SELF-PERCEIVED SLEEP QUALITY DURING THE COVID PANDEMIC: RISK AND PROTECTIVE FACTORS

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ABSTRACT

The situation derived from the Coronavirus disease (COVID-19) and lockdowns ordered to control the pandemic led to unprecedented problems in different areas of people's well-being. This study aimed to explore the acute effects of the first lockdown on self-perceived sleep quality, as well as the risk/protective factors that modulated this impact. The sample was composed by 1,275 respondents ranging in age from 18 to 55 years. Participants were recruited during the COVID-19 first lockdown in Spain. They were evaluated regarding their self-reported sleep problems before and during lockdown, as well as other areas related to the impact of lockdown (e.g., on diet, physical activity, or use of digital media), psychological states (positive and negative affect), and traits (impulsivity). Most participants (66.7%) reported a decrease in their self-perceived sleep quality during the pandemic. Correlational analyses showed that maintaining good levels of physical activity and diet quality during the pandemic were positively associated with sleep quality; furthermore, greater levels of positive affect, living in bigger homes during lockdown, and age were positively associated with sleep quality as well. On the contrary, negative affect, female sex, and the impact of the pandemic on various domains (mental health, relationship quality, personal finances, and the use of digital media) were negatively related to self-perceived sleep quality. In brief, this study supports the impact of the COVID-19 pandemic on self-perceived sleep quality and provides a preliminary foundation for identifying protective and risk factors contributing to sleep quality during lockdowns and other situations of distress.

Keywords: COVID-19; sleep quality; risk factors; protective factors; cross-sectional study

RESUMEN

Autopercepción de la calidad del sueño durante la pandemia de COVID-19: Factores de riesgo y protección. La situación derivada de la enfermedad por Coronavirus (COVID-19) y los sucesivos confinamientos ordenados para controlar la pandemia llevaron a problemas sin precedentes en diferentes aspectos del bienestar de las personas. Este estudio tuvo como objetivo explorar los efectos agudos del primer confinamiento en la calidad del sueño autopercibida, así como los factores de riesgo y protectores que pueden modular este impacto. La muestra estuvo compuesta por 1,275 encuestados con edades entre 18 y 55 años. Los participantes fueron reclutados durante el primer confinamiento por COVID-19 en España. Se les evaluó en relación con sus problemas de sueño autoinformados antes y durante el confinamiento, así como en otras áreas relacionadas con el impacto del confinamiento (por ejemplo, en la dieta, la actividad física o el uso de medios digitales), estados psicológicos (afecto positivo y negativo) y rasgos (impulsividad). La mayoría de los participantes (66.7%) informaron de una disminución en la calidad del sueño percibida durante la pandemia. Los análisis correlacionales mostraron que mantener buenos niveles de actividad física y calidad de la dieta durante la pandemia estaban positivamente asociados con la calidad del sueño; además, niveles mayores de afecto positivo, vivir en hogares más grandes durante el confinamiento y la edad también estaban positivamente asociados con la calidad del sueño. Por el contrario, el afecto negativo, el ser mujer y el impacto de la pandemia en varios dominios (salud mental, calidad de las relaciones, finanzas personales y el uso de medios digitales) estaban negativamente relacionados con la calidad del sueño percibida. Así pues, esta investigación sustenta el impacto de la pandemia de COVID-19 en la calidad del sueño percibida y proporciona una base preliminar para identificar factores protectores y de riesgo que contribuyen a la calidad del sueño durante el confinamiento y otras situaciones de estrés.

Palabras clave: calidad del sueño; COVID-19; factores de riesgo; factores protectores; estudio transversal

INTRODUCTION

COVID-19 was initially detected in Wuhan, China, in late December 2019. On March 11, 2020, the World Health Organization classified the outbreak as a pandemic (WHO, 2020). The severity, length, and specifics of the lockdowns varied significantly across different countries (Hale et al., 2021), generally including mandatory home confinement and a total ban on public activities.

