

The quality of rest and its relationship with physical activity practice during the COVID-19 lockdown in Spain

Calidad del descanso durante el confinamiento por la COVID-19 en España. Su relación con la práctica de actividad física

*Ana María Magaz-González, **Cristina Mendaña-Cuervo, **César Sahelices-Pinto, ***Marta García-Tascón
*Universidad de Valladolid (España), **Universidad de León (España), ***Universidad Pablo de Olavide (España)

Abstract. The Spanish state of alarm, for the COVID-19 outbreak, resulted in mobility restrictions, changes of habits and sleep disorders. We are investigating whether these disorders can be reduced with the practice of physical activity (PA). A questionnaire was administered to 1,046 people (48.57% men and 51.43% women), with an average age of 40 years (SD: ± 13.35). A descriptive quantitative methodology based on a non-purposive sample was used and the data were subjected to non-parametric tests. Regarding rest (quantity of hours of sleep) increased in general, going from 7.13 hours to 7.65 ($p=.000$), whereas sleep quality worsened, the score decreased from 3.67 to 3.24, $p=.000$. For the age ranges (18 to 24 years, 25 to 64 and 65 or older), there was significant data (quality and quantity) for the first two ranges ($p=.000$), and none for the third. The relationship between PA practice and hours/quality of sleep, there were no significant correlations in the entire sample ($p=.191$, $p=.113$). The main finding was no significant correlation for any age ranges (sleep quantity & sleep quality), except for the group of 18-24 years. This result contradicts the findings of previous studies.

Keywords: COVID-19; lockdown; sleep; physical activity; health.

Resumen. El estado de alarma en España, por el brote de COVID-19, se tradujo en restricciones de movilidad, cambios de hábitos y trastornos del sueño. Se investiga si dichos trastornos pueden reducirse con la práctica de actividad física (AF). Se administra cuestionario a 1.046 personas (48,57% hombres y 51,43% mujeres), con una edad media de 40 años (DE: $\pm 13,35$). Se emplea metodología cuantitativa de corte descriptivo basado en muestra no intencional y los datos se someten a pruebas no paramétricas. En cuanto al descanso (cantidad de horas de sueño) aumentó en general, pasando de 7,13 horas a 7,65 ($p=.000$), mientras que la calidad del sueño empeoró, la puntuación disminuyó de 3,67 a 3,24, $p=.000$. Para los rangos de edad (18 a 24 años, 25 a 64 y 65 o más), hubo datos significativos (calidad y cantidad) para los dos primeros rangos ($p=.000$), y ninguno para el tercero. La relación entre la práctica de AF y las horas/calidad de sueño, no hubo correlaciones significativas en toda la muestra ($p=.191$, $p=.113$). El principal hallazgo fue que no hubo correlación significativa para ningún rango de edad (cantidad y calidad del sueño), excepto para el grupo de 18-24 años. Este resultado contradice conclusiones de estudios anteriores.

Palabras clave: COVID-19; confinamiento; sueño; actividad física; salud.

Introduction

The World Health Organisation (hereinafter WHO) declared the disease caused by the SARS-CoV-2 virus as a pandemic on March 11th 2020 (WHO, 2020c), which resulted in the confinement of the world population in the following months. This lockdown has been implemented by countries at different levels.

In Spain, the management of the pandemic led to the declaration of the state of alarm through Royal Decree 463/2020, of March 14th (Ministry of Presidency, 2020), initially for 15 days, although it was extended by

successive Royal Decrees (RD) until June 21st 2020. As a result of this situation, for one and a half months, people were not allowed outside their homes to meet the basic needs gathered in art. 7 of RD 463/2020, thus limiting the freedom of movement to one's household. After this period, limitations have been maintained at different levels.

During the state of alarm, different regulations were passed for its management, among which it is worth highlighting Order SND/380/2020, of April 30th, which, from May 2nd 2020, allowed people over 14 years of age to practice *non-professional outdoors* physical activity (PA) under certain conditions and with time restrictions. This PA comprised «both the practice of non-professional individual sport activities without contact and daily walks» (Ministry of Health, 2020, p. 2). This date marked

the beginning of the unlockdown for PA.

