2022, **Retos**, *43*, 274-282
 ISSN: Edición impresa: 1579-1726. EdiciónWeb: 1988-2041 (https://recyt.fecyt.es/index.php/retos/index)

Effect of Confinement by COVID-19 on the Lifestyle of the University Population of Argentina: Evaluation of Physical Activity, Food and Sleep

Efecto del confinamiento por COVID-19 sobre el estilo de vida en población universitaria de Argentina: Evaluación de la actividad física, alimentación y sueño

*Leonardo Intelangelo, **Nacim Molina Gutiérrez, *Nicolás Bevacqua, *Cristian Mendoza, ***Iris Paola Guzmán-Guzmán, ****Daniel Jerez-Mayorga

*University of Gran Rosario (Argentina), **Universidad Católica de Maule, Talca, (Chile), ***Universidad Autónoma de Guerrero (Mexico), ****Universidad Andres Bello (Chile)

Abstract. Objective: to determine lifestyle changes, such as physical activity, nutrition, and sleep in an Argentinean university population, caused by confinement during the COVID-19 pandemic. Methods: Cross-sectional study via web survey. 1021 the Argentinean university population (women, n = 645 and men, n = 376) aged between 18–70 years old was participate. Survey was utilized to measure participant physical activity behavior, nutrition, and sleep April to May 2020. Results: the main findings revealed that 4.3% of the sample showed obesity; the highest proportion of the sample stayed more than 6 hours in a sedentary status; 21.74% reported bad sleep quality; a reduction in good feeding pattern; and an increase in subjects who do not perform physical activity. According to socio-demographic and anthropometric factors, being a student (OR 2.19, CI95% 1.18 - 4, p= .012), overweight (OR 1.71, CI95% 1.19 – 2.44, p= .003), obesity (OR 4.45, CI95% 2.27 – 8.7, p< .001), and have been confined more than 45 days was associated with bad feeding. Likewise, low physical activity levels were associated with obesity (OR 3.2 CI95% 1.66 – 6.18, p= .001), being female (OR 1.61, CI95% 1.14–2.28, p= .006) and get married (OR 1.72, CI95% 1.14 – 2.61, p= .009). Moreover, being a student was associated with poor sleep quality (OR 43.6, CI95%5.4 – 350, p< .001). Conclusion: This study suggests that confinement decreased healthy living habits such as good nutrition and physical activity and affected the quality of sleep in young subjects.
Keywords: COVID-19 pandemic, University population, Lifestyle, Physical activity.

Resumen. Objetivo: determinar los cambios en el estilo de vida, como la actividad física, la nutrición y el sueño en una población universitaria argentina, causados por el confinamiento durante la pandemia de COVID-19. Métodos: Estudio transversal mediante encuesta por Internet. Participaron 1021 personas de la población universitaria argentina (mujeres, n = 645 y hombres, n = 376) de entre 18 y 70 años de edad. La encuesta fue utilizada para medir el comportamiento de la actividad física, la nutrición y el sueño de los participantes de abril a mayo de 2020. Resultados: los principales hallazgos mostraron que el 4,3% de la muestra presentaba obesidad; la mayor proporción de la muestra permaneció más de 6 horas en estado sedentario; el 21,74% informó sobre la mala calidad del sueño; una reducción de los hábitos correctos de alimentación; y un aumento de los participantes que no realizan actividad física. De acuerdo con factores socio-demográficos y antropométricos, ser estudiante (OR 2.19, CI95% 1.18 - 4, p= .012), el sobrepeso (OR 1.71, CI95% 1.19 - 2.44, p= .003), la obesidad (OR 4.45, CI95% 2.27 - 8.7, p< .001), y haber estado confinado más de 45 días se asoció con una mala alimentación. Asimismo, los bajos niveles de actividad física se asociaron con la obesidad (OR 3,2; IC95% 1,66 - 6,18, p= .001), ser mujer (OR 1,61; IC95% 1,14 -2,28, p= .006) y estar casado (OR 1,72; IC95% 1,14 - 2,61, p= .009). Además, ser estudiante se asoció con una mala calidad de sueño (OR 43,6, CI95% 5,4 - 350, p< .001). Conclusión: Este estudio sugiere que el confinamiento disminuyó los hábitos de vida saludables como la buena nutrición, la actividad física, y afectó la calidad del sueño en sujetos jóvenes.
Palabras claves: Pandemia, COVID-19, Población universitaria, Estilo de vida, Actividad física.

Introduction

The coronavirus is part of a large family of viruses that are both phenotypically and genotypically diverse («World Health Organization COVID-19 Pandemic Statement by World Health Organization»). The pandemic of COVID-19 began in December 2019 in Wuhan, China. From 20 March 2020 to date, human-to-human transmission resulted in 10.6 million confirmed cases and 315.600 deaths in South America alone (WHO Situation Reports - Updated as of 21 Nov 2020). Particularly in Argentine, the number of infections is 1.366.182 and 36.902 deaths. (PAHO Reports - Updated as of 21 Nov 2020) («Organización Panamericana de la Salud. Situación de COVID-19 en la Región de las

Fecha recepción: 18-03-21. Fecha de aceptación: 07-07-21
Leonardo Intelangelo
leonardo.intelangelo@gmail.com

Américas»). As the COVID-19 pandemic continues to unfold in almost all territories and regions of the world, various protective measures have been implemented by government authorities, including the closure of schools and universities and bans on travel, cultural and sporting events, and social meetings. In most of these cases, people have been ordered or advised to stay in their homes. In this context, these measures lead people to spend more time doing activities with sedentary characteristics, thus hurting physical activity (PA), well-being, sleep patterns, and quality of life (Castañeda-Babarro, Coca, Arbillaga-Etxarri, & Gutiérrez-Santamaría, 2020; Cheval et al., 2018; Narici et al., 2020; Pappa et al., 2020; Reyes-Olavarría et al., 2020).

