Impact of COVID-19 lockdown on the Portuguese population's physical activity

Impacto del confinamiento por la COVID-19 en la actividad física de la población portuguesa

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Abstract

Introduction: Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. This disease harmed people's lives, compromising a healthy lifestyle.
Objective: This study aims to analyze the impact of COVID-19 lockdown on the Portuguese population's physical activity and seated time during quarantine.
Methodology: This retrospective longitudinal study was based on an online Google Forms survey concerning the lockdown period from the 18th of March to the 30th of April, 2020. A total of 541 responses were analyzed; all Portuguese (42.2 ± 14.8 years) completed the survey concerning the period. The valid responses were obtained from the 4th to 30th of May 2020. The physical activity during a week and the average seated time on a weekday before (T0) and during (T1) the quarantine were studied.
Results: When comparing T0 and T1, there was a decrease in moderate-vigorous physical activity ($p < 0.0001$), walking time ($p < 0.0001$), and an increase in seated time ($p < 0.0001$), considering the whole sample group. All age groups decreased the time spent walking and increased the time seated. The highest value of seated time was displayed in the age interval of 26–35. Compared to the others, the age interval of 46—55 years showed the lowest values for vigorous and moderate activity.
Conclusion: The first quarantine had a significantly negative effect on the Portuguese population's physical activity hours and contributed to a significant increase in the seating time during a weekday.

Keywords

COVID-19; physical activity; quarantine; seated time; sedentarism.

Resumen

Introducción: La enfermedad por coronavirus (COVID-19) es una enfermedad infecciosa causada por el virus SARS-CoV-2. Esta enfermedad ha perjudicado la vida de las personas, comprometiendo un estilo de vida saludable.
Objetivo: Este estudio tiene como objetivo analizar el impacto del confinamiento por COVID-19 en la actividad física y el tiempo que la población portuguesa pasa sentado durante la cuarentena.
Metodología: Este estudio longitudinal retrospectivo se basó en una encuesta en línea de Google Forms sobre el período de confinamiento del 18 de marzo al 30 de abril de 2020. Se analizaron un total de 541 respuestas; todos los portugueses (42.2 ± 14.8 años) completaron la encuesta sobre el período. Las respuestas válidas se obtuvieron del 4 al 30 de mayo de 2020. Se estudió la actividad física durante una semana y el tiempo medio sentado en un día laborable antes (T0) y durante (T1) la cuarentena.
Resultados: Al comparar T0 y T1, hubo una disminución en la actividad física moderada-vigorosa ($p < 0.0001$), el tiempo de caminata ($p < 0.0001$) y un aumento en el tiempo sentado ($p < 0.0001$), considerando todo el grupo de muestra. Todos los grupos de edad disminuyeron el tiempo dedicado a caminar y aumentaron el tiempo sentado. El valor más alto de tiempo sentado se mostró en el intervalo de edad de 26 a 35 años. En comparación con los demás, el intervalo de edad de 46 a 55 años mostró los valores más bajos de actividad vigorosa y moderada.
Conclusión: La primera cuarentena tuvo un efecto significativamente negativo en las horas de actividad física de la población portuguesa y contribuyó a un aumento significativo en el tiempo sentado durante un día laborable.

Palabras clave

Actividad física; COVID-19; cuarentena; tiempo sentado; sedentarismo.

Introduction

With the rapid spread of the novel coronavirus (SARS-CoV-2) the World Health Organization (WHO) (WHO, 2020) defined COVID-19 as a pandemic disease. This pathological condition is a respiratory infection causing severe acute respiratory syndrome. Infected subjects can be asymptomatic or manifest low to moderate complications like fever, dry cough, shortness of breath, anorexia, fatigue, and/or myalgia. The subjects' symptomatic condition can also progress to severe pneumonia, possibly leading to acute respiratory distress syndrome (ARDS), which is more common in older patients and can be lethal (Guo et al., 2020). As the virus mechanisms were poorly understood and the infection was spread through human contact, some countries were forced to take several actions to prevent COVID-19 spread (Sohrabi et al., 2020; Yuki et al., 2020). In Portugal, the first case was diagnosed on the 1st of March 2020 (DGS, 2020), and with increasing new cases every day, this pressure on the health system led to an overloaded and unsustainable healthcare environment. Following the example of other nations and guided by WHO's guidelines, a state of emergency was declared in Portugal on the 18th of March 2020, resulting in a mandatory lockdown (Presidencia da República, 2020).

