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Body weight in relation to hours of sleep, and physical activity in Latin American university students during the Covid-19 pandemic

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ABSTRACT

Introduction: Short sleep, physical inactivity, and being locked up are risk factors for weight gain. **Objective:** We evaluated weight gain according to sex, age, hours of sleep and physical activity in university students from 10 Latin American countries during the COVID-19 pandemic. **Methods:** Cross-sectional and multicenter study ($n=4880$). **Results:** The average age was 22.5 ± 4.4 years. 60.2% were currently locked up. 73.6% were women, 48.2% increased their body weight, 66% reported insufficient sleep hours, and 65.9% were inactive. Women gained more weight than men (73.2%) and younger students gained more weight (85.1%). Those who had insufficient sleep hours gained most weight (67.6%). Inactive participants gained most weight (74.7%). Students who have insufficient sleep are 21% more likely to have changes in body weight compared to students who have optimal sleep. **Conclusion:** The increase in body weight and its risk factors during confinement should be considered as emerging from public health.

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Introduction

The novel coronavirus disease 2019 (COVID-19) pandemic emerged in Wuhan, China, in December 2019.¹ By early March 2020, most countries had identified cases, and by mid-March statewide school closures and stay-at-home orders were announced in many countries. This implied that many college students were expected to continue their academic work remotely.²

There are many reasons explaining why students are at high risk for COVID-19 contagion. Many undergraduate students faced this disruption without a familiar routine

and without the support that gives them a sense of emotional stability and coherence.³

The COVID-19 pandemic forced the population lockdown at home in order to halt the spread of the virus.⁴ These measures limited sporting and social activities. During 2020, elements of the built environment and other factors related to individual's environments were restricted due to the state of alarm. This created a valuable opportunity to assess physical activity without taking these factors into account. Expert's recommendations to prevent sedentary behavior during lockdown included taking active breaks, getting up and walking around the house, and doing online workouts.⁵ However, during the pandemic, an overall

negative effect on physical activity intensity was observed, as well as a greater consumption of less healthy food and a 28.6% increase in sedentary behavior in Asia, Africa and Europe.⁶ A reduction in physical activity was also observed in Australian university students,⁷ along with increased levels of anxiety among 18- to 34-year-olds.⁸

Furthermore, such contagious viral epidemics may cancel out the existing efforts to curb obesity epidemic. Among all affected, the youth is a particular vulnerable population to such changes, due to their newly obtained freedom to manage their lifestyles, however, relatively insufficient capacity of coping with such unexpected changes. School or campus closures may have further aggregated the impact of lockdown measures on them by triggering physical activity (PA) challenges.^{9,10} Millions of students are thus affected by school closures globally.

Another parameter to take into account in university students is the quantity and quality of sleep. Sleep problems are quite common among university students: Up to 16% need more than 30 min to fall asleep and 7.7% meet the diagnostic criteria for an insomnia disorder.¹¹ In Latin American populations, for example, a study carried out on Peruvian university students, using the Pittsburgh Sleep Quality Index, revealed that there is 89.5% poor quality sleep.¹² In another study carried out on Brazilian university students, the same index revealed that 95.2% have poor quality sleep.¹³ This high proportion of students with sleep disorders requires particular attention, since sleep deprivation has been related to the detriment of multiple cognitive variables, such as attention, memory, processing speed and reasoning.¹⁴

Limited studies have shown how the youth's obesity prevalence and activity patterns have been changed by COVID-19 pandemic. A recent study in Italy has explored the changes in lifestyles associated with COVID-19 lockdown among 41 children and adolescents with obesity.¹⁵ It revealed that sports activities decreased, sleep time increased, and screen time escalated significantly. However, lifestyle changes in Italy may only represent the situation in western countries; the neighborhood environment, lifestyles among the youth, and the degree to which lockdown measures have been implemented are different in other regions.

For all the aforementioned mention, the present study aims to evaluate the changes in self-reported body weight in relation to the quality of sleep, duration of sleep, and physical activity in Latin American university students during the COVID-19 pandemic.