In this context, PA has decreased considerably during confinement, and inactive persons (less than 75 minutes per week of vigorous activity) and sedentary time have significantly increased (Castañeda-Babarro et al., 2020). This impact was particularly high among men, youth, students, and the physically active population (Castañeda-Babarro et al., 2020). The reported incidence of physical inactivity and increased sedentary behaviors, such as television watching, were associated with an increased likelihood of negative mental health outcomes (Werneck et al., 2020). Immobility due to hospitalization, bed rest, physical inactivity due to sustained confinement, and social distancing may reduce organ systems' ability to resist viral infections (Woods et al., 2020). On the other hand, it may also increase the risk of damage to the immune, respiratory, cardiovascular, musculoskeletal, and brain systems (Narici et al., 2020; Woods et al., 2020). On the other hand, the beneficial effects of regular PA have been demonstrated on different magnitudes' health outcomes (Matthews et al., 2012). In particular, research has been shown benefits such as improved physical and physiological health parameters and positive outcomes in areas of mental health and well-being (Pedersen & Saltin, 2015).

In additional, a negative impact in response to confinement has been unhealthy nutritional habits (Mattioli, Sciomer, Cocchi, Maffei, & Gallina, 2020). Social isolation produces emotional changes such as anxiety, depression, restlessness and anger, modifying certain behaviors such as alcohol consumption, smoking, overeating, or the number of main meals (Ammar et al., 2020; Mattioli et al., 2020). The prevalence of western diets (high content of saturated fats, sugars and refined carbohydrates) could increase the risk of pathology and severe mortality by COVID-19 (Butler & Barrientos, 2020; Mattioli et al., 2020). The prevalence of this type of food damages the adaptive immunity, which leads to chronic inflammation and a decrease in the host's defenses against the virus (Butler & Barrientos, 2020). For this reason, health care strategies should be promoted, focusing on the consumption of Vitamin C, D, and Zinc since these have shown a preventive role in respiratory infections (Derbyshire & Delange, 2020; Mattioli et al., 2020; Zabetakis, Lordan, Norton, & Tsoupras, 2020).

On another hand, social isolation has not only had its negative consequences on PA and nutritional habits but has also affected the quality of sleep (Pérez-Carbonell et al., 2020). The bidirectional relationship between emotional reactivity and sleep has been shown to play an essential role in the gestation of insomnia (Altena et al., 2016). The dream disturbances have affected a substantial proportion of the general population, having a narrow relation with mental health alterations (anxiety, depression, etc.) (Bigalke, Greenlund, & Carter, 2020; Partinen et al., 2020; Pérez-Carbonell et al., 2020; Zhang et al., 2020). In this regard, women have shown a greater association between the poor quality of sleep and anxiety (Bigalke et al., 2020), and approximately a third of health personnel suffered from sleep disorders (Zhang et al., 2020).

As a result of these actions and human behaviors, health could be affected. In addition to this feature, there is the uncertainty of not knowing that the isolation period could extend for months. Therefore, the present study aimed to determine lifestyle changes, such as PA, nutrition, and sleep in an Argentinean university population, caused by confinement during the COVID-19 pandemic.

Materials and methods

Study design

This study was cross-sectional and based on a voluntary sample for convenience. The information was collected by an electronic survey designed by a multidisciplinary team uploaded to the Google forms platform. The survey was disseminated through social networks, WhatsApp, e-mails, and the university's official communication channels. Before starting the questionnaire, essential aspects related to the study are detailed; it is emphasized that participation is voluntary and that each individual can withdraw or resign at any time, being the data obtained anonymous and confidential. All of the sample completed the survey after a median (5-95) 45 days (34-75).

Participants

A total of 1.021 people completed the online survey between April and June and during the period of obligatory confinement due to COVID-19. Inclusion criteria were: (a) age between 18–70 years old; (b) be Argentines university population or foreigners university residing in Argentina; and (c) have internet access. Participants were excluded if they presented: (a) unable to give consent, (b) intellectual limitations, or (c) no internet access). All participants gave their informed consent before the survey began. This study was approved by the Ethics and Bioethics Committee of the Instituto Universitario Italiano de Rosario (Resolution Nro:37/20).

Electronic survey

A survey with structured and multiple-choice questions was used to collect information on the effects of isolation on sleep quality and life habits such as PA and diet. Only PA information was reported before and during to the confinement. This tool consists of 31 questions that are distributed into three different domains. These are PA before and after isolation, eating habits and sleep quality. It was designed to be answered in approximately 3 to 5 minutes.

Personal history

The first section was related to personal background: gender (female, male, other), age (years), body weight (kg), size (cm), marital status (single, married, separated, widowed), physical condition or disease that prevents PA and current occupation at the university (student, professor, administrative staff, maintenance staff, other). The body mass index (kg/m^2) and its classification category (normal weight, overweight, or obese) were calculated. Also, they were asked for information on food habits and PA before confinement.

Personal situation during isolation, food habits and sleep quality

The second section was related to the personal situation during confinement: a number of people who shared the same place for quarantine, current occupation, the time they spend sitting or lying down (not counting sleep period), food habits and sleep quality.

The general perception of diet was consulted as to whether it was healthier, less healthy, or maintained compared to before COVID-19 confinement for the collection of antecedents related to eating. To collect data related to the quality of sleep, the participants were asked how many hours they slept during isolation (average), the quality of sleep (very bad, bad, regular, good, very good), and whether they woke up during the night (none, once, twice, three times or more).

PA Patterns

Regarding PA, an adapted version of the International Physical Activity Questionnaire (IPAQ-SF) short-form was used. We asked about the frequency of PA per week (1, 2, 3, 4, 5, every day, or do not do it), duration (number of minutes dedicated per session according to the current references of PA for the population over 18 years) and intensity (mild, moderated or intense) (Ruiz-Casado et al., 2016). They were asked what type of PA they performed (walking, running, cycling, strength - elastic bands, body weight-, cross-fit, yoga, dance, aerobic training, high-intensity training) and how they organized their routines (own knowledge, professional consultation, social networks, others).

The survey was developed through the virtual platform «Google Form» where an account was created specifically to record each of the responses that were stored in its database.