During the first lockdown period, there was a deterioration in people's mental health. This was due to various causes (e.g., fear of contracting COVID-19, decreased time dedicated to physical activity, or lack of socialization) (Brooks et al., 2020; Prommas et al., 2023; Richaud et al., 2022; Schimmenti et al., 2020).

Sleep quality was another aspect significantly impacted by the health crisis (Limongi et al., 2023; Altena et al. 2020). Various studies demonstrated that from the beginning of the pandemic, particularly since the implementation of social distancing measures and lockdown, people experienced multiple problems in maintaining an adequate sleep hygiene. For example, a study among 1,300 Italians during the first weeks of lockdown showed that both the sleep pattern and its quality significantly worsened (Cellini et al., 2020). Participants reported going to bed and getting up later, as well as spending more time in bed; yet subjective perception of sleep quality significantly worsened. Another study conducted among 5,525 Canadians during three months of lockdown showed that a large proportion of the population experienced clinically meaningful sleep difficulties, with researchers identifying three different sleep profiles: "Reduced Time in Bed," "Delayed Sleep," and "Extended Time in Bed" (Robillard et al., 2020). Similarly, a study with 958 participants from India showed delays in sleep onset and bedtime, along with an overall reduction in nighttime sleep and an increase in daytime naps (Gupta et al, 2020). Lastly, research analyzing sleep quality using a self-report measure and a wristband found an increase in the amount of sleep time and a delay in getting up during the lockdown compared to previous sleep patterns; however, this increase did not result in a significant improvement in sleep quality (Sañudo et al., 2020).

Sleep plays a central role in regulating multiple psychological and biological processes, including the maintenance of immune and metabolic balance, homeostasis of basic physiological processes, and the facilitation

of learning and memory (Dattilo et al., 2011; Beck et al., 2020). Both in the short and medium term, sleep problems can lead to a reduction in work and/or academic productivity (Espie et al., 2012), an increased likelihood of multiple psychopathologies (Soehner & Harvey., 2012), weight gain (Cizza, 2011; Hasler et al., 2004; Cappuccio et al., 2008), poor muscle recovery (Dattilo et al., 2011), an increased risk of developing diabetes (Vgontzas et al., 2009) or cardiovascular diseases (Lao et al., 2018), and a generalized worsening of physical and psychological health (Hall et al., 2018; Liu & Chen, 2019; Rappoport, 2019; Orzeł-Gryglewska, 2010). Thus, studying factors that worsen sleep quality constitutes a priority, especially during the particularly sensitive periods such as the past COVID-19 pandemic and the subsequent lockdowns.

Under normal circumstances, multiple biopsychosocial factors negatively affect sleep quality. The level of stress (Wang & Xan, 2023; Olini et al., 2017), the presence of certain medical conditions (Tranmer et al., 2003) or mental disorders (Merrill et al., 2023), the consumption of psychoactive substances (Nicholson et al., 1994; Navarro-Martínez et al., 2020) or certain lifestyle patterns such as the frequency and intensity of physical activity (Chennanoui et al., 2015; Zhang et al., 2020) or the type of diet (Ammar et al., 2020; Dalmases et al., 2019; Peuhkuri et al., 2012) have been associated with sleep quality. According to a meta-analysis, sex (specifically being a woman) would also be related to a worse sleep quality (Zhang & Wing, 2006). Additionally, a meta-analysis focused on the COVID-19 pandemic replicated these findings (Alimoradi et al., 2022). These aspects, along with other factors that emerged as a result of the COVID pandemic and lockdown, may have influenced the two main sleep regulation systems: the homeostatic system (the system that regulates "the need" for sleep –aka, sleep pressure–) and the circadian system (the system that regulates "when" –i.e., at what time of the day– such pressure is most likely to appear) (Borbély et al., 2016). During the pandemic, the homeostatic system was adversely affected by reduced physical activity, which is important in increasing levels of adenosine that determine the onset of sleep (Dworak et al., 2007). Likewise, the flexibility of schedules due to the promotion of home office favored people spending more time in bed throughout the day, increasing the time spent on multiple short periods of "light sleep" and reducing the accumulation of sleep that leads to deeper, longer-lasting, and restorative sleep (Weller, 2020; Santillán-Marroquín, 2020). This alternation of usual schedules, together with the reduction of exposure to sunlight and the increase of artificial light, in turn caused an alteration of the circadian sleep regulation system (Kutana & Lau, 2020). Similarly, the increase in time in front of screens observed during the pandemic (Király et al., 2020) and whose negative effect on sleep quality has been well demonstrated (Hale & Guan, 2015) may explain the higher prevalence of sleep problems.