Methods

A descriptive, observational, cross-sectional and multicenter study was conducted. The sample was nonprobabilistic (accidental) and consisted of 4,880 university students from Universities of 10 Latin American countries (Argentina, Colombia, Costa Rica, Chile, Ecuador, Guatemala, Mexico, Paraguay, Panama and Peru). The sample inclusion criteria were: (i) 18 years of age or older; and (ii) active enrollment in a higher education institution in Latin America. The exclusion criteria were: (i) those who partially responded to the survey; and, (ii) postgraduate students. The university

students were invited to participate in the study (between 5 November and 22 December 2020). All participants were invited to participate voluntarily and anonymously through different platforms and social networks such as Facebook, Instagram, Twitter, and both personal and institutional emails. The application method of surveys and Google Docs forms were used. All instruments were applied in a single opportunity. Students then had to complete a voluntary and self-administered online digital questionnaire, where students had to read the aim of the study, the criteria for the use and handling of the data collected, as well as explicitly accept an informed consent.

The research protocol was developed in accordance with the guidelines of the Declaration of Helsinki in relation to research involving human subjects and was approved by the Scientific Ethics Committee of the Universidad de Las Americas, Chile (code number CEC_FP_2020017).

The questionnaires used were prepared by the authors in order to obtain the data presented here. Demographic data such as gender, age, variables on self-report bodyweight during lockdown (increased, decreased, maintained), report of hours of sleep (Quite satisfied, satisfied, normal, dissatisfied and quite dissatisfied), hours of sleep (optimal; 9 or more hours, borderline; between 8 and 9 hours and insufficient; less than 8 hours) and physical activity (active or inactive) were collected (Figure 1).

To evaluate relationships between qualitative variables, the Chi square test was used in contingency tables. To assess body weight and sleep associations, we used logistic regression analysis, where body weight was the outcome (coded as 0=no change in body weight and 1= change in body weight (decrease or increase)). Model 0 was unadjusted, Model 1 was adjusted for sex, and Model 2 was adjusted for sex, physical activity, and smoking. Following a stepwise method, the final model was adjusted by sex, physical activity, and smoking. Results are presented as odds ratios (OR) with their respective 95% confidence interval (CI). The statistical package STATA version 16.0 was used to perform all analyses. A *p* value of <0.05 was considered significant. Mean and standard deviation (SD) was used to present numerical variables; and frequency, and percentage for categorical variables.

Results

A total of 4,880 students were included in the study. The predominant gender was female (73.6%). Most of the participants were Mexicans (25.5%) and 60.2% were currently in lockdown. Health Sciences was the most area of study in a 64.1%. 95.7% was having online/virtual class modality. The age average was 22.5 ± 4.4 years (Table 1).

Regarding health, self-report weight from quarantine revealed that 48.2% of people increased their body weight. 32.8% self-reported a normal range of hours of sleep however, 66% reported insufficient hours of sleep. Regarding the physical activity, 65.9% reported to be insufficiently active (Table 2).

Self-report bodyweight according to gender, showed that women gained more weight than men (73.2% vs 26.8%) and