Data Analyses

Statistical analyses were performed using STATA V.13.0. (StataCorp, College Station, TX, USA). Normal distribution was tested using the Kolmogorov–Smirnov test. For continuous variables, values are presented as the median and 5–95 percentiles. Differences between groups were determined using the U-Mann–Whitney test. The qualitative variables are presented as numbers and proportions, compared using the Chi^2 test. Logistic regression and the inclusion of odds ratios were used to determine the association between variables (OR; 95% CI). Values of $p < 0.05$ were considered statistically significant.

Results

General Characteristics of the Study Sample

Participants were a median of 22 years old (18–44 years old) among 376 men and 645 women and the highest percentage of the sample were students (85%), were single (76.3%), and were in company with at least one more person (90%) (Table 1).

Anthropometric characteristics of the study sample

Concerning confinement days, the sample was a

Table I.
General characteristics of the population in study.

Variables	Total (n=1.021)
Age[a]	22 (18-44)
Sex n (%)	
Women	645 (63.17)
Men	376 (36.83)
Occupation n (%)	
Student	868 (85.01)
Professor	119 (11.66)
Administrative	34 (3.33)
Marital status n(%)	
Single	779 (76.30)
Married/Living common-law	220 (21.55)
Separated	22 (2.15)
Housingcompany in confinement (%)	
None /alone	54 (5.29)
1 person	166 (16.26)
2 persons	232 (22.72)
3 persons	302 (26.15)
=4 persons	267 (25.15)

The data showed represent number (percent).
[a]information presented as median and 5-95 percentiles.

Table II.
Anthropometric parameters of the study sample according to sex in confinement time.

Variables	Total	Women	Men	
	n =1.021	n =645 (63.17)	n =376 (36.83)	*p* value
Age (years)[a]	22 (18-44)	22 (18-45)	22 (18-43)	.270
Confinement days	45 (34-75)	45 (35-75)	45 (32-75)	.800
	Anthropometric parameters			
Weight (kg)[a]	65 (50-90)	60 (48-80)	76 (60-95)	**< .001**
Height (m)[a]	1.68 (1.55-1.85)	1.63 (1.53-1.75)	1.77 (1.67-1.90)	**< .001**
BMI (kg/m^2)[a]	23.0 (18.9-29.5)	22.1 (18.5-30.1)	24.1 (20.0-29.1)	**< .001**
Category, BMI[b]				**< .001**
Normal range (18.5-24.9)	741 (72.6)	507 (78.6)	234 (62.23)	
Overweight (25-29.9)	236 (23.1)	105 (16.28)	131 (34.84)	
Obese (=30)	44 (4.3)	33 (5.12)	11 (2.93)	

Data showed represents [a]median and 5 - 95 percentile, [b] represent number and proportions.
BMI: body mass index. U-Mann-Whitney test was used to compare differences between groups.
p values < .05 are statistically significant.

Table III.
Comparison of sedentary, daily activity, and sleep parameters according to sex, in confinement time.

Variables	Total n=1,021	Women n=645 (63.17)	Men n=376 (36.83)	*p* value
Homework				.850
No	599 (58.67)	377 (58.45)	222 (59.04)	
Yes	422 (41.31)	268 (41.55)	154 (40.96)	
Times it has gone out				**.002**
None	158 (15.48)	114 (17.67)	44 (11.70)	
1	239 (23.41)	157 (24.34)	82 (21.81)	
2	239 (23.41)	158 (24.5)	81 (21.54)	
=3	385 (37.71)	216 (33.49)	169 (44.95)	
Sedentary status				
Sedentary life style (h)[a]	7 (3-12)	7 (3-12)	7 (3-12)	.430
Sedentary time n (%)				.530
=5 h	71 (6.95)	49 (7.6)	22 (5.85)	
6-8 h	737 (72.18)	460 (71.32)	277 (73.67)	
=8 h	213 (20.86)	136 (21.09)	77 (20.48)	
Defects of Sleep				
Hours of Sleep[a] h	8 (5-10)	8 (5-10)	8 (5-10)	.480
Hours of Sleep n (%)				.530
=5 h	71 (6.95)	49 (7.6)	22 (5.85)	
6-8 h	737 (72.18)	460 (71.32)	277 (73.67)	
=8 h	213 (20.86)	136 (21.09)	77 (20.48)	
Sleep quality[b]				**.006**
Verygood	126 (12.34)	74 (11.47)	52 (13.83)	
Good	312 (30.56)	176 (27.29)	136 (36.17)	
Regular	361 (35.36)	243 (37.67)	118 (31.38)	
Bad	222 (21.74)	152 (23.57)	70 (18.62)	
Difficult to fall asleep (times per week)[b]				**.002**
None	233 (22.82)	133 (20.62)	100 (26.6)	
1 times	308 (30.17)	179 (27.75)	129 (34.31)	
2 times	166 (16.26)	115 (17.83)	51 (13.56)	
=3 times	314 (30.75)	218 (33.80)	96 (25.53)	
Times you wake up during the night (times per week)[b]				**.001**
None	213 (20.86)	110 (17.05)	103 (27.39)	
1 times	297 (29.09)	190 (29.46)	107 (28.46)	
2 times	286 (28.01)	191 (29.61)	95 (25.27)	
=3 times	225 (22.04)	154 (23.88)	71 (18.88)	

Data shows represent numbers and proportions. [a]Represent median and 5 and 95 percentiles, [b]Represent number and proportions. U-Mann-Whitney test was used to compare differences between groups. *p* values < .05 are statistically significant. Chi^2 test was used to quantitative data.

median of 45 days. Regarding anthropometric parameters, 72.6% of the sample reported being normal weight and 4.3% reported obesity. Men reported a higher prevalence of overweight than women ($p<$ .001), and women had a higher prevalence of obesity than men ($p<$ .001) (Table 2).

The lower percentage of the sample did not leave their home (15.48%), but men left more than three times their home than women ($p=$ .002). About defects of sleep, only 6.95% of the sample studied slept less than 5 hours; 21.74% reported bad sleep quality; 22.82% reported no difficulties to fall asleep, and 20.86% reported not having woken up at night. Women had poorer sleep quality ($p=$ .006), more difficulties falling asleep ($p=$ .002), and woke up more times at night than men ($p=$ .001) (Table 3).