In these health circumstances, these factors may continue playing an important role in modulating sleep hygiene; however, little research has been carried out in the current context. This data is crucial in planning a comprehensive approach to sleep quality during the lockdown situation. One notable exception is the study by Dal Santo et al. (2021), who explored the acute impact of the pandemic during the first week of lockdown on self-reported sleep disturbances in a large Spanish sample (n=15,070). The authors reported that 23.9% of the participants had difficulties in maintaining or initiating sleep. Sleep problems were associated with being older, female sex, drinking alcohol, income reduction, caring for elderly dependents, and high levels of anxiety, depression, and stress. Unfortunately, this study did not explore alternative risk factors with a proven impact on sleep quality, such as the use of digital media, diet, or physical exercise.

The present study aimed to explore the effects of the lockdown on sleep quality in an adult Spanish sample, as well as the risk/protective factors that may have an impact on this aspect. It was expected that those people who were more affected by the pandemic and subsequent lockdown in terms of physical, mental health, and eating habits would experience an increased impact on perceived sleep quality during the pandemic. Furthermore, we expect that other psychological (e.g., negative emotions) and sociodemographic aspects (e.g., economic impact of the pandemic) would play an important role in worsening sleep quality during the pandemic.

METHODS

This study took place from April 15 to April 23, 2020, during which Spain experienced a significant impact from COVID-19, with a high number of confirmed cases and deaths. One month before (14th March), the Spanish government ordered a strict lockdown. During this lockdown, people were only allowed to leave their homes for essential tasks. Hence, participants in this study were recruited after a 30-day lockdown period. Participants accessed the survey via a LimeSurvey link. They were recruited through posts on various platforms (e.g., Instagram, Facebook groups). Participants completed a battery of measures including different ad hoc scales and standardized self-report measures (see table 1 for a complete description of the study measures).