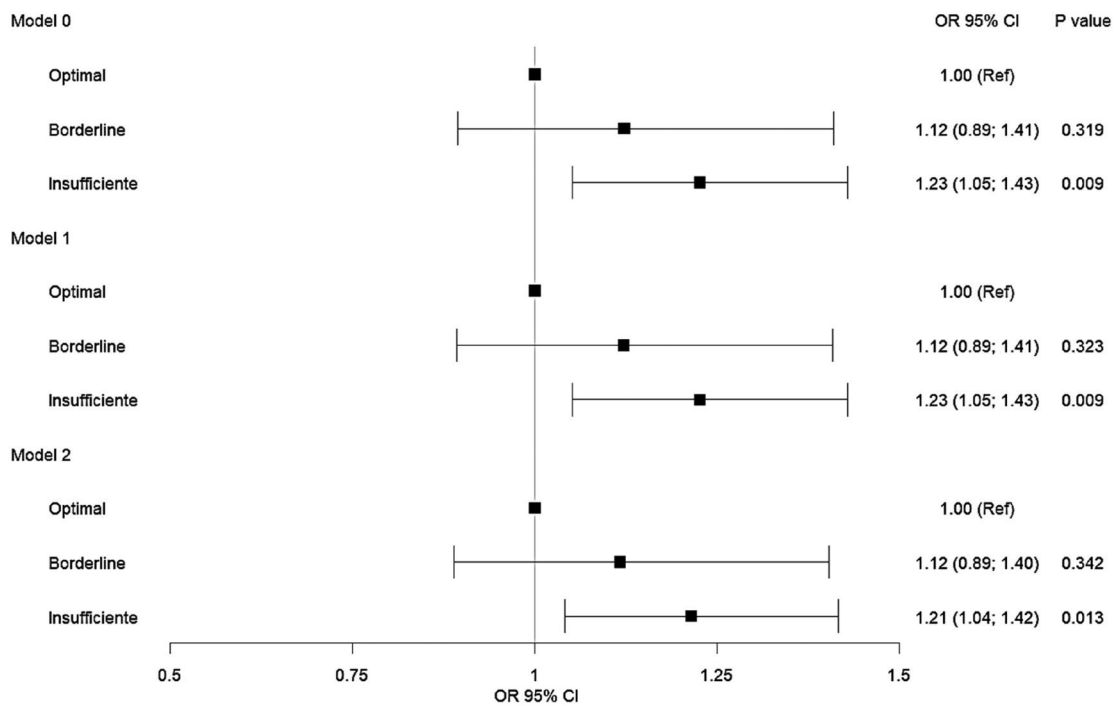


Figure 1. Association of self-report body weight in relation to sleep. Data are presented in odd ratio (OR) with 95% confidence intervals (95% CI). The reference group was those with optimal sleep. Model 0 was unadjusted, Model 1 was adjusted for sex, and Model 2 was adjusted for sex, physical activity, and smoking.

Table 1. Baseline of population characteristics.

Variable		n (%)
Gender	Male	1198 (26.4)
	Female	3341 (73.6)
Age	18–25	3869 (85.2)
	26–46	670 (14.8)
Country	Argentina	473 (10.4)
	Paraguay	253 (5.6)
	Colombia	245 (5.4)
	Costa Rica	541 (11.9)
	Mexico	1157 (25.5)
	Ecuador	636 (14.0)
	Peru	280 (6.2)
	Chile	371 (8.2)
	Panama	251 (5.5)
	Guatemala	332 (7.3)
Currently in lockdown	Yes	2734 (60.2)
	No	1805 (39.8)
Study area	Arts, architecture and design	59 (1.3)
	Agricultural and biological sciences	181 (4.0)
	Management and economics sciences	148 (3.3)
	Health Sciences	2908 (64.1)
	Education, social sciences and humanities	182 (4.0)
	Engineering and exact sciences	821 (18.1)
	Other	240 (5.3)
Class modality	Online/virtual	4346 (95.7)
	Mixed (face-to-face and virtual)	164 (3.6)
	Face-to-face	29 (0.6)
Age (mean ± SD)		22.5 ± 4.4

Table 2. Health-related data.

Variable		n (%)
Self-report weight from lockdown	Decreased	1005 (22.1)
	Increase	2186 (48.2)
Self-report of hours of sleep	Remained	1348 (29.7)
	Quite satisfied	467 (10.3)
	Satisfied	1014 (22.3)
Hours of sleep	Normal	1488 (32.8)
	Unsatisfied	1196 (26.3)
	Quite dissatisfied	374 (8.2)
Physical activity	Optimal	1017 (22.4)
	Borderline	524 (11.5)
	Insufficient	2998 (66.0)
Physical activity	Active	1547 (34.1)
	Insufficiently active	2992 (65.9)

according to age, younger college students (18–25 years) gained more weight (85.1%). Statistical differences were found between gender according to body weight status ($p < 0.002$) (Table 3).

On the other hand, self-reported body weight according to self-reported hours of sleep, participants who stated that they were normal with self-report of hours of sleep, was

the group that gained the most weight in 31.7%. Those who had insufficient sleep hours were the ones who gained most weight (67.6%). Physically inactive participants reported the highest proportion of weight gain (74.7%). Statistical differences were found between self-report of hours of sleep and physical activity according to body weight status ($p < 0.001$) (Table 4).