Changes in feeding, physical activities and time of execution of physical activities patterns

Figure 1 compares the changes in feeding, PA, and the execution of PA in pre and in-confinement. Figure 1a shows a reduction in good feeding pattern from 61.9% to 39.47% ($p<$ .001). Figure 1b shows an increase in subjects who don´t perform PA, from 10.3% to 18.9% ($p<$ .001). Figure 1c shows an increase in time of execution of physical activities between 30 minutes and 60 minutes (54.9% to 69%, $p<$ .001), and a reduction in activities lasting more than one hour (39.6% to 12.6%, $p<$ .001).

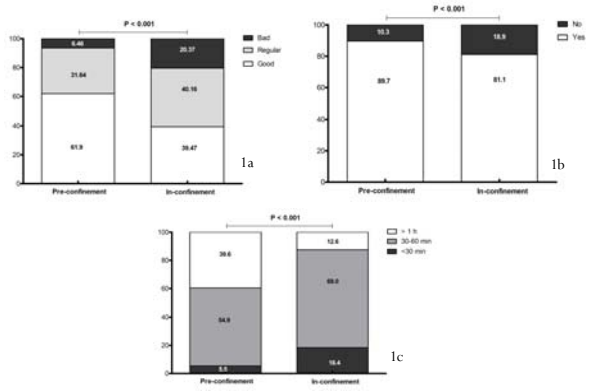

Figure 1: 1a shows a reduction in good feeding pattern. 1b shows an increase in subjects who don´t perform PA. 1c shows an increase in time of execution of physical activities between 30 minutes and 60 and a reduction in activities lasting more than one hour. The qualitative variables are presented as numbers and proportions, compared using the Chi^2 test.

Changes in physical and sports activities in-confinement

High-intensity training and collective sports have disappeared in-confinement, and running/swimming decreased from 28.1% to 10.77%. Bodyweight training, like CrossFit, has increased from 28.65% to 74.33%. Regarding the instructor, 52.07% of the sample study followed the recommendations done by a physical trainer, and 26.24% self-administered the exercises (Table 4).

Table IV.
Physical and sports activities pre and in-confinement.

Variables	Pre-confinement	In-confinement
Activities/Sports		
Running/swimming	256 (28.10)	89 (10.77)
Body weight/Cross-Fit	261 (28.65)	614 (74.33)
Aerobic class	90 (9.88)	95 (11.50)
Yoga	53 (5.82)	28 (3.39)
Collective sports	146 (16.03)	-
High-Intensity training	105 (11.53)	-
Instructor		
Physical Trainer		477 (52.07)
Physiotherapist/Physician		28 (3.06)
Self-administered		244 (26.64)
None		61 (6.66)
Other		10.6 (11.57)

Data shows represent numbers and proportions.

Association of socio-demographic and anthropometric variables with lifestyle patterns in confinement

According to socio-demographic and anthropometric factors, being a student (OR 2.19, CI95% 1.18 - 4, p= .012), overweight (OR 1.71, CI95% 1.19 – 2.44, p= .003), obesity (OR 4.45, CI95% 2.27 – 8.7, p< .001), and have been confined more than 45 days was associated with bad feeding. On the other hand, being single was associated with lower bad feeding probabilities (OR 0.55 CI95% 0.36 – 0.84, p= .006) (Table 5).

Likewise, low PA levels were associated with obesity (OR 3.2 CI95% 1.66 – 6.18, p= .001), being female (OR 1.61, CI95% 1.14–2.28, p= .006) and get married (OR 1.72, CI95% 1.14 – 2.61, p= .009). Moreover, being a student was associated with poor sleep quality (OR 43.6, CI95%5.4 – 350, p< .001). No associations were found between sedentary lifestyle with the occupation, corporal status, sex, company confinement, marital status and confinement time (Table 5).

Table V.
Socio-demographic and anthropometric factors related to lifestyle patterns in confinement.

Impaired	Feeding (Bad)	Low physical activity (<30 minutes)	Sedentary (>8 hours)	Poor sleep quality (Bad < 5 h)
	OR (CI95%) *p* value	OR (CI95%) *p* value	OR (CI95%) *p* value	OR (CI95%) *p* value
Occupation				
Student	2.19 (1.18 – 4.0), .012	0.40 (0.15 – 1.05), .060	0.99 (0.65 – 1.51), .960	43.6 (5.4 – 350), < .001
Academic/administrative	0.45 (0.25 – 0.84), .012	2.47 (0.94 – 6.44), .060	-	0.02 (0.002–0.18), < .001
Corporal status				
Overweight	1.71 (1.19 – 2.44), .003	1.33 (0.92 –1.93), .120	1.32 (0.97 – 1.79), .071	1.14 (0.64– 2.04), .630
Obesity	4.45 (2.27 – 8.7), < .001	3.2 (1.66 – 6.18), .001	1.82 (0.94 – 3.54), .075	1.97 (0.75 – 5.14), .160
Sex				
Male	-	0.61 (0.43 – 0.87), .006	-	0.77 (0.45 –1.29), .330
Female	1.31 (0.95 – 1.81), .100	1.61 (1.14 –2.28), .006	1.14 (0.97 – 1.48), .29	1.29 (0.76 – 2.18), .330
Company in confinement				
Alone or 1	0.63 (0.96 – 1.0), .070	0.56 (0.28 – 1.13), .110	0.86 (0.59 – 1.25), .430	1.72 (0.82 – 3.61), .390
2-3 persons	1.41 (0.91– 2.19), .110	1.08 (0.68 – 1.73), .710	0.96 (0.71 – 1.29), .810	0.77 (0.44 – 1.35), .370
=4 persons	1.56 (0.96 – 2.54), .070	1.795 (0.88 – 1.73), .110	1.16 (0.79 – 1.69), .430	0.57 (0.27 – 1.21), .140
Marital status				
Single	0.55 (0.36 –0.84), .006	0.57 (0.38 –0.87), .009	1.12 (0.79 – 1.60), .490	1.29 (0.64 – 2.58), .470
Married	1.79 (1.18 – 2.71), .006	1.72 (1.14 – 2.61), .009	0.88 (0.62 – 1.25), .490	0.77 (0.38 – 1.55), .790
Separated	2.21 (0.63 –7.69), .210	1.83 (0.61 –5.42), .270	0.68 (0.26 – 1.76), .420	1.56 (0.39 –6.25), .520
Confinement time				
1-30 d	0.84 (0.38 – 1.83), .029	6.38 (0.85 – 47.9), .070	0.66 (0.35 – 1.26), .210	1.32 (0.44 – 3.98), .610
31–45 d	0.83 (0.38–1.79), .640	1.44 (0.95 – 2.2), .085	1.82 (0.97 – 3.43), .060	0.81 (0.49 – 1.34), .430
>45 d	1.18 (0.54 –2.56), .670	1.19 (0.53 –2.68), .660	1.49 (0.78 – 2.84), .210	0.75 (0.25 – 2.26), .610

