saturated fat. Part of these changes can be attributed to the increase in anxiety or boredom during SI, as well as to the decrease in motivation to participate in PA or maintain a healthy diet[14].

It is known that university students are one of the population groups most vulnerable to sedentary behavior and physical inactivity, especially women, as pointed out in the literature[21,24]. Thus, the present study shows how SI resulting from the COVID-19 pandemic increased this problem and affected the PAL and physical inactivity of the participants, thus leading to an increase in the body mass of these individuals.

The present study demonstrates that although SI is essential and effective for the prevention of the coronavirus contamination, it can induce sedentary behavior and reduce the population's levels of physical activity, thereby generating long-term consequences for public health.

Currently, Brazil ranks second in number of cases and is a new epicenter of the COVID-19 pandemic[29]. The impact of the long-term effects of social isolation may negatively affect public health promotion policies such as healthy eating, encouraging physical practice and physical activity, which are used as strategies to tackle noncommunicable diseases[30]. In addition to the current problems caused by COVID-19, it is observed that there will be an exponential increase in the prevalence of diseases such as obesity and its comorbidities in Latin America due to the increase in sedentary behavior[31]. Thus, these findings may contribute to the implementation of strategies to prevent the increase of hypokinetic diseases and mortality from all causes.

The data collection was carried out online, which may characterize a potential limitation of information reported incorrectly due to difficulty in interpreting a question on the instrument or due to data that are less reliable, such as self-reported body mass and height. In addition, the sample size was not representative of the population. However, we present results that allow actions targeted at the university community to minimize the negative impact on health and quality of life in addition to bringing relevant findings that may support the development of a longitudinal study for the future formulation of post-pandemic public health policies.

CONCLUSION

The SI recommended by health managers due to the pandemic caused by COVID-19 was responsible for inducing an increase in body mass and BMI accompanied by an increase in screen time on weekdays and a decrease in the PAL of individuals belonging to the community of university students at UFJ.

Thus, health promotion strategies that include the implementation of interventions with physical activity in a safe way become essential as a measure to control the increase in sedentary lifestyle caused by SI.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTIONS

David Michel de Oliveira, **Luiz Fernando Gouvêa-e-Silva** and **Eduardo Vignoto Fernandes** contributed to the study conception and design; analysis and interpretation of results; and the writing and critical review of the manuscript content. **Verônica dos Santos da Costa** and **Edlaine Faria de Moura Villela** contributed to the study conception and design and the writing and critical review of the manuscript's content. All authors approved the final version of the manuscript and are responsible for all aspects, including ensuring its accuracy and integrity.

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