Therefore, schools and universities were closed, social distancing was required, and social events were forbidden (República, 2020). With all these restrictions, the population's lifestyle changed drastically, increasing isolated people. This population was, naturally, more susceptible to feelings of loneliness and a greater risk of depression (Singh & Misra, 2009). Besides, studies have shown that during the initial stage of COVID-19, the levels of psychological impact and anxiety were moderate to severe (Wang et al., 2020). In Portugal, participants of an online survey reported moderate to severe psychological effects during quarantine (Paulino et al., 2021). Moreover, with mandatory lockdown, several studies reported negative psychological effects (Brooks et al., 2020), such as post-traumatic stress symptoms, anger, and confusion (de Lima et al., 2020).

Worldwide, the COVID-19 pandemic restrictions have reduced PA levels and increased sedentary behavior (Wilke et al., 2022). In particular, low physical activity levels were found in Portuguese children (Pombo et al., 2021). However, other effects have been reported in Portugal, such as healthcare routine disruption and negative financial status impacts (Valente et al., 2020).

All sporting events were suspended, and public gyms and public parks were closed, resulting in fewer outdoor activities, which led to a possible decrease in the Portuguese population's physical activity (PA). Physical inactivity can be associated with some non-communicable diseases worldwide, decreasing lifespan (Lee et al., 2012). It can be related to almost 5% of healthcare costs (Ding et al., 2017). Sedentariness or lack of PA can be detrimental to human health, resulting in cardiovascular and musculoskeletal system complications, obesity, and early aging. Studies demonstrated that increased PA helps prevent these (Bortz & Alto, 1984). With the population majority in self-quarantine, older people, who are more susceptible to the previously mentioned comorbidities, can be severely affected by PA decrease (Castrogiovanni et al., 2019; Ravalli & Musumeci, 2020). Also, it is well known that PA benefits the immune system and improves diaphragm capacity. As COVID-19 is a respiratory disease caused by a virus, improving the immune system and overall respiratory health can be essential to prevent major health damage (Romeo et al., 2010; Woods et al., 2020).

Although necessary to stop the spreading of the virus, all of the restrictions imposed by the Portuguese Government could be potentially harmful, lowering the PA level of the Portuguese population. Several studies involving the Italian population have shown that the levels of PA present lower values during quarantine regarding all age groups. They related a greater impact on males' total weekly energy outflow during PA, resulting in lower psychological well-being (Giustino et al., 2020; Woods et al., 2020). Furthermore, physical education teachers reported feeling limited in teaching content from a distance during the pandemic (Hortigüela-Alcalá et al., 2021). Both studies suggested clear instructions to follow training protocols, including home-based training, which would significantly boost self-esteem and increase stress resilience (Maugeri et al., 2020). Also, when exercise is practiced with moderate intensity, it improves the body's immune function, lowering the probability of viral infections' occurrence and reducing its harshness (Martin et al., 2009).

Regular physical activity is important across all ages and contributes to maintaining physical, social, and mental health. WHO recommends at least 2.5 to 5 hours of moderate aerobic activity per week, or the equivalent vigorous activity, for all adults and limiting the amount of time spent being sedentary (WHO,

2020). On the other hand, prolonged sitting time is a risk factor for chronic diseases like cardiovascular and cancer mortality, type 2 diabetes, and depression (Zhai et al., 2015; Patterson et al., 2018; Bailey et al., 2019) and is considered a sedentary behaviour (Healy et al., 2011). According to Mclaughlin et al. (2020), in 2017, the average time the Portuguese population over 15 years old spent seated was 4.57 hours (CI 95%: 4.42, 4.70).