OR Odds Ratio adjusted by age. Regression logistic model. p values < .05 are statistically significant.

Discussion

This study aimed to determine lifestyle changes, such as PA, nutrition, and sleep in an Argentinean university population, caused by confinement during the COVID-19 pandemic. The main findings of this study revealed that (I) 4.3% of the sample showed obesity; (II) the highest proportion of the sample stayed more than 6 hours in a sedentary status; (III) 21.74% reported bad sleep quality; (IV) a reduction in good feeding pattern; and (V) an increase in subjects who do not perform PA. These findings suggest that confinement decreased healthy living habits such as good nutrition and PA and affected the quality of sleep in young subjects.

The most studied aspects of the effects of confinement on the general population are sedentary behaviors and PA, nutritional habits, sleep quality, and mental health. Regarding PA, different literature reports show a decrease in PA levels and an increase in sedentary behaviors (Castañeda-Babarro et al., 2020; Gallo, Gallo,Young, Moritz, & Akison, 2020; Robinson et al., 2020; Werneck et al., 2020). Also, physical inactivity promotes systemic inflammation and has a negative impact on the immune system and mental health (Deschasaux-Tanguy et al., 2020; Mattioli et al., 2020; Narici et al., 2020; Pappa et al., 2020; Woods et al., 2020). Therefore, sleep disturbances have affected a substantial proportion of the general population during the COVID-19 pandemic (Partinen et al., 2020; Pérez-Carbonell et al., 2020). Social isolation has exposed most people to unprecedented anxiety and stress that affects sleep quality (Bigalke et al., 2020; Partinen et al., 2020; Pérez-Carbonell et al., 2020); another important aspect is immunonutrition. In this context, the evidence suggests consuming food containing vitamins C, D, and zinc instead of western diets (Butler & Barrientos, 2020; Derbyshire & Delange, 2020; Zabetakis et al., 2020). This food could have a role in preventing pneumonia and respiratory infections (Butler & Barrientos, 2020; Derbyshire & Delange, 2020; Zabetakis et al., 2020). Thus, individuals should be mindful of the importance of healthy eating habits, mental health, and PA to reduce susceptibility to and long-term complications from COVID-19 (Butler & Barrientos, 2020).

Staying active constitutes a protective factor against the negative effects of the sedentary lifestyle and PA reduction caused by the COVID-19 pandemic

(Castañeda-Babarro et al., 2020). Our study found a slight and statistically significant reduction in PA participation when compared before and in-confinement periods. These findings are in line with some reports, what have reported the same in a Mexican, Brazilian, Chilean, Colombian, Spanish, and Italian population (Ruíz-Roso et al., 2020; Alarcón Meza & Hall-López, 2021) . In addition, we found that being men and single are protective factors against lower levels of PA. Conversely, being married and obesity are factors that increase the probability of having low PA levels. In a study developed in Chile, Reyes-Olavarria et al. found that being overweight was associated with lower levels of PA, in contrast with our findings; moreover, they found a strong association between sedentary time and lower levels of PA (Reyes-Olavarría et al., 2020). We were not found an association between sedentary time with the occupation, corporal status, sex, a company in confinement, marital status and confinement time. These differences could be because our sample was represented by 85% of university students and 89% of physically active people previous to the confinement period. Moreover, we were considered more than 8 hours as cut-off sedentary time to categorize as sedentary, unlike the Chilean study, which considered more than 6 hours.

In the Canadian population, Lesser et al. have conducted a cross-sectional study and shown that PA behaviors were similar to Argentine, Brazil, Colombia and Chile when compared before and in-confinement (Lesser & Nienhuis, 2020). They reported that 40.5% of inactive individuals became less active and only 22.4% of active individuals became inactive (Lesser & Nienhuis, 2020). Conversely, 33% of inactive individuals became more active, while 40.3% of active individuals became more active (Lesser & Nienhuis, 2020). These findings are in line with our results, but maybe the different ways to administrate the social restrictions and confinement time have influenced PA participation (Urbaneja, Pedro Julião, Nogueira Mendes, Dorado, & Farías-Torbidoni, 2020). Canadian population remained with outdoor physical activities, which represent a difference with government political decisions made in Argentine (Lesser & Nienhuis, 2020). We did data collection while people were in-confinement, without the possibility of doing outdoor physical activities.

On the other hand, Ammar et al. conducted the biggest survey multicenter study regarding confinement on PA impact and reported a negative effect during the COVID-19 pandemic (Ammar et al., 2020). They found that the number of days/week of PA decreased by 24% during home confinement and the number of minutes/day of all PA decreased by 33.5% during home confinement (Ammar et al., 2020). These findings coincide with our findings, with a slight difference in PA intensity categories, because we used questions about modifications of PA time rather than the IPAQ-SF to figure out results in METS, as Ammar et al. did (Ammar et al., 2020).

