Journal of Development and Social Sciences
www.jdss.org.pk

RESEARCH PAPER

Association between Covid-19 Lockdown and Sleep Health among Athletic Population: An Analytical Perspective

[1]Fariq Ahmed [2]Dr. Asif Ali *

1. BS student, Department of Physical Education & Sports Sciences, Government College University, Lahore, Punjab, Pakistan
2. Associate Professor, Department of Physical Education & Sports Sciences, Government College University, Lahore, Punjab, Pakistan

*Corresponding Author   asif.ali@gcu.edu.pk

ABSTRACT

The emergence of the Covid-19 has led to the implementation of widespread lockdown, significantly impacting athletes' sleep routine. Therefore, determining the association between Covid-19 lockdown and sleep health among athletic population was primary objective of this systematic review. Through a comprehensive review of existing literature, a collection of 5,128 article titles and corresponding abstracts were obtained. Finally, after the completion of additional screening and quality assessment procedure, only 13 studies met the necessary quality criteria and were deemed eligible for the final analysis. Among the included studies, a majority of the studies (69%) revealed a negative impact of Covid-19 lockdown on sleep health among athletes, whereas 23% reported a positive impact. Additionally, a minority of the studies (7%) indicated no significant impact. Hence, the collective findings from the reviewed studies indicate a likelihood of Covid-19 lockdown having a detrimental effect on the sleep health of athletes.

| **Keywords:** | Athletes, Covid-19, Lockdown, Pandemic, Sleep |

Introduction

Covid-19 has been one of the most vicious diseases that has ever taken place during the human history. It has brought the world to a standstill, with governments implementing strict measures to mitigate its spread, including widespread lockdowns (Wang et al., 2021; Yaseen, Jathol, & Muzaffar, 2020). These measures have also effected negatively on peoples' health (physically and mentally) around the globe .While these precautions have been widely acknowledged as crucial for curbing the transmission of Covid-19 within various communities, they have inadvertently resulted in the disruption of individuals' biorhythms and sleep-wake schedules. (Leone, Sigman, & Golombek, 2020).

Sleep is an essential component of athletic performance and overall well-being (Chaput, Dutil, & Sampasa-Kanyinga, 2018). A comprehensive research has consistently emphasized the fundamental significance of sleep for various essential brain functions, including the working of nerve cells (neurons) and cognitive functions (Joiner, 2018; Ramar et al., 2021). Unfortunately, advent of this sudden pandemic has hindered athletes from attaining these numerous advantages.

Extensive evidence suggests that the global impact of the Covid-19 has been substantial on sleep health. In this regard, certain researchers have been examining the probable effects of Covid-19 on sleep patterns. One such study, conducted in Italy, stated that peoples' sleep health was effected negatively by Covid-19 (Gualano, Lo Moro, Voglino, Bert, & Siliquini, 2020). Among the various consequences of the pandemic, it's impact on athletes' sleep health has emerged as a critical area of concern.

Nevertheless, the sleep-wake patterns of athletes were also significantly disrupted during Covid-19 lockdown. Despite the crucial importance of obtaining the necessary

amount of sleep, a notable observation revealed that a majority of athletes struggled to attain the requisite volume of rest (Facer-Childs, Hoffman, Tran, Drummond, & Rajaratnam, 2021). However, a comprehensive and unbiased evaluation of the existing body of research on the subject matter was unavailable.

Correspondingly, previous studies have also failed to yield a definitive conclusion on this matter. Therefore, in order to coverup this gap, a systematic review in this regard was very crucial and significant. By identifying these gaps through a systematic review, researchers and policymakers can better allocate resources and prioritize future studies to address the specific needs of athletes in maintaining optimal sleep health during lockdowns or similar challenging circumstances.

By comprehensively analysing the association between sleep health and Covid-19 lockdown, this analysis aims to shed light on the challenges faced by athletes during this period and provide valuable insights for coaches and athletes. The findings of this review may also bring forth a more precise evaluation of sleep disruptions/disturbances among athletes during COVID-19 lockdown. Secondly the study also aims to provide significant findings to help understand the challenges faced by athletes in order to mitigate the negative consequences on their sleep health and, subsequently, enhancing their overall athletic performance and well-being during such harsh circumstances in the future.