Table 1. Description of the study measures

Domain assessed	Instrument	Variable	Description	Reliability
Dependent variable				
Sleep quality	Ad hoc scale	Δ Sleep quality	Single indicator of increased/decreased sleep quality during the pandemic, calculated by subtracting the answer given to a question assessing self-perceived sleeping quality during the COVID-19 pandemic ('*Please, rate your sleeping quality during the COVID pandemic*'; from '0=*extremely unsatisfactory*' to '9=*extremely satisfactory*') from the answer given to a question assessing retrospectively this aspect before the COVID-19 crisis ('*Please, rate your sleeping quality before the COVID pandemic. To answer this question, consider your sleeping quality in reference to the last two weeks having preceded the COVID-19 lockdown (i.e., 1st to 14th of March)*'; from '0=*extremely unsatisfactory*' to '9=*extremely satisfactory*'). The sign and size of the resulting figure indicated the direction and the degree of the changes: i.e., positive scores indicate increased sleep quality, whereas negative scores indicate decreased sleep quality.	NA
Independent variables				
Demographics	Ad hoc scale	Sex	Sex (*male* vs. *female*; 1 item)	NA
		Age	Age (1 item)	NA
Lockdown conditions	Ad hoc scale	Days in lockdown	Days spent in lockdown (1 item)	NA
		Lockdown compliance	Compliance with the lockdown ('1=*complete compliance*' to '6=*not compliance at all*'; 1 item)	NA
		N of people cohabiting with	Number of people cohabiting with during lockdown (1 item)	NA
		Home size	Size of the place where they stayed during the lockdown ('1=*limited*' to '6=*spacious*'; 1 item).	NA
Impact of lockdown	Ad hoc scale	Impact on mental health	Self-perceived impact of lockdown on mental health ('1=*not at all*' to '9=*extremely*'; 1 item).	NA
		Impact on personal finances	Self-perceived impact of lockdown on personal finances ('1=*not at all*' to '9=*extremely*'; 1 item).	NA
		Impact on relationship quality	Self-perceived impact of lockdown on relationships quality ('1=*not at all*' to '9=*extremely*'; 1 item)	NA
Physical activity	Ad hoc scale	Δ Physical activity	Single indicator of increased/decreased physical activity durng the pandemic, calculated following the same approach as for the calculus of 'Δ Sleep quality'. Positive scores indicate an increase in physical activity during the COVID pandemic, whereas negative scores indicate a decrease in physical activity.	NA
Diet	Ad hoc scale	Δ Diet quality	Single indicator of increased/decreased diet quality during the pandemic, calculated following the same approach as for the calculus of 'Δ Sleep quality'. Positive scores indicate an increase in diet quality during the COVID pandemic, whereas negative scores indicate a decrease in diet quality.	NA
Affect	Positive and Negative Affect Schedule (PANAS; Sandín et al., 1999) [a]	Positive affect	Positive affect (e.g., *interested*, *excited*; 10 items)	a=.89
		Negative affect	Negative affect (e.g., *distressed*, *upset*; 10 items)	a=.87
Impulsivity	Impulsive Behavior Scale (UPPS-P short version, Cándido et al., 2012) [a]	Negative urgency	Tendency to act impulsively under conditions of negative affect (4 items)	α=.79
		Positive urgency	Tendency to act impulsively under conditions of positive affect (4 items)	α=.65

		Lack of premeditation	Tendency to overlook consequences of an action (4 items)	α=.75
		Lack of perseverance	Inability to stay focused and persist on a task (4 items)	α=.78
		Sensation seeking	Tendency to engage in new (and potentially dangerous) activities (4 items)	α=.81
Digital media use	Online Activity Before and During the COVID Pandemic (Zarco-Alpuente et al., 2021)	Time using digital media	Difference in the time invested in six online behaviors (i.e., online TV series, online sexual activities, video games, social networks, gambling, online shopping, and instant messaging) before and during the COVID-19 pandemic. Positive scores (expressed in minutes per week) indicate an increase in the time using digital media during the COVID pandemic, whereas negative scores indicate a decrease.	NA
		Excessive use of digital media	Difference in the severity (i.e., loss of control, interference, etc.) associated to the engagement in six online activities before and during the COVID-19 pandemic. Positive scores indicate an increase in the severity of digital media use during the COVID pandemic, whereas negative scores indicate a decrease.	NA
Risky behaviors	Selection of four questions from the Screener for Substance and Behavioural Addiction (SSBA, Schluter et al., 2018)	Overeating	Eating more than is needed for day-to-day living ('0=*none of the time*' to '5=*all of the time*'; 1 item)	NA
		Loss of control over eating	Unable to stop eating once started ('0=*none of the time*' to '5=*all of the time*'; 1 item)	NA
		Stop despite consequences	Unable to stop overeating despite negative consequences ('0=*none of the time*' to '5=*all of the time*'; 1 item)	NA
		Overdrinking	Drinking more alcohol than is recommended ('0=*none of the time*' to '5=*all of the time*'; 1 item)	NA

Note: [a] = Spanish translation and validation; NA=Non-applicable. These measures were also used in Zarco-Alpuente et al. (2021).