Alterations or modifications of the life habits of people in confinement affect not only PA and eating but also psychological alterations such as anxiety, fear, depression, symptoms of post-traumatic stress and sleep disorders are described (Ingram, Maciejewski, Hand, et al., 2020). In the context of confinement applied in the world by the SARS-CoV-2 virus pandemic, two studies carried out in the general Italian population show that between 42 and 52% of the population have sleep disorders or lack of sleep, while that in China, around 18% refer to this same condition (Gualano, Lo Moro, Voglino, Bert, & Siliquini, 2020; Huang & Zhao, 2020; Ingram, Maciejewski, & Hand, 2020). In part, social restrictions and modifications and changes in work routines and daily activities could affect the normal sleep cycle (Cellini, Canale, Mioni, & Costa, 2020).

Also, we report that women have poorer sleep quality, have greater difficulty falling asleep, and wake up more times during the night than men. Gualano et al., Found a positive association of the female gender with sleep disturbances (Gualano et al., 2020). However, the evidence contradicts this point, as Huang et al. Found no significant interaction between gender and quality of sleep (Huang & Zhao, 2020). In our study, an association was found between college students and poor sleep quality, with nearly 21% reporting poor sleep quality during the virus pandemic period. These data are similar to studies conducted in the United Kingdom, Italy, the United States and Spain, where sleep modifications or problems were evidenced during this period in college or undergraduate students (Gualano et al., 2020; Ingram, Maciejewski, & Hand, 2020; Martínez-Lezaun, Santamaría-Vázquez, & Del Líbano, 2020; Son, Hegde, Smith, Wang, & Sasangohar, 2020). In a context of «normality», Lucero et al. reported that at least 42% of medical students in Argentina suffer from a sleep disorder (Lucero, Federico, Perrote, & Concari, 2014), while in Colombia and Peru, young students of the same career who reported poor sleep reached 79 and 77% respectively (MacHado-Duque, Echeverri Chabur, & MacHado-Alba, 2015; Vilchez-Cornejo et al., 2016).

Therefore, given the context of the pandemic and the high level of academic demand involved in studying for a university degree, there may be maladaptive events such as denial and disconnection that are significant predictors of depression among young people (Nastasi, Sarkar, Varjas, & Jayasena, 1998). Wong et al. have consistently documented a high prevalence of sleep problems and mental health problems in college students with psychological distress symptoms, increased anti-social personality problems, anxiety problems, attention-deficit/hyperactivity problems, depressive problems, and somatic complaints (39).

The human body requires optimal micronutrients for effective immune function, with different requirements throughout every stage of life. Micronutrient deficiencies could affect the immune system and predispose individuals to infection (40). Evidence suggests that vitamin C, D, and zinc intake play an important role in preventing pneumonia and respiratory infections (15,16,40).

The COVID-19 pandemic has negatively impacted eating habits, in part due to social isolation and anxiety. Some studies showed diets poor in vegetables and fruits and reported eating snacks more frequently, with a consequent low intake of antioxidants and vitamins (Ammar et al., 2020; Deschasaux-Tanguy et al., 2020; Gallo et al., 2020; Mattioli et al., 2020; Robinson et al., 2020). In our study, an association was found between overweight and obesity and confined more than 45 days with bad feeding. These data are similar to other studies. Derbishyre et al. suggest that the lockdown led to unhealthy nutritional behaviors in a substantial part of the French population (Derbyshire & Delange, 2020). Similar results were reported by Robinson et al. in the UK population; many participants reported negative changes in eating behavior and had experienced barriers to weight control (Robinson et al., 2020). Also, during a lockdown, higher BMI was associated with lower levels of PA and diet quality and a greater reported overeating frequency (Robinson et al., 2020). Ammar et al. (2020) made an online survey and 1047 replies (54% women) from Asia (36%), Africa (40%), Europe (21%), and others (3%) were included in the analysis (Ammar et al., 2020). They showed food consumption and meal patterns (the type of food, eating out of control, snacks between meals, number of main meals) were more unhealthy during confinement (Ammar et al., 2020). Mattioli et al. showed that quarantine leads to unhealthy diets. In patients with obesity, stress and anxiety due to confinement made them more vulnerable to over-eating and sedentary lifestyle, thus predisposing them to further weight gain (Mattioli et al., 2020).

Ultimately, we found an association between being a student and poor eating habits. Similar results were reported by Gallo et al. in Australian university students, wherein females, but not males, energy intake, was ~20% greater during the pandemic, and snacking frequency and energy density of consumed snacks also increased and during a gradual easing of nationwide restrictions this behavior persisted (Gallo et al., 2020).

This research project's strengths include an important sample of the university population, which has been widely distributed in three very important cities in Argentina and provides novel results in our population applicable to develop strategies for future confinements. However, there were also limitations, is it is the cross-sectional design, and the results were self-reported, which could mean that these data are underestimated or overestimated.

Conclusion

The survey's preliminary results indicate a negative effect of home confinement on PA, nutrition, and sleep behavior with a significant increase in sitting time and unhealthy diet. Also, high-intensity training and collective sports have disappeared in-confinement, and bodyweight training has increased. These findings suggest that confinement decreased healthy living habits such as good nutrition and PA and affected the quality of sleep in young subjects.

References

Alarcón Meza, E. I., & Hall-López, J. A. (2021). Actividad física en estudiantes deportistas universitarios, previo y en el confinamiento por pandemia asociada al COVID-19. *Retos*, *2041*(39), 572–575. https://doi.org/10.47197/retos.v0i39.81293

Altena, E., Micoulaud-Franchi, J. A., Geoffroy, P. A., Sanz-Arigita, E., Bioulac, S., & Philip, P. (2016). The bidirectional relation between emotional reactivity and sleep: From disruption to recovery. *Behavioral Neuroscience*, *130*(3), 336–350. https://doi.org/10.1037/bne0000128

Ammar, A., Brach, M., Trabelsi, K., Chtourou, H., Boukhris, O., Masmoudi, L., … Hoekelmann, A. (2020). Effects of COVID-19 home confinement on eating behaviour and physical activity: Results of the ECLB-COVID19 international online survey. *Nutrients*. https://doi.org/10.3390/nu12061583