Globally, physical inactivity is estimated to cost between 1–3% of national healthcare expenditures (Bull et al., 2017). It is crucial to understand the effects of the lockdown on these two aspects, physical activity amount performed and time spent seated to help develop measures to attenuate its health immediate and long-term effects. To our knowledge, few studies have analyzed sitting time and level of physical activity in individuals aged 18 to 100 years in Portugal. Therefore, this study can contribute to a better perception of Portuguese people's behavior during the pandemic lockdown, essentially contributing to data on sitting time. We consider it extremely important to know the population's behavior in the pandemic conditions that require radical lifestyle changes so that measures can be taken in the future to mitigate the negative effects on people's health, economy, and social status. So, this study aims to analyze the impact of COVID-19's lockdown on the Portuguese population's PA and sitting time during quarantine based on an online survey. The authors hypothesize that the amount of physical activity is reduced, and the time spent seated is also augmented.

Method

Participants

The sample size consisted of 541 participants. All subjects were exclusively Portuguese citizens of different ages and professional areas. Except for age, no other restrictions were considered. Before answering the questionnaire, informed consent was obtained from all the participants, and the procedures were conducted according to the principles expressed in the Declaration of Helsinki.

Considering the Portuguese population of 9089825 people over 15 years old (FFMS, 2020), to maintain a confidence level of 95% with a 5% Margin of error, a sample of 385 was necessary (SurveyMonkey, 2024).

Procedure

An online survey using the Google Forms web platform (Mountain View, California, USA) was accomplished and disseminated through social media. A description of the study was inserted on the survey's first page, together with informed consent, to clarify the participant about the methodology, goals, procedures, and confidentiality. This retrospective observational longitudinal study was reviewed and approved by the Ethics Committee of the Polytechnic Institute of Coimbra (62_CEPC2/2020).

The valid responses were obtained from the 4th to the 30th of May 2020, immediately after the mandatory lockdown that lasted 6 weeks, from the 18th of March to the 30th of April, 2020. It allowed the analysis of demographic data and PA levels before (T0) and during (T1) the Portuguese population quarantine due to the COVID-19 pandemic. The questionnaire was divided into three main parts. The first part was designed to inform the participants about the goal and the methodology with additional informed consent. The second part was constituted of questions about age, self-perception of health status, and working mode during quarantine. The last part focused on the questions from the International Physical Activity Questionnaire-Short Form (IPAQ-SF), used to assess the physical activity during a week and the seated time on a weekday before and during the mandatory lockdown. People who answered the questionnaire described the time during a week, in hours, performing vigorous physical activity (i.e., carrying/lifting heavy objects, cycling at high speed, unable to maintain a conversation during the activity); moderate physical activity (i.e., carrying/lifting light objects, average speed cycling and playing tennis, manage to maintain a conversation during the task) and walking. The seated time spent on a weekday was also described.

Data analysis

The data were statistically processed with the IBM SPSS Statistics 25.0 software (IBM Corporation, New York, USA). The descriptive statistics, mean and standard deviation, were calculated for all variables

regarding both moments. Before the inferential analysis, the normality of the distribution was explored. We identified a non-normal sample distribution based on the Kolmogorov-Smirnov test (d > 0.081, p < 0.001). Differences between paired samples were assessed using the Wilcoxon test in the comparison between the T0 and T1. The effect size by Cohen was considered small for r values from 0.1 to 0.3 or -0.1 to -0.3, medium for r values from 0.3 to 0.5 or -0.3 to -0.5, and large for values from 0.5 to 1.0 or -0.5 to -1.0. The significance level was set at 5% (p < 0.05).