In such lockdown period, the Spanish population had to adapt to a scenario dominated by long-range restrictions in daily living: limitation of the freedom of movement, cessation of face-to-face education, cessation of commercial activity (except essential goods) and closing of non-essential businesses and infrastructures (e.g., gymnasiums, parks and restaurants) (Ministry of Presidency, 2020). This transformed labour relationships and ways of working, and limited social and personal contact. Unavoidably, there were alterations in eating, sleep and PA practice patterns, which have had a direct impact on people's physical and mental health (García-Tascón et al., 2020; Jakobsson et al., 2020).

Naturally, these circumstances affected the productive sectors, with a contraction of the Gross Domestic Product (GDP) in the second trimester of 2020, which decreased by 18.5% with respect to the previous trimester (Spanish Statistics Institute [INE], 2020b). Consequently, there was a 5.46% increase of unemployment in the second trimester of 2020 with respect to the previous trimester (INE, 2020c), although this number does not include those affected by Temporary Redundancy Plans (ERTEs in Spanish). These plans did have an impact on the effective working hours recorded, which decreased 22.59% with respect to the first trimester of 2020. However, this situation improved substantially with the activation of the economy after the restrictions were reduced, reaching values of 15.1% (INE, 2020d).

Thus, 95.5% of the Spanish population is *quite* or *very* concerned about the coronavirus crisis, according to the report of the Spanish Sociological Research Centre (CIS, 2020b), and 88.3% consider that the general economic situation of Spain derived from the COVID-19 crisis is *bad* or *very bad*. The same report also indicates the concern of the Spanish population about the effects of this crisis on health (41.2%), the economy and employment (19.9%) and both (38.4%). Similar results are shown by the report entitled '*What worries the world*' (Ipsos, 2020), which monthly gathers the main concerns of 27 countries. According to this Ipsos report, in October 2020 in Spain, the concern caused by the coronavirus was 60%, which was very close to that related to unemployment (59%). Therefore, the coronavirus and its consequences have become the main concern of Spanish citizens, along with unemployment.

Furthermore, the spread of alarming news and fake news about the pandemic led official organisations such as the WHO to recommend limiting the exposure to

the media during the lockdown, in order to reduce the infodemic (excess information about this virus) (WHO, 2020b). Different studies suggest that media exposure (Sandín et al., 2020) and the excessive use of social networks can pose a threat to health, as it may amplify the stress caused by the pandemic (Amsalem et al., 2020; Casero-Ripollés, 2020; Depoux et al., 2020; Gao et al., 2020; Garfin et al., 2020; Liu & Liu, 2020; Mertens et al., 2020; Schmidt et al., 2020).

Thus, the particular consequences derived from the COVID-19 pandemic and the state of alarm ordered by the Spanish government: confinement and duration of quarantine, social contact restrictions and disconnection, worsening of interpersonal conflicts, teleworking, children at home and overload of tasks and work, academic stress, modifications of the teaching methodology and uncertainty regarding the professional future, fear of infection, frustration and boredom, possible ERTE situation, inadequate supplies, financial problems and stigma, concerns about the economy, unemployment and health, and the dissemination of inadequate information and alarming news, are they all stressors, generators of stress levels without precedents (Brooks et al., 2020; García-Heras et al., 2020; Herazo et al., 2020; López et al., 2021; Marco-Ahulló et al., 2021) that have undoubtedly affected parameters that influence quality of life, such as health. In turn, a lower capacity to cope with the stress generated by this situation and the mentioned concerns affect both the quantity and quality of sleep, which is a factor of health and quality of life (Agudelo et al., 2008; Benetó Pascual, 2003; OECD, 2010). In fact, several studies such as that of Åkerstedt et al. (2007) or Talamini et al. (2013), with samples below 100 individuals for short periods of time and physiological sleep tests, or that of Wright et al. (2020), which analyzes adversities not directly related to confinement, but to the pandemic, indicate that stressful situations and worries affect sleep.

PA has been long associated with better sleep (Lang et al., 2016). It has been reported that exercise can be used as a non-pharmacological treatment option against sleeping disorders (Kline, 2014) and as a valuable intervention in general for those who do not have an adequate quantity and/or quality of sleep (Dolezal et al., 2017; Loprinzi & Cardinal, 2011). Other studies have even identified a two-sided correlation (no sleep – no exercise, no exercise – no sleep), asserting that the lack of sleep can contribute to decreasing PA and vice versa (Kline, 2014).