Bigalke, J. A., Greenlund, I. M., & Carter, J. R. (2020). Sex

differences in self-report anxiety and sleep quality during COVID-19 stay-at-home orders. *Biology of Sex Differences*, *11*(1), 1–11. https://doi.org/10.1186/s13293-020-00333-4

Butler, M. J., & Barrientos, R. M. (2020). The impact of nutrition on COVID-19 susceptibility and long-term consequences. *Brain, Behavior, and Immunity*, *87*(April), 53–54. https://doi.org/10.1016/j.bbi.2020.04.040

Castañeda-Babarro, A., Coca, A., Arbillaga-Etxarri, A., & Gutiérrez-Santamaría, B. (2020). Physical activity change during COVID-19 confinement. *International Journal of Environmental Research and Public Health*, *17*(18), 1–10. https://doi.org/10.3390/ijerph17186878

Cellini, N., Canale, N., Mioni, G., & Costa, S. (2020). Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. *Journal of Sleep Research*, *29*(4), 1–5. https://doi.org/10.1111/jsr.13074

Cheval, B., Boisgontier, M. P., Orsholits, D., Sieber, S., Guessous, I., Gabriel, R., … Cullati, S. (2018). Association of early- and adult-life socioeconomic circumstances with muscle strength in older age. *Age and Ageing*, *47*(3), 398–407. https://doi.org/10.1093/ageing/afy003

Derbyshire, E., & Delange, J. (2020). COVID-19: is there a role for immunonutrition, particularly in the over 65s? *BMJ Nutrition, Prevention & Health*, *3*(1), 100–105. https://doi.org/10.1136/bmjnph-2020-000071

Deschasaux-Tanguy, M., Druesne-Pecollo, N., Esseddik, Y., Szabo de Edelenyi, F., Alles, B., Andreeva, V., … Touvier, M. (2020). Diet and physical activity during the COVID-19 lockdown period (March-May 2020): results from the French NutriNet-Sante cohort study, (May). https://doi.org/10.1101/2020.06.04.20121855

Gallo, L. A., Gallo, T. F., Young, S. L., Moritz, K. M., & Akison, L. K. (2020). The impact of isolation measures due to covid-19 on energy intake and physical activity levels in australian university students. *Nutrients*, *12*(6), 1–14. https://doi.org/10.3390/nu12061865

Gombart, A. F., Pierre, A., & Maggini, S. (2020). A review of micronutrients and the immune system–working in harmony to reduce the risk of infection. *Nutrients*, *12*(1). https://doi.org/10.3390/nu12010236

Gualano, M. R., Lo Moro, G., Voglino, G., Bert, F., & Siliquini, R. (2020). Effects of COVID-19 lockdown on mental health and sleep disturbances in Italy. *International Journal of Environmental Research and Public Health*, *17*(13), 1–13. https://doi.org/10.3390/ijerph17134779

Huang, Y., & Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Research*, *288*, 112954. https://doi.org/10.1016/j.psychres.2020.112954

Ingram, J., Maciejewski, G., & Hand, C. J. (2020). Changes in Diet, Sleep, and Physical Activity Are Associated With Differences in Negative Mood During COVID-19 Lockdown. *Frontiers in Psychology*, *11*(September). https://doi.org/10.3389/fpsyg.2020.588604

Ingram, J., Maciejewski, G., Hand, C. J., Cellini, N., Canale, N., Mioni, G., … Mok, D. S. Y. (2020). Psychological health during the coronavirus disease 2019 pandemic outbreak. *Revista Colombiana de Psiquiatria*, *11*(4), 1–13. https://doi.org/10.1080/02796015.1998.12085913

Lesser, I. A., & Nienhuis, C. P. (2020). The impact of COVID-19 on physical activity behavior and well-being of canadians. *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph17113899

Lucero, C., Federico, C., Perrote, F. M., & Concari, I. A. (2014). Trastornos del sueño-vigilia en alumnos de 5.° año de Medicina de la Universidad Nacional de Córdoba y su impacto sobre el rendimiento académico, *6*(4), 184–192.

MacHado-Duque, M. E., Echeverri Chabur, J. E., & MacHado-Alba, J. E. (2015). Somnolencia diurna excesiva, mala calidad del sueño y bajo rendimiento académico en estudiantes de Medicina. *Revista Colombiana de Psiquiatria*, *44*(3), 137–142. https://doi.org/10.1016/j.rcp.2015.04.002

Martínez-Lezaun, I., Santamaría-Vázquez, M., & Del Líbano, M. (2020). Influence of Confinement by COVID-19 on the Quality of Sleep and the Interests of University Students . *Nature and Science of Sleep*, *Volume 12*, 1075–1081. https://doi.org/10.2147/nss.s280892

Matthews, C. E., George, S. M., Moore, S. C., Bowles, H. R., Blair, A., Park, Y., … Schatzkin, A. (2012). Amount of time spent in sedentary behaviors and cause-specific mortality in US adults 1 – 3. https://doi.org/10.3945/ajcn.111.019620.Am

Mattioli, A. V., Sciomer, S., Cocchi, C., Maffei, S., & Gallina, S. (2020). Quarantine during COVID-19 outbreak: Changes in diet and physical activity increase the risk of cardiovascular disease. *Nutrition, Metabolism and Cardiovascular Diseases*, *30*(9), 1409–1417. https://doi.org/10.1016/j.numecd.2020.05.020

Milojevich, H. M., & Lukowski, A. F. (2016). Sleep and mental health in undergraduate students with generally healthy sleep habits. *PLoS ONE*, *11*(6), 1–14. https://doi.org/10.1371/journal.pone.0156372

Narici, M., De Vito, G., Franchi, M., Paoli, A., Moro, T., Marcolin, G., … Maganaris, C. (2020). Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: Physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures. *European Journal of Sport Science*, *0*(0), 1–22. https://doi.org/10.1080/17461391.2020.1761076

Nastasi, B. K., Sarkar, S., Varjas, K., & Jayasena, A. (1998). Participatory Model of Mental Health Programming: Lessons Learned from Work in a Developing Country. *School Psychology Review*, *27*(2), 260–276. https://doi.org/