Discussion

First of all, we observed that the majority of students were female (73.6%), amount that exceeds what was found by Changwon et al.,¹⁶ (56.9%) in their study on the effects of the COVID-19 pandemic on university students, but in his research also the majority were women. Gender has been seen to have an influence on the quality of sleep, as demonstrated by the study by Marelli et al.,¹⁷ on the Impact of COVID-19 lockdown on sleep quality in university students and administration staff, they showed that women had worse

Table 3. Self-report bodyweight in relation to gender and age.

Variable		Body weight (n and %)			Total	p*
		Decreased	Increased	Remained		
Gender	Female	780 (77.6)	1601 (73.2)	960 (71.2)	3341 (73.6)	0.002
	Male	225 (22.4)	585 (26.8)	388 (28.8)		
Total		1005 (22.1)	2186 (48.2)	1348 (29.7)	4539 (100)	
Age	18-25	876 (87.2)	1861 (85.1)	1132 (84.0)	3869 (85.2)	
	26-45	129 (12.8)	325 (14.9)	216 (16.0)		
Total		1005 (22.1)	2186 (48.2)	1348 (29.7)	4539 (100)	

*p value < 0.05.

Table 4. Self-report body weight in relation to sleep, lockdown and physical activity.

Variable		Body weight (n and %)			Total	p*
		Decreased	Increased	Remained		
Self-report of hours of sleep	Quite satisfied	107 (10.6)	191 (8.7)	169 (12.5)	467 (10.3)	<0.001
	Satisfied	221 (22.0)	463 (21.2)	330 (24.5)	1014 (22.3)	
	Normal	310 (30.8)	694 (31.7)	484 (35.9)	1488 (32.8)	
	Unsatisfied	281 (28.0)	625 (28.6)	290 (21.5)	1196 (26.3)	
	Quite dissatisfied	86 (8.6)	213 (9.7)	75 (5.6)	374 (8.2)	
Total		1005 (22.1)	2186 (48.2)	1348 (29.7)	4880 (100)	
Hours of sleep	Optimal	228 (22.7)	455 (20.8)	334 (24.8)	1017 (22.4)	0.079
	Borderline	111 (11.0)	254 (11.6)	159 (11.8)	524 (11.5)	
	Insufficient	666 (66.3)	1477 (67.6)	855 (63.4)	2998 (66.0)	
Total		1123 (23)	2274 (46.5)	1483 (30.5)	4880 (100)	
Physical activity	Active	501 (49.9)	552 (25.3)	494 (36.6)	1547 (34.1)	<0.001
	Inactive	504 (50.1)	1634 (74.7)	854 (63.4)	2992 (65.9)	
Total		1123 (23)	2274 (46.5)	1483 (30.5)	4880 (100)	
Currently in lockdown	Yes	631 (62.8)	1306 (59.7)	797 (59.1)	2734 (60.2)	0.162
	No	374 (37.2)	880 (40.3)	551 (40.9)	1805 (39.8)	
Total		1120 (23)	2274 (46.5)	1486 (30.5)	4880 (100)	

*p value < 0.05.

sleep quality than men. However, more studies are needed to prove this to reinforce this hypothesis. On the other hand, the greater number of women may be due to the fact that most of the students in this study (64.1%) were from the area of Health Sciences, where it has been seen in other studies that the predominant gender is female.^{18,19}

The average of age of this work was 22.4 years, similar to the 22.8 year found in the study of Xiaomei et al.²⁰

The 60.2% was currently in lockdown and with online classes. Most of the adolescents and young adults are likely to have experienced such a stressful situation for the first time in their lives. The uncertainty about the adverse impact of this situation on their future academic and carrier prospects, besides other concerns, makes college students particularly vulnerable to stress during the COVID-19 pandemic. This could also be a potential factor impacting the mental health of college students.²⁰

In this work, 64.1% of students were from Health Sciences careers. A variety of factors which positively and negatively influence students to choose these careers were found within the literature. Positive influences included job satisfaction, lifestyle and maintaining a work-life balance.²¹⁻²³ Perhaps because of this, most of the students chose health-related careers.