A total of 1,789 individuals accessed the survey link. Duplicate entries and unreliable responses were excluded from the sample. Only those who completed at least 80% of the questionnaires were retained. As a result, the final sample consisted of 1,275 participants. Participant characteristics are detailed in Table 2.

Table 2. Participants' characteristics

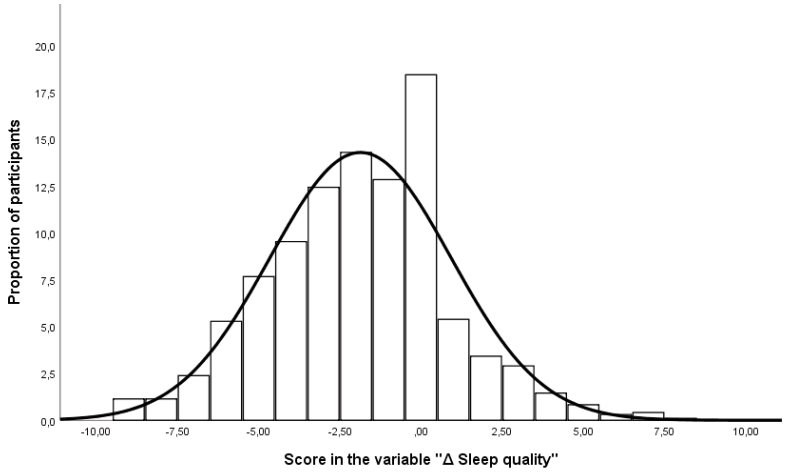
	% (*n*) or *M* (*SD*)
Demographics	
Sex	
Men	33.9% (432)
Women	66.1% (843)
Age (18-55 years)	26.23 (9.64)
Marital status	
Single	49.7% (628)
In a relationship	37.0% (467)
Married	11.7% (148)
Education Level	
Vocational training	28.4% (355)
College or university graduate	54.6% (682)
Post-graduate degree	12.3% (154)
Occupational status	
Student	66.4% (847)
Employed	27.0% (344)
Unemployed	9.3% (114)
Short-time work scheme [a]	8.9% (118)
Lockdown	
Days in lockdown (range: 17-32)	32.37 (4.23)
Lockdown compliance (scale from 1 [complete compliance] to 6 [no compliance])	1.94 (0.84)
Number of cohabitants (range: 0-9)	3.34 (1.18)
Home size (scale from 1 [limited] to 6 [spacious])	3.21 (0.89)
Self-assessed negative impact of lockdown (scale from 1 [not at all] to 10 [extremely])	
On mental health	5.24 (2.42)
On household finances	4.50 (3.07)
On relationship quality with cohabitants	4.04 (2.63)

Note: To maintain conciseness, categories with fewer than 3% of responses were excluded from the table. Note: [a] = Short-time work scheme (also known as short-time compensation) is a subsidy for workers temporarily laid off by firms impacted by the COVID-19 pandemic. These measures were also used in Zarco-Alpuente et al. (2021).