The relationship between PA and sleep has also been

analysed from different perspectives such as the presence of diseases, the use of medications and the participation in PA programs and based on specific population groups, such as older people (Aguilar-Parra et al., 2015; Carmona Fortuño & Molés Julio, 2018), school children and adolescents (Beltran Valls et al., 2019; Casaux Huertas & Garcés Bernaldez, 2017; Santos et al., 2016), women (Beltran Valls et al., 2019) and people with different pathologies (Bonardi et al., 2016; Kishida & Elavsky, 2016; López Sánchez et al., 2016). In general terms, it can be asserted that the relationship between the quality of sleep and PA practice is positive, although in some specific cases it was not possible to establish such correlation (Carmona Fortuño & Molés Julio, 2018; Santos et al., 2016).

Not practising PA and having sedentary habits, in addition to being associated with certain diseases (ACSM, 2018; Jakicic et al., 2001), has been considered a pandemic in developed countries due to the consequences of such combination, becoming a priority topic of interest for public health (Abellán Alemán et al., 2014; Donnelly et al., 2009; Jakicic et al., 2001; Saris et al., 2003). The circumstances derived from COVID-19 in the Spanish population may have enhanced these ailments and added them to those most related to sedentary lifestyle reported by the INE (2019): high blood pressure (20% of the population) and high cholesterol (18%). This is why the guidelines of both the WHO (2018a; 2010, 2018b, 2020a) and the American College of Sport Medicine (ACSM, 2018) include parameters of frequency, duration, intensity, type and quantity of PA, with the aim of improving health and reducing diseases, mortality and risk of depression.

Regarding hours of sleep, there seems to be consensus among the main national and international associations on the duration of sleep for optimal health. Thus, the American Academy of Sleep Medicine (AASM, <https://aasm.org>) and the Sleep Research Society (SRS, <https://www.sleepresearchsociety.org>) have developed a consensual guide on the quantity of sleep required to promote optimal health (Consensus Conference Panel, 2015), in which they established that adults must sleep at least 7 hours per night regularly. On their part, the National Sleep Foundation (NSF, <https://www.sleepfoundation.org>) established their recommendations based on different studies, especially those of Hirshkowitz et al. (2015a, b) and Suni (2020), which consider the guidelines of the WHO (2020a) (Table 1) as the general norm at the international level. In fact, in the Spanish case, the official document of the

Spanish Society of Sleep (SES, <https://ses.org.es>) about healthy sleep (Jurado Luque, 2016, p. S7) also refer to the recommendations of the NSF.

The direct relationship between sedentary lifestyle and insomnia in the results of the survey conducted by the NSF (Buman et al., 2014) led such organisations to establish that a minimum of 10 minutes of exercise would be enough to make a difference in terms of the quantity and quality of sleep. On their part, Hirshkowitz et al (2015a) after formulating recommendations on sleep duration based on recent scientific evidence, showed that 75% of people who regularly practice some type of physical activity have better quality of sleep.

Table 1
Hours of sleep recommended by the NSF (National Sleep Foundation) and supported by the rest of the professional associations (SRS; SES; [OMS, 2018])

	Age Range	Recommended Hours of Sleep
Newborn	0-3 months old	14-17 hours
Infant	4-11 months old	12-15 hours
Toddler	1-2 years old	11-14 hours
Preschool	3-5 years old	10-13 hours
School-age	6-13 years old	9-11 hours
Teen	14-17 years old	8-10 hours
Young Adult	18-25 years old	7-9 hours
Adult	26-64 years old	7-9 hours
Older Adult	65 or more years old	7-8 hours

Thus, considering that the confinement derived from the COVID-19 pandemic altered the living conditions of the world population, including PA practice and sleep patterns (Medina-Ortiz et al., 2020), and that both are considered determining factors of health and quality of life, this descriptive research on the effect of the pandemic is of vital importance, since it delves not only into how this situation affected the vital fact of sleep, but also into how it affected other habits, such as PA, considering different segments of population. Thereupon, this study is aimed at analysing the effect of these changes on sleep in this period, as well as the possible influence of PA.