10.1080/02796015.1998.12085913

Organización Panamericana de la Salud. Situación de COVID-19 en la Región de las Américas. (n.d.). Retrieved from https://www.paho.org/es/argentina/datos-estadisticas

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., & Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain, Behavior, and Immunity*, *88*(May), 901–907. https://doi.org/10.1016/j.bbi.2020.05.026

Partinen, M., Bjorvatn, B., Holzinger, B., Chung, F., Penzel, T., Espie, C. A., … ICOSS-collaboration group. (2020). Sleep and circadian problems during the coronavirus disease 2019 (COVID-19) pandemic: the International COVID-19 Sleep Study (ICOSS). *Journal of Sleep Research*, (September), e13206. https://doi.org/10.1111/jsr.13206

Pedersen, B. K., & Saltin, B. (2015). Exercise as medicine – evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scand J Med Sci Sports*, *(Suppl. 3)*(25), 1–72. https://doi.org/10.1111/sms.12581

Pérez-Carbonell, L., Meurling, I. J., Wassermann, D., Gnoni, V., Leschziner, G., Weighall, A., … Steier, J. (2020). Impact of the novel coronavirus (COVID-19) pandemic on sleep. *Journal of Thoracic Disease*, *12*(Suppl 2), S163–S175. https://doi.org/10.21037/jtd-cus-2020-015

Reyes-Olavarría, D., Latorre-Román, P. Á., Guzmán-Guzmán, I. P., Jerez-Mayorga, D., Caamaño-Navarrete, F., & Delgado-Floody, P. (2020). Positive and negative changes in food habits, physical activity patterns, and weight status during covid-19 confinement: Associated factors in the chilean population. *International Journal of Environmental Research and Public Health*, *17*(15), 1–14. https://doi.org/10.3390/ijerph17155431

Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N. G., Marty, L., … Hardman, C. A. (2020). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. *Appetite*, (June), 104853. https://doi.org/10.1016/j.appet.2020.104853

Ruiz-Casado, A., Alejo, L. B., Santos-Lozano, A., Soria, A., Ortega, M. J., Pagola, I., Fiuza-Luces, C., Palomo, I., Garatachea, N., Cebolla, H., & Lucia, A. (2016). Validity of the Physical Activity Questionnaires IPAQ-SF and GPAQ for Cancer Survivors: Insights from a Spanish Cohort. *International journal of sports medicine*, *37*(12), 979–985. https://doi.org/10.1055/s-0042-103967

Ruíz-Roso, M. B., De Carvalho Padilha, P., Matilla-Escalante, D. C., Brun, P., Ulloa, N., Acevedo-Correa, D., … Dávalos, A. (2020). Changes of Physical Activity and Ultra-Processed Food Consumption in Adolescents from Different. *Nutrients*, *12*(2289), 1–13.

Son, C., Hegde, S., Smith, A., Wang, X., & Sasangohar, F. (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *Journal of Medical Internet Research*, *22*(9). https://doi.org/10.2196/21279

Urbaneja, J. S., Pedro Julião, R., Nogueira Mendes, R. M., Dorado, V., & Farías-Torbidoni, E. I. (2020). Impacto de la COVID-19 en la práctica deportiva de personas participantes en eventos deportivos de carrera a pie y ciclismo en España y Portugal. *Retos*, 39, 743–749. https://doi.org/10.47197/retos.v0i39.82564

Vilchez-Cornejo, J., Quiñones-Laveriano, D., Failoc-Rojas, V., Acevedo-Villar, T., Larico-Calla, G., Mucching-Toscano, S., … Díaz-Vélez, C. (2016). Mental health and quality of sleep from eight faculties of medical students in Peru. *Revista Chilena de Neuro-Psiquiatria*, *54*(4), 272–281. https://doi.org/10.4067/s0717-92272016000400002

Werneck, A. O., Silva, D. R., Malta, D. C., Souza-Júnior, P. R. B., Azevedo, L. O., Barros, M. B. A., & Szwarcwald, C. L. (2020). Physical inactivity and elevated TV-viewing reported changes during the COVID-19 pandemic are associated with mental health: A survey with 43,995 Brazilian adults. *Journal of Psychosomatic Research*, *140*(July 2020), 110292. https://doi.org/10.1016/j.jpsychores.2020.110292

Wong, M. L., Lau, E. Y. Y., Wan, J. H. Y., Cheung, S. F., Hui, C. H., & Mok, D. S. Y. (2013). The interplay between sleep and mood in predicting academic functioning, physical health and psychological health: A longitudinal study. *Journal of Psychosomatic Research*, *74*(4), 271–277. https://doi.org/10.1016/j.jpsychores.2012.08.014

Woods, J. A., Hutchinson, N. T., Powers, S. K., Roberts, W. O., Gomez-Cabrera, M. C., Radak, Z., … Ji, L. L. (2020). The COVID-19 pandemic and physical activity. *Sports Medicine and Health Science*, *2*(2), 55–64. https://doi.org/10.1016/j.smhs.2020.05.006

World Health Organization COVID-19 Pandemic Statement by World Health Organization. (n.d.). Retrieved from https://www.who.int/es/emergencies/diseases/novel-coronavirus-2019?gclid=CjwKCAiA8Jf-BRBEiwAWDtEGlCZPtY4r_x9SyYxiPgqTG9lVUY7oXl99BAUxs47kICGIhR_6YtFxoCD2QQAvD_BwE

Zabetakis, I., Lordan, R., Norton, C., & Tsoupras, A. (2020). Covid-19: The inflammation link and the role of nutrition in potential mitigation. *Nutrients*, *12*(5), 1–28. https://doi.org/10.3390/nu12051466

Zhang, C., Yang, L., Liu, S., Ma, S., Wang, Y., Cai, Z., … Zhang, B. (2020). Survey of Insomnia and Related Social Psychological Factors Among Medical Staff Involved in the 2019 Novel Coronavirus Disease Outbreak. *Frontiers in Psychiatry*, *11*(April), 1–9. https://doi.org/10.3389/fpsyt.2020.00306