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Changes in physical activity and sedentary time before, during and after the confinement by COVID-19 in Spanish university students

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Abstract: The coronavirus disease 2019 pandemic resulted in restrictive measures in many countries. The aim of this study was to analyse the changes in physical activity (PA) and sedentary time in Spanish university students before, during and after the confinement. An online questionnaire was designed and distributed at two times. Participants were more inactive and sedentary and increased the use of social networks during the confinement. After the confinement, they did not reach PA pre-confinement levels and the use of social networks remained higher than before. The confinement has impacted on PA of Spanish university students, with the potential to affect healthy habits.

Keywords: Pandemic; International Physical Activity Questionnaire; Exercise; Lockdown

1. Introduction

The coronavirus disease 2019 (COVID-19) was recognized as a pandemic in March of 2020 [1]. To slow down the spread of the virus, many countries had to take extraordinary measures that reduced physical contact among people [2]. Spanish population was strictly home-confined and only allowed to leave home for essential needs for nearly two months [3]. During this period, people could only go out for purchasing food or pharmacological supplies and performing specific professional activities. Even individual outdoor physical activity (PA), which was considered essential and therefore permitted in many countries, was banned in Spain. This resulted in a decrease in time spent on PA and an increase in sedentary time among Spanish population [4,5], being some of these changes specially pronounced in university students [6]. After this strict home-confinement, going out became gradually allowed, and individual outdoor PA was permitted again [7]. However, it could happen that the new habits of PA have been maintained even after the withdrawal of restrictive measures, which could have future health implications.

The World Health Organization (WHO) Global Action Plan on Physical Activity 2018–2030 indicated PA as an effective strategy for the prevention of non-communicable diseases [8], and its protective effect against COVID-19 was well documented during the pandemic [9,10]. In consequence, PA should be especially promoted in the context of current pandemic.

The new WHO 2020 guidelines on PA and sedentary time claim that all adults should meet the PA recommendations (150-300 minutes of moderate PA or 75-150

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minutes of vigorous PA per week), do strength training two or more days a week and limit sedentary time [11].

University life, which usually coincides with the transition between adolescence and adulthood, is a crucial period to establish habits that will be maintained throughout life [12]. Currently, many studies have been published reporting changes in PA during the confinement. However, most of them were focused on the general population and few studies assessed university students, a collective of paramount importance for the social and economic development of the society [13]. Moreover, to our knowledge, there is no scientific information regarding changes in PA after strict home-confinements caused by COVID-19 in this population.

Therefore, the aim of this study was to analyze the changes in PA and sedentary time in Spanish university students before, during and after the confinement by COVID-19. As a secondary aim, we analyzed the tools used to practice PA.

2. Materials and Methods

This research presents data from a comparative study (Clinical.trials.gov, NCT04361019), analyzing the differences between PA-related parameters before, during and after the confinement due to COVID-19 in Spanish university students. Data were collected via an online survey sent at two points in time: 1) during the confinement (April 16th to May 2nd) [14] and 2) after the confinement (July 15th to August 31st) [15]. The first survey asked about PA-related parameters at both, before-confinement and during-confinement periods, while the second one collected the same information but for the after-confinement period.

2.1. Survey Development and Promotion

The survey was based on the International Physical Activity Questionnaire-Short Form (IPAQ-SF) [16] and also included questions regarding qualitative aspects of PA and sedentary time. At the first time, participants were recruited by distributing an invitation through administrative channels of 16 universities. They filled in the second survey by distributing it to the e-mail given by them at the first survey. University students older than 55 years and those that did not fill in both surveys were excluded from the analysis. All participants gave their informed consent before they participated in the study. The study was conducted in accordance with the declaration of Helsinki, and the protocol was approved by the Ethics Committee for Human Beings of the University of the Basque Country (M10_2020_078).

2.2. Survey Dimension

2.2.1. Sociodemographic, academic, and anthropometric data

Data concerning gender, age, and academic degree (Bachelor´s, Master´s, PhD) were collected.

2.2.2. Physical activity and sedentary time

The time spent on moderate and vigorous physical activities, as well as walking and sedentary time, were assessed using the IPAQ-SF, which has been validated among Spanish university students [17]. Additionally, time per week in each type of PA performed and time per day spent on leisure- and study-related screen activities were collected.

Finally, information about the tools used to practice PA was collected by close-ended questions with yes/no response options.