This general aim led to the following objectives and hypotheses:

Objective 1: Investigate how sleep was affected during the lockdown.

H1.1: The levels of sleep reported before the pandemic remained the same during the lockdown, measured in terms of quantity (hours) of sleep.

H1.2: The levels of sleep reported before the pandemic remained the same during the lockdown, measured in terms of quality of sleep.

Objective 2: Investigate whether the levels of sleep recommended by the professional associations (NSP, SRS, SES, WHO -WHO 2020a-) were maintained during the lockdown.

H2.1: The recommended levels of sleep were maintained during the lockdown.

Objective 3: Investigate whether PA practice during the lockdown was related to better sleep.

H3.1: There was a positive relationship between the quantity (hours) of PA and the hours of sleep during the lockdown.

H3.2: There was a positive relationship between the amount (hours) of PA and the quality of sleep during the lockdown.

Materials and Methods

This study was conducted using a descriptive quantitative methodology based on a non-intentional sample. Individuals, selected based on non-random criteria, were asked to voluntarily respond to a public online survey and, although not every individual had a chance of being included in the study, the final sample was representative of the population.

Participants

The study universe was the general Spanish population in 2019, which consisted of 47,431,256 inhabitants (49% males and 51% females) (INE, 2020a). The sampling obtained and analysed consisted of 1,046 participants (48.57% males and 51.43% females) with an average age of 40 years ($SD = \pm 13.35$). Regarding the education level of the participants, 81.07% had higher studies, 16.63% had secondary studies, 2.10% had primary studies and only two participants had no education. The sample covered 15 out of 17 autonomous communities with at least 10% of participants in each one.

Instrument

Once the objectives were set, a questionnaire was developed *ad hoc*, which included socio demographic data (four variables related to gender, age, autonomous community and educational level) and aspects related to PA habits (weekly hour of PA) *before* and *during* the lockdown caused by COVID-19, as well as aspects of sleep related of the average daily hours of sleep (Appendix). For the data collection, the questionnaire was divided into different areas, taking different scales as a reference: selection among several options and categorisation through a 5-point Likert scale (considering that odd-scoring items are the most popular) (Pérez Santamaría et al., 2002).

The questionnaire was validated by an expert pa-

nel, selected in compliance with the requirements proposed by Skjong & Wentworth (2000). Specifically, the expert panel consisted of 12 experts (50% men and 50% women) in the scope of teaching and health. Four of these experts were active PhD professors with over 10 years of experience in the scope of physical activity and sport science, psychology and new technologies, two were from new technology companies, two were managers of municipal services and another two were owners of fitness centres and gymnasiums. The other two people were no experts in the sector of physical activity and sport: one of them practised PA regularly, whereas the other one did not.

Procedure

The instrument used to gather the information was a questionnaire applied through the Google Forms platform, ensuring confidentiality and anonymity at all times. This instrument was selected based on the fact that it shows what the respondents do and think (Colás & Buendía, 2012). Moreover, the online administration of the questionnaire was not only the best option but also the only option to obtain the information, due to the lockdown.

An informed consent was obtained from each of the participants prior to data collection, which was carried out by having the participants complete a question at the beginning of the questionnaire. The participants were informed that all the information gathered was to be used solely for scientific purposes. Therefore, only adult people (18 or more years old) in Spain were considered.

Ethical approval was requested from the Ethics and Human Research Committee of the University of Valladolid. The principles of the Declaration of Helsinki (World Medical Association (WMA), 2013) were followed for this type of research.

The instrument was administered between April 10th and May 10th 2020, which is the period when no PA could be practised outside of the household. The link to the referred questionnaire was shared via different electronic applications, social networks and e-mail with diverse associations, institutions and companies of both sport and non-sport sectors, with the aim of contacting their members. Some of these entities were sport federations (national and regional), business and civil associations, universities, public and private schools, friends, relatives, etc.

Of the data collected, 39 questionnaires were discarded due to incorrect completion (21 women, 18 men).

Data Analysis

Once the database was cleansed, the data were treated using the IBM SPSS Statistics software (v.26). The obtained responses were subjected to a Kolmogorov-Smirnov test, which showed that the study variables did not meet the assumption of normality. Therefore, and since it was not possible to use parametric techniques, it was decided to apply non-parametric alternatives. Specifically, we used the paired samples Wilcoxon test and Spearman's correlation coefficient (r_s). For every case, the significance level was set at $p < .05$.