Literature review

A study conducted on elite athletes belonging to 40 different countries examined that Covid-19 did impact negatively on the sleep health of athletes (Romdhani, Fullagar, et al., 2022). Similarly, some other studies including Chandler et al. (2021), Elce et al. (2022), Ellis et al. (2022), Filice (2022), Kurniarobbi, Chikih, Andeansah, Lestari, and Sukendar (2022), Mon-López, de la Rubia Riaza, Hontoria Galán, and Refoyo Roman (2020), Romdhani, Rae, et al. (2022) and Vitale et al. (2021) also highlighted negative association between Covid-19 lockdown and sleep health of athletes. Alternatively, a study conducted by Facer-Childs et al. (2021) on athletes belonging to different athletic disciplines revealed a positive correlation between sleep health and Covid-19 lockdown. Similarly, another study conducted on Community level tennis players by Beranek et al. (2022) in Australia observed increased sleep health during this pandemic.

Material and Methods

Criteria to include and exclude studies

- The norms of inclusion are given below:

- Articles that aimed to assess athletes' sleep health during the pandemic, either as main aim or secondary approach
- experimental, case-control, longitudinal, cross-sectional and cohort research articles.
- studies included participants of 3 age types (adolescents, young and adults) that were of both genders i.e. (Male and Female).
- studies having sleep, Covid-19 lockdown and athletes related keywords (e.g., Covid-19, lockdown, sleep, pandemic) either in the abstracts or titles of the studies.
- Studies published in reputable peer-reviewed journals.

Following articles were eliminated from the review:

- studies that were not available in full texts.
- studies in which sleep of athletes was not assessed during Covid-19 lockdown.
- studies in which insufficient data is available regarding the basic objective of this study.

- commentaries, thesis and dissertations, op-ed, studies, books, chapters that were not published.
- published reviews and case-studies were also excluded.

Search Strategy

This systematic search utilized prominent research databases, including PubMed, ScienceDirect, Taylor & Francis, PsycINFO, Google Scholar, Medline, Sage Journals, and Springer, to ensure comprehensive coverage of relevant literature. Search terms or keywords consisted of "athletes" AND "sleep", "sleep quality" AND "Covid-19", "lockdown" AND "athletes", "rest" AND "pandemic", "professional versus non-professional" AND "adolescent athletes", and "young athletes" AND "sleep health".

Study Selection

An independent extensive review was performed to select studies for systematic review using PRISMA (Moher, Liberati, Tetzlaff, Altman, & Group*, 2009) according to the criteria set to include and exclude the studies.. Figure 1 shows complete details of the procedure of the selection of the studies.
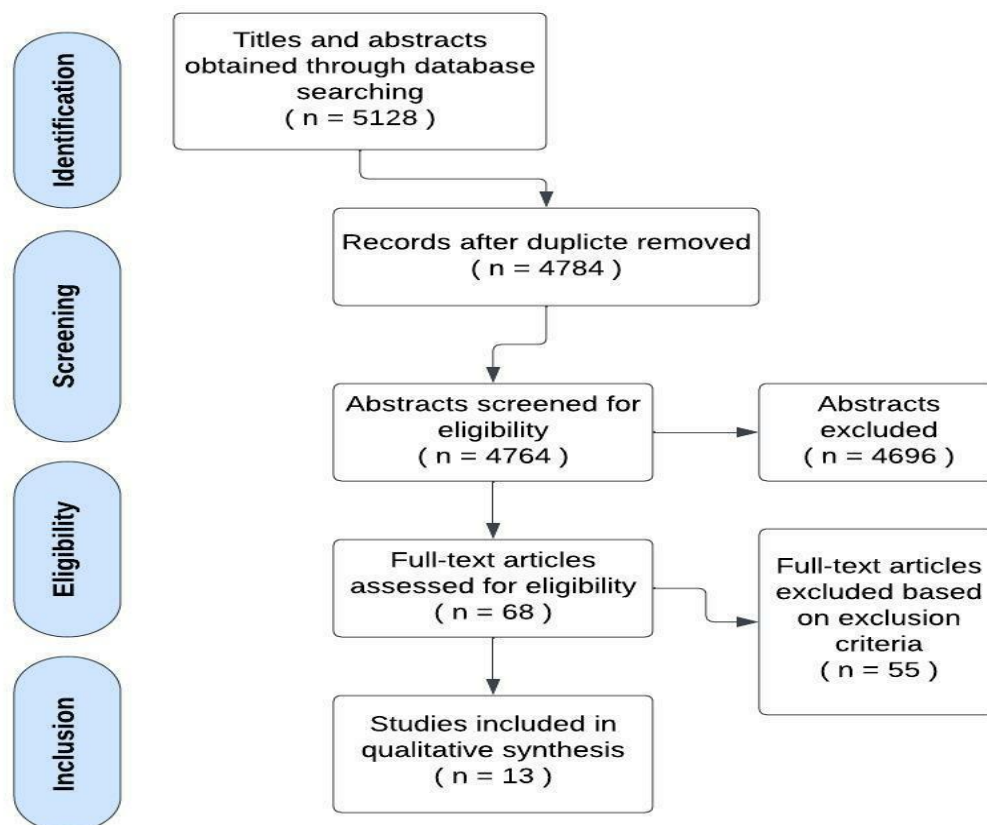