Results

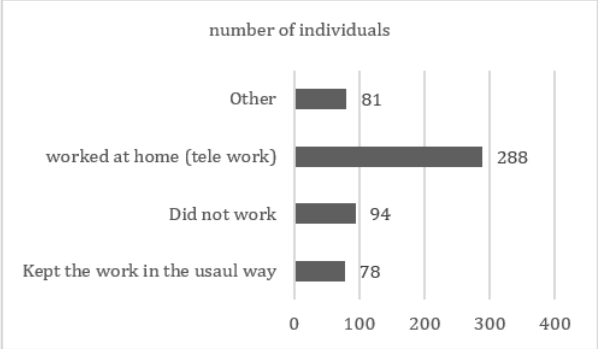
The sample distribution in age intervals is specified in Table 1. Most participants were between the ages of 36 and 55 (48.06%). People considered they had a high level of health previous to lockdown (8.36/10).

Table 1. Sample Age distribution

Age Distribution		
Years	n	%
18–25	94	17.38
26–35	76	14.05
36–45	111	20.52
46–55	149	27.54
56–65	73	13.49
66–75	32	5.91
76–85	4	0.74
86–100	2	0.37

The type of work during lockdown is depicted in Figure 1. During lockdown, most of the respondents (53%) worked at home, and just 14% kept working as usual.

Figure 1. Type of work activity during the lockdown.



The results of the time spent on different physical activities before and during the lockdown are presented in Table 2, showing a decrease in the level of all types of activity and an increase in the time spent seated. Based on the Wilcoxon test statistical analysis, all paired outcomes presented statistically significant differences between T0 and T1 (p < 0.001).

Table 2. Physical Activity and Time Seated before and during the lockdown.

All ages	Mean ± SD [hours]		p-value[1]	Z	r
	T_0	T_1	($T_1 - T_0$)*		
Vigorous Activity	2.55 ± 3.75	1.95 ± 2.75	< 0.0001	-3.63	-0.12
Moderate Activity	2.52 ± 3.62	2.08 ± 2.78	< 0.0001	-2.89	-0.10
Walk	3.10 ± 3.57	2.33 ± 3.11	< 0.0001	-7.02	-0.23
Sit	4.88 ± 3.12	7.21 ± 3.68	< 0.0001	-15.10	-0.48

T0, before lockdown; T1, after the lockdown, considering data during lockdown the Covid-19 pandemic.
*Wilcoxon Signed Rank Test. [1]p < 0.05. Z-score. r (Cohen effect size): small – r values from 0.1 to 0.3 or -0.1 to -0.3; medium – r values from 0.3 to 0.5 or -0.3 to -0.5, and large – values from 0.5 to 1.0 or -0.5 to -1.

To better understand the physical activity modification during the lockdown, the sample was divided by group age, and their activity is depicted in Table 3. All age groups decreased the time spent walking and increased the time seated. The ages interval of 26–35 and 36–45 years slightly increased the vigorous activity, although with no statistical significance. Compared to the others, the age interval of 46–55 showed the lowest values for vigorous and moderate activity. The highest value of sitting time was displayed in the age interval of 26–35. This group also had the highest walking time.

Table 3. Physical Activity and Time Seated before and during lockdown for each age interval