Results

Regarding the first aim, to analyse sleep *during* the lockdown with respect to *before* the pandemic, we compared both the quantity (measured in terms of hours of sleep) and quality of sleep («1. Very bad», «2. Bad», «3. Not so good», «4. Good», «5. Very Good»). Table 2 shows the results obtained.

Table 2
Quantity (hours) and quality of sleep before and during the lockdown

N=1046	Mean	Standard Deviation	Wilcoxon W	Z	Sig.
Hours	Before 7.13 (7h07)*	.892	208737.500	12.472	.000
	During 7.65 (7h39)*	1.282			
Quality	Before 3.67	.852	37029.500	-12.374	.000
	During 3.24	1.047			

* h=hours; ' =minutes

For the entire sample, there were less hours of sleep *before* the lockdown (M=7.13 -equivalent to 7 hours and 07 minutes-) than *during* the lockdown (M=7.65 -equivalent to 7 hours and 39 minutes-). However, the quality of sleep shown by the respondents worsened (*before*: M=3.67, *during*: M=3.24), although they were in the same range («Not so good»). The results are significant in both cases.

Regarding the hours of sleep, the professional associations establish different criteria or guidelines for the different age groups (Table 1). Table 3 shows the results by age groups.

Regarding age groups, it should be noted that the segment of people over 65 resulted to be smaller than that of the other age ranges, since its members are not regular users of social networks, and their access to the questionnaire was more complex. In any case, this group was handled following the age ranges stated by the NSF (National Sleep Foundation), supported by the rest of the professional associations (SRS; SES; WHO).

The results for the age group of 18-25 years allow rejecting the null hypothesis, that is, the difference in

hours of sleep was significant between *before* (M=7.37, equivalent to 7 hours and 22 minutes) and *during* the lockdown (M=7.92, equivalent to 7 and hours 55 minutes). The quality of sleep was worse *during* the lockdown (M=3.09) than *before* the lockdown (M=3.85).

Table 3
Quantity (hours) and quality of sleep before and during the lockdown, by age groups

		Mean	Standard Deviation	Wilcoxon W	Z	Sig.
Between 18-25 years (N=240)						
Hours	Before	7.37 (7h22')	.915	14293.00	-5.557	.000
	During	7.92 (7h55')	1.323			
Quality	Before	3.85	.799	2400.00	-7.994	.000
	During	3.09	1.108			
Between 26 a 64 years (N=778)						
Hours	Before	7.08 (7h05')	.841	111924.00	-11.291	.000
	During	7.60 (7h36')	1.239			
Quality	Before	3.63	.856	19746.50	-9.355	.000
	During	3.28	1.024			
More than 65 years (N=28)						
Hours	Before	6.61 (6h37')	1.480	13.00	-.541	.589
	During	6.68 (6h41')	1.473			
Quality	Before	3.32	.945	13.50	-1.155	.248
	During	3.18	1.056			

For the age group of 26-64 years, the differences were also significant, with similar results: more hours of sleep *during* the lockdown (M=7.60, equivalent to 7 hours and 36 minutes) than *before* the lockdown (M=7.08, equivalent to 7 hours and 05 minutes), and worse quality of sleep *during* the lockdown (M=3.28) than *before* the lockdown (M=3.63).

However, in the age group of 65 or more years, the difference was not significant, neither for the quantity nor the quality of sleep, thus it can be asserted that the participants slept the same hours *during* the lockdown (M=6.68, equivalent to 6 hours and 41 minutes) and *before* the lockdown (M=6.61, equivalent to 6 hours and 37 minutes), and that the quality of sleep was also similar (*before* M=3.32, *during* M=3.18).

The second objective was to determine whether the levels of sleep recommended by the professional associations (NSP, SRS, SES, WHO - WHO 2020a-) were met. Since the recommendations are the same in all cases, according to the values established by the NSF (Table 1), the age groups of 18-25 years (young adults) and 26-64 years (adults) met the recommendations of hours of sleep, as both groups were within the interval of 7-9 daily hours. However, although both groups were in the lower part of such range *before* the pandemic (near 7 hours), they were both near the mean of this interval *during* the pandemic (M=7.92 for young adults, M=7.60 for adults), due to the increase in the number of hours of sleep. In this sense, it can be asserted that the levels of sleep were not only maintained but also improved, probably due to the longer spare time at home.