RESULTS

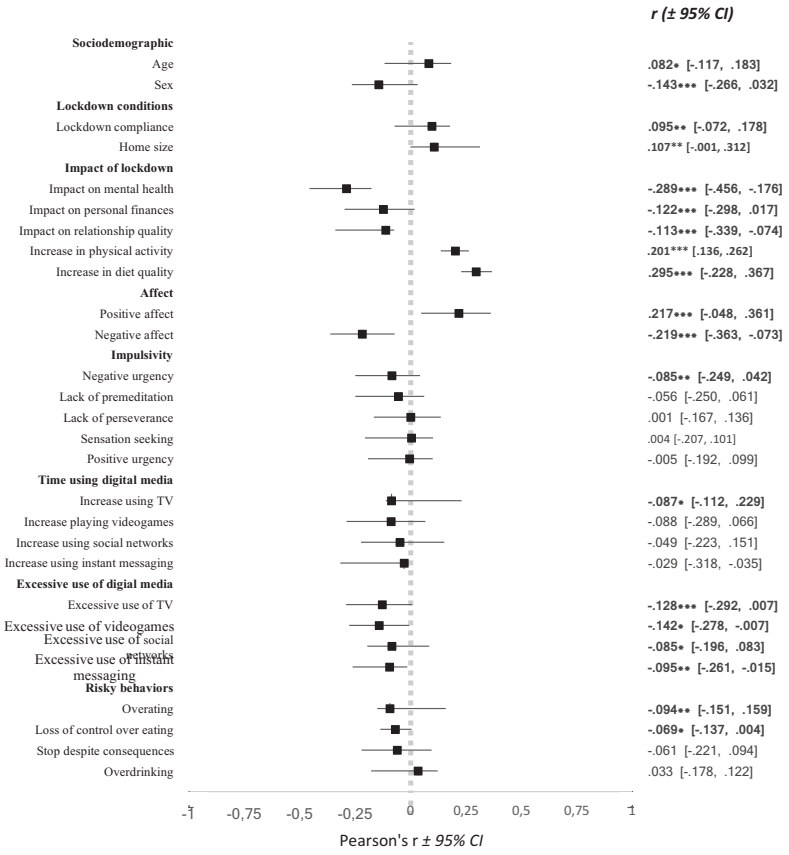
Figure 1 shows participants' distribution according to their sleep quality before and during lockdown (i.e., ' Sleep quality'). Positive scores indicate increased sleep quality, figures around zero indicate no changes in sleep quality before and during lockdown, and negative scores indicate decreased sleep quality. Most participants showed a worsening of their sleep quality during the pandemic (M=-1.865, SD=2.790). In terms of proportion of the sample, 66.7% reported a decrease in their sleep quality during pandemic. According to gender, sleep quality during pandemic was significantly lower in females than in males (M of-2.138 and -1.287 respectively; t=4.47; p<.001; d=.30). However, the proportion of females reporting a worsening in their self-perceived sleep quality was lower than that reported in males (58.4% in females vs. 70.7% in males; ^{2}=14.34; p<.001). Thus, whereas the proportion of females reporting a worsening in sleep quality was lower, the severity of this reduction was significantly higher.

Figure 1. Participants' distribution according to their self-perceived sleep quality before and during lockdown (i.e., ' Sleep quality')



To test the relationship between self-perceived sleep quality during the COVID pandemic and the rest of the study measures, participants' scores in the variable ' Sleep quality' were correlated (Pearson's r) with the other study measures (Figure 2).

Figure 2. Correlations between ' Sleep quality' and the other study measures.



Note: *p<0.05; **p<0.01; ***p<0.001.

As shown in Figure 2, the increase in physical activity (*r*=.201***) and the improvement of the diet quality during the COVID pandemic (*r*=.295***) were positively associated with a higher self-perceived sleep quality. Similarly, positive affect (*r*=.207***) and age (*r*=.082*) were correlated with a better sleep quality. Furthermore, the two lockdown conditions (degree of lockdown [*r*=.095**] and home size [*r*=.107*]) were positively correlated with sleep quality. On the contrary, negative affect (*r*=-.219***), female sex (*r*=-.143**), and impact of the pandemic on mental health (*r*=-.289***), on personal finances (*r*=-.122***), or on relationship quality (*r*=-.113***) were negatively related to perceived sleep quality. Similarly, all the variables related to excessive use of digital media (e.g., excessive use of videogames, social networks, etc.) were negatively correlated with sleep quality (*r* between -.085 and -.128).

DISCUSSION & CONCLUSIONS

Both the COVID-19 pandemic and the lockdown necessitated significant adjustments to the new situation, including modifications to healthy lifestyles. The purpose of this study was to explore the effects of lockdown on

self-perceived sleep quality, as well as the risk and protective factors that may have significantly impacted this aspect in an adult Spanish sample.