The 95.7% were taking virtual classes. In this sense, Sharma et al,²⁴ reported that although recently adopted, the satisfaction of the students toward online classes appears to be good, and prioritizing the identified predictors and working on the weak links could assist in enhancing student's satisfaction and better outcomes. However, many students in other countries like the countries of Latin America have

a poor connection or limited Internet access, which makes it difficult to learn correctly.²⁵

Self-report body weight from lockdown threw a 48.2% of students that increase their weight. Hence, increased stress may rise the risk of obesity and its comorbidities, which include hypertension, metabolic syndrome, heart disease, and diabetes.²⁶⁻²⁸ Although there is evidence of high stress level being a risk factor for an increase in adiposity,^{16,27} the relationship between stress and anxiety encountered during university or college enrollment and weight status is still not well understood, and the evidence is not strong enough to generalize. Boukrim and colleagues in 2020, evaluated the effect of confinement on the weight load, physical activity and dietary behavior of higher education students during the period of confinement. They found that more than a quarter of the students were overweight or obese. During the confinement of COVID-19, most of the students suffered from nutritional disorders, only one-third were moderately physically active, and the majority of students were at risk of stress. Multivariate analysis showed that the concept of threat of stress increases the risk of weight gain. The study showed that confinement appeared to contribute to weight gain and those students were more sedentary than active with unhealthy eating behaviors.²⁹ Our data from self-report bodyweight, women were the ones who increased their weight in the greatest proportion (73.2%). This may be due to factors such as sedentary lifestyle due to not releasing activities outside the home, in addition to the fact that women are more likely to gain weight in adipose mass. In terms of age, the youngest college students gained the most weight during the pandemic (85.1%). This would be

explained based on the fact that the youngest university students are the ones who drastically change their eating habits, the type of food they eat and the little time they have to carry out any physical activity.

Insufficient hours of sleep were found in a 66%, amount that is almost similar compared to the 76.4% found by Qiushuang and Qlan in their study carried out in 2008, on college students regarding to hours of sleep.³⁰ In this sense, Durán-Agüero et al., in 2019, found in their study 77.9% of university students who sleep less than recommended, a result that shows that the lives of these students are a factor that leads to poor quality of sleep.³¹ In another study by Durán-Agüero et al, in university students, they found that 57.1% slept less than recommended and that, in addition, less sleep is associated with overweight and obesity.³²

Finally, regarding the other variables, the participants who were in lockdown, who had insufficient hours of sleep and who were physically inactive, were the ones who increased their body weight the most during the pandemic. With these results, we show that sleeping well, doing physical activity and trying to do activities outside the house could help maintain an adequate and healthy body weight.

Statistical analyzes revealed significant differences between the variables of gender, self-reported of hours of sleep and physical activity based on the behavior of self-reported body weight, showing that those with the worst profile gained weight in higher proportion than the others.

By performing a logistic regression analysis, we were able to verify that students who have insufficient sleep are 21% more likely to have changes in body weight compared to students who have optimal sleep (model 2, OR 1.21, 95%, CI 1.04 to 1.42).

Among the main strengths of the study are: (i) the number of Latin American university students and the diversity of countries of residence, which broadens the scope of the study, (ii) the similarity of the baseline characteristics of the sample, which homogenizes the data, (iii) the use of surveys, which allows comparison with other studies. As limitations we point out: (i) the study design that does not allow cause and effect relationships, (ii) the type of sampling (nonprobabilistic accidental) that does not allow extrapolation of the data to the entire population of university students, and (iii) the use of self-report surveys, which could reduce the external validity of the data. Despite this, our study strengthens the scientific literature and provides valuable information on the body weight, quality of sleep and physical activity.

Conclusions

The results demonstrated here reveal that short sleep, being physically inactive and spending a lot of time indoors are factors that increase the risk of gaining weight during the COVID-19 pandemic. Taking this into account, it would be interesting at this pandemic time to develop programs for managing physical inactivity, few hours of sleep and lockdown, improving quality of life and sleep design exclusively for university students who need support to prevent or treat

these risk factors. and can cope with their academic responsibilities.

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Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of Chile and received approval from the Universidad de Las Américas, Chile.

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