For the participants aged 65 or more years (older adults), the NSP recommends 7-8 hours of sleep per day, which, in this case, was not met neither *before*

(M=6.61, equivalent to 6 hours and 37 minutes) nor *during* the lockdown (M=6.68, equivalent to 6 hours and 41 minutes). Moreover, despite the slight increase, each difference was so insignificant that it is not even near the lower part of the recommended interval. Therefore, for this group, it can be asserted that the hours of sleep were not met and that the quality of sleep did not improve significantly.

The third objective was to determine the relationship between sleep (measured in hours of sleep) and PA practice *during* the lockdown. In this case, PA practice was quantified in 5 levels (measured in weekly hours): «1. Nothing (none)», «2. Little (less than 3h.)», «3. Some (between 3h and 5h59)», «4. Enough (between 6h and 8h59)» and «5. A lot (9h or more)». The different levels of PA quantity were established from the adaptation of the ACSM (2018) and WHO (2018a, 2020a) PA frequency and duration recommendations, the Eurobarometer PA frequency (European Commission, 2018), the expert judgment that validated the questionnaire, the recommendations on PA quantity and quality from Garber et al., (2011) and the adaptation of the physical activity guideline reflected in García-Tascón et al. (2020).

The results (Figure 1) show that there was no significant direct relationship between the quantity (hours) of PA and the hours of sleep during the lockdown for neither the entire sample nor any of the age groups (H3.1). For the young adults, adults and older adults, the Spearman's correlation coefficient was $r_s = .035$ ($p = .588$), $r_s = .019$ ($p = .592$) and $r_s = -.115$ ($p = .560$), respectively, while the entire sample obtained a value of $r_s = .040$ ($p = .191$).

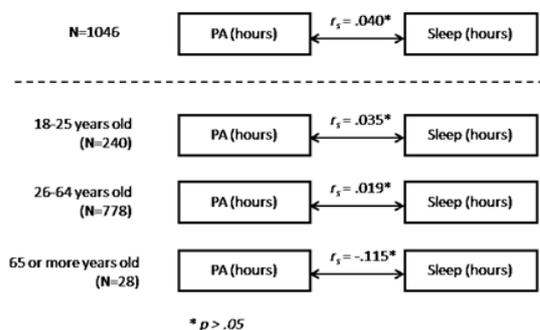


Figure 1. Spearman's correlation coefficient r_s (amount (hours) of PA practice and hours of sleep)

We also analysed the relationship *during* the lockdown (H3.2) between the quality of sleep («1. Very bad», «2. Bad», «3. Not so good», «4. Good» and «5. Very good») and PA practices (quantified in the above mentioned terms). In this case, the results (Figure 2) show that there was a weak positive correlation between the

amount (hours) of PA and the quality of sleep *during* the lockdown for the age group of 18-25 years ($r_s = .136$; $p = .036$), that is, the more hours of PA practice, the better the quality of sleep, and vice versa. However, for the age group of 26-64 years ($r_s = .031$, $p = .389$) and 65 or more years ($r_s = -.207$, $p = .291$) there was no significant relationship, as well as for the entire sample ($r_s = .049$, $p = .113$).

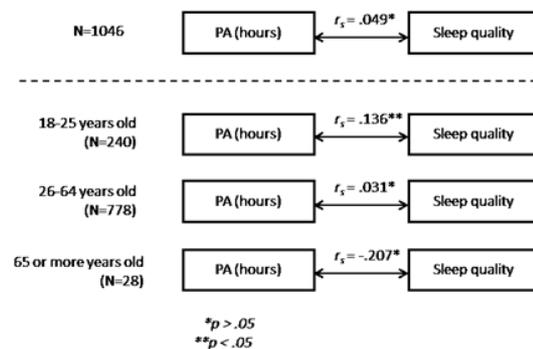


Figure 2. Spearman's correlation coefficient (amount (hours) of PA practice and quality of sleep)

Discussion

The COVID-19 pandemic and the subsequent mobility restrictions approved by governments all over the world with the aim of stopping the spread of the disease caused modifications in the lifestyles, working relations, ways of working and social and personal contact of the general population. The general concerns derived from this situation, together with the proliferation of alarming news related to the virus, had a negative influence on sleep and, thus, on the sleeping habits of people, which must be studied in order to propose actions targeted to reducing such risk.