One of the key findings from this research was that the COVID-19 pandemic and the subsequent lockdowns resulted in major disruptions in self-perceived sleep quality for the majority of the population. Most participants in our study (66.7%) reported a significant deterioration in sleep quality during the lockdown, while only a minority reported no changes or improvements in this area. These findings align with general observations of sleep changes in pandemic-related contexts (Cellini et al., 2020; Gupta et al., 2020; Limongi et al., 2023, Romero-Blanco et al., 2020; Fu et al., 2020). In our research, females experienced a more pronounced deterioration in their sleep quality, a finding consistent with previous studies indicating that females are more susceptible to sleep problems than males (Dal Santo et al., 2021; Zhang & Wing, 2006).

As for the variables associated with perceived sleep quality during lockdown, we found that aspects such as the maintenance (or the improvement) of certain health habits (i.e., physical activity or diet quality) were related to a better adaptation to the new health context in terms of sleep quality. This is coherent with the myriad of empirical studies supporting the relevance of health habits in maintaining a good sleep hygiene (Ammar et al., 2020; Chennanoui et al., 2015; Dalmases et al., 2019; Peuhkuri et al., 2012; Zhang et al., 2020). Similarly, psychological variables such as positive affect acted as a protective factor against the negative impact of lockdown on sleep quality. Once again, this finding is in line with studies highlighting the relevance of the mental health status when it comes to predicting the occurrence of sleep problems (Wang & Fan et al., 2023; Nadja, 2017). Contrary to our expectations, in the pandemic context, being older was also related to a better sleep quality. This result is at odds with literature on the relationship between age and sleep quality (Gualano et al., 2020), and with studies conducted in the pandemic context (Dal Santo et al., 2021). This contrary finding may be explained by the major disruption that the pandemic has had in young people's live in terms of academical disruption and the subsequent stress (Romero-Blanco et al., 2020), the cessation of social activities (a central aspects in young people's life), and even to the increase in the use of digital media (an aspect with a documented impact on sleep quality) (Zarco-Alpuente et al., 2021). Supporting this later point, we observed that all the variables related to the excessive use of digital media were negatively correlated with sleep quality (r between -.085 and -.142).

Concerning the variables with a negative impact on self-perceived sleep quality during lockdown, psychological variables such as the level of negative affect (Cellini et al., 2017) and the impact of the pandemic on mental health (Franceschini et al., 2020) and social bonds (Grey et al., 2020) predicted a negative impact on this domain. In the same line, a greater impact of the pandemic on personal finances derived from the lockdown was also a risk factor for the development of sleep problems in our sample.

Because of its similarity with our research (in terms of sample characteristics and data collection date), the study by Dal Santo et al. (2021) constitutes an important reference when it comes to comparing our results with those found in other studies conducted during lockdown. As for risk factors for sleep disturbances, our research confirmed most of the results reported by Dal Santo et al. (2021), such as the relationship with sex (being a female) and mental health (anxiety, depression, and stress). However, we also found contradictory results concerning age (which in our study acted as a protective variable) and alcohol consumption (which was not associated with sleep quality in our research).

This study provides a preliminary foundation for identifying the unique risk and protective factors during lockdown, as well as for planning how to prevent sleep problems in future similar situations. In this regard, promoting exercise and healthy eating habits may assist in reducing the negative effects of the pandemic over sleep quality. In this context, it would also be important to generate preventive measures for those people who perceived a high impact on mental health during lockdown, as well as identifying the causes of this impact in order to provide them with the necessary tools for dealing with these situations. Finally, it would be necessary to further investigate the causes of the increased risk of the worsening in sleep quality during stressful situations in women.

Limitations

The limitations of this study are as follows. First, this study is cross-sectional, not longitudinal. Consequently, asking participants to recall certain aspects of their past may result in memory biases (Solhan et al., 2009). Additionally, self-reported sleep quality was measured with a single item. Although it would have been preferable to use a dedicated questionnaire for this purpose, the length of the survey precluded this option.

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