2.3. Statistical Analysis

Normality of distribution was checked by the Kolmogorov-Smirnov test. Quantitative variables were shown using mean (± standard deviation) and ANOVA test was used to compare them before, during and after the confinement. In this test, effect size was calculated by η^2. Values for η^2 of 0.01, 0.06, and 0.13 were considered small, medium, and large, respectively [18]. To analyze differences between two specific time periods (i.e. before vs. during, before vs. after and during vs. after the confinement) Bonferroni´s post hoc test was used. Qualitative variables were expressed by frequency and percentage in each category. For these variables, Cochran´s Q test was used to analyze the changes by time and McNemar´s test was used to compare two specific time periods. For all analysis, significance level was set at $p<0.05$. Statistical analysis was performed using IBM SPSS Statistics for Windows version 24.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Descriptive analysis of participants

Table 1 shows the descriptive data of the sample. 2,524 participants filled in both surveys. The average age of respondents was 27.3 years for women and 25.5 years formen: 69.5% of participants were women, 30.2% were men, and 0.3% did not declare gender.

Table 1. Descriptive data of study sample.

Variable	**Overall** *n= 2,524*	**Women** *n= 1,755*	**Men** *n= 761*
Age (years), mean (SD)	25.4 (10)	27.3 (12.4)	25.5 (8.6)
Academic degree, n (%)			
Bachelor's degree	1,805 (71.5)	1,298 (74)	499 (65.6)
Master's degree	292 (11.6)	193 (11)	99 (13)
PhD	328 (13)	211 (12)	117 (15.4)
Other	99 (3.9)	53 (3)	46 (6)

3.2. Changes in intensity and type of physical activity

Table 2 shows the changes in the time spent on each intensity and type of activity before, during and after the confinement. University students spent more time on moderate-to-vigorous physical activity (MVPA) after the confinement than during it (+9.8%); but they did not reach pre-confinement levels (-14%). Specifically, participants spent more time on moderate PA after than during the confinement (+25.3%), reaching pre-confinement levels. In contrast, vigorous PA time was lower after than during the confinement (-6.9%). Walking time was higher after the confinement than during it (+346.7%); but remained lower than before the confinement (-18.8%). Sedentary time decreased after the confinement (-8.8% vs before and -39.5% vs during), and so did the study/work-related screen time (-30.2% vs before and -47.4% vs during). Leisure-related screen time was lower after than during the confinement (-32.8%); but higher than before (+14.7%). Regarding the type of PA, the time spent on aerobic activity and sports was higher after than during the confinement (+25% and +300%, respectively), but participants did not reach pre-confinement levels (-18.9% and -46.7%, respectively). The time spent on HIIT was lower after the confinement than during and before it (-46.2% and -30%, respectively). Finally, the time spent on mind-body was lower after than during the confinement (-46.7%), but equal to pre-confinement levels.

3.3. Changes in tools used for doing physical activity

Table 3 shows the differences in the tools used to practice PA before, during and after the confinement. Social networks and equipment for aerobic and strength exercise were tools less used at home after than during the confinement (-38.2%, -26.4% and -22.2%; respectively). However, their use remained higher than before the confinement (+25.3%, +21.1% and +24.2%; respectively); while gyms were less used after the confine-

ment than before it (-46.5%). The use of equipment for outdoor exercise was higher after the confinement than before it (+19.7%).

Table 2. Participants' reported Physical Activity, Exercise, and Sedentary Time before, during and after COVID-19 confinement.

Variable	n	Before confinement	During confinement	After confinement	ANOVA test (p)	η^2
IPAQ-SF						
Vigorous PA (min/week)	2,524	314 (352)	248 (267) ¶	231 (295) ‡§	$<10^{-6}$	0.048
Moderate PA (min/week)	2,524	352 (500)	273 (465) ¶	342 (512) §	$<10^{-6}$	0.029
MVPA (min/week)	2,524	666 (705)	522 (590) ¶	573 (661) ‡§	$<10^{-6}$	0.041
Walking time (min/week)	2,460	754 (807)	137 (381) ¶	612 (636) ‡§	$<10^{-6}$	0.483
Sedentary time (min/day)	2,491	365 (176)	550 (196) ¶	333 (193) ‡§	$<10^{-6}$	0.575
Exercise						
Aerobic (min/week)	2,395	222 (240)	144 (168) ¶	180 (198) ‡§	$<10^{-6}$	0.097
Strength (min/week)	2,329	132 (180)	132 (162)	102 (144) ‡§	0.02	0.041
HIIT (min/week)	2,205	60 (114)	78 (126) ¶	42 (78) ‡§	$<10^{-6}$	0.065
Mind-body (min/week)	2,275	48 (108)	90 (162) ¶	48 (84) §	$<10^{-6}$	0.079
Sports (min/week)	2,197	90 (180)	12 (60) ¶	48 (126) ‡§	$<10^{-6}$	0.178
Screen time						
Leisure (min/day)	2,462	204 (138)	348 (198) ¶	234 (144) ‡§	$<10^{-6}$	0.545
Study, work (min/day)	2,405	258 (150)	342 (162) ¶	180 (174) ‡§	$<10^{-6}$	0.393