Age interval (years)	Physical activity	Mean ± SD [hours]		*p*-value[1]	Z*	r
		T0	T1			
18–25	Vigorous Activity	3.56 ± 0.55	2.88 ± 0.37	0.109	-1.60	-0.12
	Moderate Activity	2.47 ± 0.35	2.31 ± 0.27	0.892	-0.14	-0.01
	Walk	4.53 ± 0.87	2.53 ± 0.33	0.000*	-3.83	-0.28
	Sit	5.99 ± 0.41	9.58 ± 0.61	0.000*	-7.54	-0.55
26–35	Vigorous Activity	2.25 ± 0.36	2.29 ± 0.29	0.891	-0.14	-0.01
	Moderate Activity	2.25 ± 0.63	2.11 ± 0.29	0.389	-0.86	-0.07
	Walk	5.38 ± 1.16	3.04 ± 0.61	0.008*	-2.65	-0.22
	Sit	5.77 ± 0.49	10.25 ± 1.51	0.000*	-5.67	-0.47
36–45	Vigorous Activity	2.43 ± 0.45	2.53 ± 0.59	0.109	-1.60	-0.11
	Moderate Activity	3.01± 0.54	2.43 ± 0.49	0.006*	-2.73	-0.19
	Walk	4.15 ± 0.72	1.82 ± 0.25	0.001*	-3.34	-0.23
	Sit	4.74 ± 0.58	7.83 ± 0.905	0.000*	-7.46	-0.49
46–55	Vigorous Activity	2.05 ± 0.61	1.11 ± 0.21	0.015*	-2.43	-0.17
	Moderate Activity	2.17 ± 0.49	1.61 ± 0.27	0.078	-1.76	-0.12
	Walk	3.28 ± 0.60	2.17 ± 0.32	0.025*	-2.24	-0.15
	Sit	5.25 ± 0.51	8.71 ± 0.92	0.000*	-7.43	-0.47
56–65	Vigorous Activity	2.03 ± 0.54	1.19 ± 0.26	0.007*	-2.71	-0.26
	Moderate Activity	3.45 ± 0.97	2.39 ± 0.85	0.003*	-2.99	-0.29
	Walk	3.78 ± 1.16	2.37 ± 0.43	0.002*	-3.03	-0.27
	Sit	5.52 ± 0.77	7.37 ± 0.72	0.000*	-5.05	-0.45
66–75	Vigorous Activity	2.92 ± 1.19	2.10 ± 0.95	0.374	-0.89	-0.14
	Moderate Activity	3.41 ± 0.98	6.67 ± 3.59	0.776	-0.29	-0.04
	Walk	3.47 ± 0.78	2.85 ± 0.89	0.221	-1.23	-0.18
	Sit	3.88 ± 0.44	5.03 ± 0.64	0.027*	-2.21	-0.33

T0, before lockdown; T1, after the lockdown, considering data during lockdown the Covid-19 pandemic.
*Wilcoxon Signed Rank Test. [1]$p < 0.05$. Z-score. r (Cohen effect size): small – r values from 0.1 to 0.3 or -0.1 to -0.3; medium – r values from 0.3 to 0.5 or -0.3 to -0.5, and large – values from 0.5 to 1.0 or -0.5 to -1.

Discussion

The main purpose of this study was to analyze the impact of COVID-19 lockdown on the Portuguese population's physical activity and seated time during quarantine. Our results showed decreased walking practice and vigorous and moderate physical activities, contributing to a significant increase in sitting time. A medium effect size of the seated time was found, which was the one with greater effect for all the age groups.

The high transmissibility of SARS-CoV-2 led to a state of emergency and many restrictive measures, including mandatory social distancing. During this national lockdown, people were forbidden to leave their houses, except for certain essential activities. With many people working from their homes, forced to stay off their normal routine, more individuals spend further time in the seated position and less time physically active, as when working at home, there is no need for displacements, and eventually, more sedentarism is installed. The restrictive measures were applied to sports facilities, outside parks, and gyms destined to have some PA. With all these measures, the only safe place to get some PA was a brief walk in the neighborhood or some home-based workout. The last one is the only one that could be an example of vigorous exercise. According to WHO, people should aim for 150 min (2.5 hours) of PA per week, preferentially with 10 minutes or more bouts of moderate or greater intensity exercise (World Health Organization, 2010). After analyzing the levels of PA in the Portuguese population aged 18 to 64, roughly 70% of the participants reached the desired goal; however, in participants over 64 years old, only 35% managed to do it. When analyzing the second recommendation, the concern is bigger, the prevalence of bouts of 10 minutes or more of moderate or greater intensity was "4%–6% at 18–39 years, 7%–9% at 40–64 years, ~3% in persons age 65 year or older" (Baptista et al., 2012).