Moreover, although PA practice has been traditionally associated with better quality of sleep (Dolezal et al., 2017; Kline, 2014; Lang et al., 2016; Loprinzi & Cardinal, 2011), some results do not support such association (Carmona Fortuño & Molés Julio, 2018; Kredlow et al., 2015; Santos et al., 2016). Therefore, it is also necessary to know how PA practice influenced sleep *during* the lockdown.

Regarding sleep (hours and quality of sleep), *during* the lockdown, there was an increase in the hours of sleep (H1.1), going from an average of 7.13 (equivalent to 7 hours and 07 minutes) before the pandemic to an average of 7.65 (equivalent to 7 hours and 39 minutes), which is in contrast to the findings of other studies that report an unaltered amount of hours of sleep (Antúnez et al., 2020). However, the quality of sleep decreased (H1.2), since, although it is in the same range («Not so good») both *before* and *during* the lockdown, it also

showed a significant decrease within this interval, going from 3.67 to 3.24. In this regard, the CIS report (2020a) after the lockdown shows that acquiring a new mattress was among the immediate purchase options of Spanish people (among the 8-10 most demanded).

These results are in line with those of other studies in the Spanish population, such as that of Balluerka et al. (2020), who reported that 61.4% of the respondents had sleeping problems during the confinement. Cantarero-Prieto et al. (2020) showed that only 14% of the respondents considered their sleep to be good or very good during the lockdown. Sandín et al. (2020) stated that sleeping problems are among the researched topics along with the prevalence of the fear of the coronavirus and emotional symptoms. In Italy, where the process derived from COVID-19 was in the same line as that in Spain, similar results have been detected: more hours of sleep but worse quality (Casagrande et al., 2020; Cellini et al., 2020; Gualano et al., 2020).

Different authors report similar results in studies conducted in other regions and/or countries, such as United Kingdom (Wright et al., 2020), Germany (Hetkamp et al., 2020), Portugal (Antunes et al., 2020), France (Beck et al., 2020), United States (Gao & Scullin, 2020), China (Huang & Zhao, 2020), Reunion Island (Chouchou et al., 2020), Taiwan (Li et al., 2020) and India (Gupta et al., 2020), among others.

Since the hours of sleep recommended by the international associations are different for the different age groups (Consensus Conference Panel, 2015; Hirshkowitz et al., 2015a, b; Jurado Luque, 2016), we also analysed the effects of the lockdown and of the modification of the established recommendations on the different age groups.

Before the lockdown, only the first two groups complied with the recommendations of the professional associations (NFS, SRS, SES, WHO -WHO, 2020a-) (18-25 and 26-64 years) in the number of hours of sleep, but not for the third group (65 or more years), which is in line with the findings of Madrid-Valero et al. (2017).

During the lockdown period, the results of the study indicate an increase of hours of sleep in the three age groups studied (18-25 years, 26-64 years and 65 or more years), although the results of the third group were not significant. The increase in hours of sleep implies the compliance with the recommendations in the first two age groups. However, in the group of people aged 65 or more years, this increase in sleeping time during the lockdown was not enough to comply with the recommended standards of sleep (objective 2, H2.1).

This could be due to the possibility that, for people aged 65 or more years, the spare time may have not changed during the lockdown, since this population group is mostly retired, thus their spare time would be the same in both periods.

Therefore, it is shown that age is a factor that affects the hours of sleep (Andrea Contreras, 2013; Madrid-Valero et al., 2017), thus both *before* and *during* the lockdown, the hours of sleep decreased with greater age.

Regarding the quality of sleep, the results of the present study show a significant worsening for the entire sample, as well as for the first two age groups (i.e., 18-25 years and 26-64 years). Such findings for the first age group are in agreement with those reported by Sandín et al., (2020), whereas other studies have detected sleeping problems regardless of age (Balluerka Lasa et al., 2020). These results were not obtained in this analysis for the oldest age group (65 or more years).