Notes: Data are presented as mean (SD). HIIT, High Intensity Interval Training; IPAQ-SF, International Physical Activity Questionnaire – Short Form; min, minutes; MVPA, Moderate-to-Vigorous Physical Activity; PA, Physical Activity.¶<0.05 (Bonferroni´s test) between before and during confinement. ‡<0.05 (Bonferroni´s test) between before and after. §<0.05 (Bonferroni´s test) between during and after confinement.

Table 3. Tools used for physical activity before, during and after the COVID-19 confinement (n=2,524).

Variable	Before confinement	During confinement	After confinement	Cochran´s Q test (p)
Tools used at home				
Equipment for aerobic exercise	426 (16.9)	701 (27.8) ¶	516 (20.4) ‡§	$<10^{-6}$
Equipment for strength exercise	842 (33.4)	1,344 (53.2) ¶	1,046 (41.4) ‡§	$<10^{-6}$
Active videogames	110 (4.4)	185 (7.3) ¶	112 (4.4) ‡	$<10^{-6}$
Computer applications	341 (13.5)	514 (20.4) ¶	367 (14.5) ‡	$<10^{-6}$
TV programs	106 (4.2)	139 (5.5) ¶	114 (4.5)	*0.023*
Social networks	810 (32.1)	1,643 (65.1) ¶	1,015 (40.2) ‡§	$<10^{-6}$
Tools used out of home				
Equipment for outdoor exercise	588 (23.3)	-	704 (27.9) §	
Equipment for sports	516 (20.4)	-	479 (19) §	
Gym	1,173 (46.5)	-	628 (24.9) §	

Notes: Data are presented as mean (SD). ¶<0.05 (McNemar´s test) between before and during confinement. ‡*<0.05* (McNemar´s test) between during and after confinement. §*<0.05* (McNemar´s test) between before and after confinement.

4. Discussion

The present study showed that Spanish university students increased the time spent on MVPA, walking and doing sports after the confinement regarding to during it; but they did not reach pre-confinement levels. Time spent on HIIT and mind-body decreased after the confinement regarding to during it; and HIIT showed lower values comparing to pre-confinement. In addition, participants decreased sedentary and leisure screen times after the confinement compared to during it. Nevertheless, leisure screen time remained higher after than before the confinement. The use of social media, equipment for aerobic and strength exercise and material for outdoor activity was higher after than before the confinement. In contrast, gyms remained less used after the confinement than before it.

Regarding to the comparison between before and after the confinement, our results are similar to the ones shown by other studies in Spanish university students during the confinement [4]. Another study in university population, carried out in Midwestern United State, observed an increase in sedentary time after the cancellation of face-to-face classes [19]. However, the increase in sedentary time found in the present study during the confinement is substantialy more pronounced; it may be because of the severity of the measures taken in Spain regarding the ones that had been taken in the United States.

Regarding to the effects after the COVID-19 confinement on PA no studies have been published yet. A protocol for a longitudinal observational study has been recently published [20]: the findings of this study will provide information about the impact of confinement on PA habits in Swiss students.

The decrease in the use of gyms and social networks found in the present study might have influenced the reduction on HIIT and strength training after the confinement comparing to before it. This could be one of the reason to explain why time spent on vigorous was lower after than before the confinement. In contrast, there was an increase in the use of equipment for outdoor exercise (e.g., bicycle) after the confinement, and it may be one reason why moderate PA had a better recovery than vigorous PA. The fact that the summer coincides with the post-confinement period here analyzed could be one of the reason of the increase of use of that type of equipment. In the same vein, the decrease in sedentary time after the confinement may be caused by the end of the academic year. However, the higher time spent in leisure screen time after than before the confinement may be worrying due to the addictive nature of some of these activities [21].

Our results after the confinement may produce concern about the health in university students because the detrimental changes in PA habits observed could be mantained throughout their lives. It is known that students who are more physically active have better health-related quality of life [22], health parameters [22,23] and academic performance [24]; so it is required to design and target strategies to increase PA and reduce sedentary time in this population to at least recover and, if possible, enhance pre-confinement levels.

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