Our study showed statistically significant differences when comparing T0 and T1, considering the whole sample group for all variables. In our population, the average time spent doing walking and vigorous and moderate physical activities was considerably lower during the quarantine time compared to the average activity performed before the lockdown. This reduction in PA time is even more concerning since the values of vigorous and moderate activities are below the WHO recommendations. When analyzing different age groups, the "46–55 years" and "56–65 years" groups showed statistically significant decreases for the vigorous activity time. The moderate activity time had a statistically significant reduction in the groups of "36–45 years" and "56–65 years". The study showed a statistically significant decrease in the walking time for all the age groups, except for the "66–75 years" group.

These results align with recent studies in other countries during home confinement (Robinson et al., 2020; Ammar et al., 2020; Tison, 2020; López-Bueno et al., 2020). Recent studies also showed an increase in sedentary behavior in adults (Zamarripa et al., 2021) and university students (Hurtado et al., 2024) during lockdown. Furthermore, a recent systematic review showed a decrease in physical activity levels and an increase in sedentary behavior due to the lockdown Covid-19 pandemic (Wilke et al., 2022).

Exercise-related motivations include stress management, enjoyment, appearance, and increasing self-esteem (Markland & Hardy, 1993; Tiggemann & Williamson, 2000). These factors are related to psychological well-being, especially with the benefits of physical activity on diseases like depression (Dinas et al., 2011). Considering the reduction in PA presented in this study, we can estimate a more indirect and secondary negative impact on the global health of the Portuguese population. A recent study showed that quality of life has been associated with the mobility and occurrence of falls even during lockdown in older people (Loureiro et al., 2024). On the other hand, physical activity practice showed no association with the amount and quality of sleep; conversely, the number of hours of sleep has increased, and the sleep quality has worsened (Magaz-González et al., 2022).

Moreover, increasing the time spent at home, being unable to work, or changing to telework could lead to more time in a seated position. More free time and less or no social activities may have resulted in increased time spent sitting in front of the computer or watching TV on the couch. Several studies refer to a greater risk of all-cause and cardiovascular disease mortality of people with higher sitting time (Bailey et al., 2019; Katzmarzyk et al., 2009; Stamatakis et al., 2019). Our study showed statistically significant differences for the whole sample, considering the average sitting time during a weekday. The value of the average sitting time during a weekday increased from 4.88 ± 3.12 hours to 7.21 ± 3.68 hours. This reduction is noted in every age group, with the highest value of 10.25 ± 1.51 hours registered in the "26–35 years" groups.

The harm induced by excessive seated time could be reduced by increasing moderate to vigorous PA (Chau et al., 2013; Ekelund et al., 2016; Stamatakis et al., 2019). Thus, our study brings to light the health consequences of what quarantine induced in our population, as the "cocktail" of more time sitting and less time moderate-vigorous PA can be very detrimental to our health.

The strength of our study was to provide information about the behavior adopted in pandemic situations that require confinement, alerting to the need for public health to create strategies that promote physical activity practice during periods of confinement since physical activity reduces the risk of mortality and has multiple health benefits. However, our study has some limitations as the assessment using a self-reported questionnaire tends to include a survey bias, which can lead to a different perception of the time spent on activities compared to the real one objectively measured. On the other hand, the study's retrospective nature, even if the inquiry was performed immediately after the lockdown, can contribute to a memory bias. Also, a sample bias can be present as the study was disseminated through social media, preventing people without access to social media to participate.

Conclusions

In conclusion, this study aims to show the impact of the first quarantine on the Portuguese population. It reveals that the first lockdown period significantly impacted PA time in the general population. The vigorous-moderate PA and walking time were significantly reduced during this period when compared

to the life before. The results also showed that the average sitting time on a weekday significantly increased compared to before and during the quarantine. This study identifies some negative health impacts of the first COVID-19 lockdown on the Portuguese population.

Conflicts of interest

The authors report no conflict of interest.

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