PA has played an important role in physical health during the lockdown (Jakobsson et al., 2020; WHO, 2020a). According to the WHO, every movement counts (WHO, 2018b), especially when coping with the limitations caused by the pandemic (WHO, 2020b). This study was focused on determining the contribution of PA to sleep as a health factor.

The results of the present study show that, during the lockdown, there was no correlation between PA practice and the hours of sleep in any of the age groups analysed (H3.1.), as opposed to previous studies that did corroborate the existence of such relationship (Aguilar-Parra et al., 2015; Beltran Valls et al., 2019; Carmona Fortuño & Molés Julio, 2018; Casaux Huer-tas & Garcés Bernáldez, 2017; Dolezal et al., 2017; Kline, 2014; Lang et al., 2016; Loprinzi & Cardinal, 2011; Santos et al., 2016). The confinement period may have contributed to this increase in hours of sleep, as well as to the decrease of PA practice (Balluerka Lasa et al., 2020; García-Tascón et al., 2020; IBV, 2020). In fact, in the study of Cantarero-Prieto et al. (2020), 80% of the respondents stated that when they were allowed to go for walks again, with the reduction of the lockdown restrictions, their sleep improved considerably. Therefore, it is necessary to analyse this exceptional situation more thoroughly with larger samples, since the scientific literature demonstrates the existence of this correlation, in most of the cases, between PA practice and the hours of sleep. The results of our study show that the quality of sleep increased significantly in young adults who practice PA, whereas no relationship

was found between the amount of PA hours and the quality of sleep neither for the other two age groups (26-64 years and 65 or more years) nor for the entire sample (H3.2). Thus, part of the findings of this study (only for the age group of 18-25 years) are in line with those of Chouchou et al. (2020) regarding the relationship between PA practice and the quality of sleep.

Conclusion

Since long ago, the scientific community has warned about the different direct and indirect effects of stressful situations and concerns on sleep (Agudelo et al., 2008; Åkerstedt et al., 2007; Benetó Pascual, 2003; OECD, 2010; Talamini et al., 2013; Wright et al., 2020). One such situation is the impact of the COVID-19 lockdown on sleep. In this sense, the present study supports that the confinement has modified the quality of sleep, affecting health and, consequently, the quality of life.

It would have been desirable to perform pre-pandemic studies to identify PA levels prior to the pandemic and compare them with the pandemic situation, as well as data on rest before confinement to corroborate the existence or not of a relationship. This may be considered a limitation of the study. Also, the size of the sample group over 65 could be deemed as a limitation (it would have been more appropriate to have had more participation from them). Nevertheless, the fact that the data gathering was conducted during confinement may have any sort of positive effect on the awareness and access to the questionnaire, since the Internet and social networks platforms were intensively requested during this period.

These conclusions indicate that we must design strategies to educate the population in sleep hygiene as a habit that contributes to health preservation, both in normal situations and during alarm situations that restrict mobility and contact with other people (Chang et al., 2020). In addition, we agree with the WHO (2018b; 2020b) on the convenience of adopting guidelines to develop national health policies that include detailed recommendations for both PA practice and sleeping habits.

The findings of the present research therefore could be taken as a reference to carry out sleep studies in people who have suffered from any kind of disorder and have post-COVID-19 aftermath, and how PA can help. As well, these results could be used to develop public health strategies, such as educational and informative courses on sleep hygiene, or to design specific strategies

in the Action Plan 2021-2024 Mental Health and Covid-19 to address the impact caused by the pandemic presented by the Government in October 2021.

Appendix

Sociodemographic data

1. Gender: Man/Woman
2. Age (years)
3. Province (Selection of the corresponding Spanish Autonomous Community)
4. Education level (No studies / Primary studies / Secondary studies / Higher studies)

Aspects of physical activity

1. Weekly hours of physical activity (1. Nothing (None) / 2. Little (< 3 hours) / 3. Some (between 3h and 5h59') / 4. Enough (between 6h and 8h59') / 5. A lot (over 9h))

Before Covid-19

During Covid-19

Aspects of sleep

1. Average daily hours of sleep

Before Covid-19

During Covid-19

1. Quality of sleep (1. Very bad / 2. Bad / 3. Not so good / 4. Good / 5. Very good)

Before Covid-19

During Covid-19

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