Figure 1. Strategy to search and select studies using PRISMA (Moher et al., 2009)

Assessment of any risk of biasness

Following the evaluation of the inclusion and exclusion criteria for the selected studies, further assessment regarding any risk of biasness was conducted. Quality assessment of studies that were cross-sectional was completed with the help of (NOS) (Herzog et al., 2013). Due to its ease of use and demonstrated reliability and validity, this scale serves as a robust instrument for examining the traits and characteristics of cross-sectional studies. (Moskalewicz & Oremus, 2020). Whereas we examined the quality of the

only quasi-experimental study with the help of JBI (CASP) (Institute, 2016)This instrument is widely recognized as a reliable and valid tool for assessing quasi-experimental studies, given its extensive utilization in previous research (Panchal et al., 2021), (Armaou, Konstantinidis, & Blake, 2020), (Cooper, Neufeld, Dolezal, & Martin, 2018). Total scores of JBI (CASP) (Institute, 2016) were summed up and presented in the form of percentages. Since no interpretation regarding the results of these tools available therefore we divided the attained scores into quintiles. This scoring method has previously been used by van Andel, Cole, and Pepping (2017).

Results and Discussion

Study selection

We screened 5128 titles of articles and their abstracts carefully in consideration of adequacy or suitability. After eliminating incompetent abstracts and titles, only 68 full text articles were left out that were further screened to assess their eligibility. Subsequently, 53 studies were excluded or eliminated from the analysis as they failed to meet the predetermined criteria set for the present investigation. 15 studies that were full texts, were ultimately finalized for quality evaluation. Two further studies were evicted from this analytical research since these articles failed to fulfil the quality evaluation standards and a final sample of 13 articles were made part of this systematic review.

Study traits

Cross-Sectional Studies (N=14)

A total of 14 eligible studies were found that were cross-sectional and had a relationship or association with athletes sleep health as a primary or secondary factor. A detailed review on the characterization of the chosen studies is demonstrated in (table 1.A). Out of these 14 studies two further studies were excluded as these studies exhibited unsatisfactory results during quality assessment.

The total athletic population, in these studies comprised of 8869 that ranged from 46 to 3911 participants. Three studies were performed in student athletes that belonged to different schools, colleges, or universities. However, ten studies were conducted on adults. The range of age of the participants in this study was 13 to 76 years. Studies or research articles, part of this systematic review, contained both male and female participants. Only five out of twelve studies (5/12) had a response rate of more than 80%.

In particular, (7/12) eligible cross-sectional studies included elite athletes, however the remaining studies included school, college, university and community level athletes. The participants were either professional or non-professional athletes. The studies were conducted in more than 49 countries that belonged to the continents of Australia, Europe, Asia, Africa, North and South America.

Quasi-experimental study (N=1)

We found only one experimental study that included the objective of finding athletes' sleep health during Covid-19 lockdown. This study consisted of 15 participants that were part of Brazilian Badminton Confederation.

Table 1
Evidence

Study	Sample size	Instrument to measure sleep	Instrument to measure sports participation, physical exercise	Study Design	Analysis	Result

(Vitale et al., 2021) Italy	89 elite athletes (N=43 men, N=46 females) representing (FIDAL).	PSQI.	Elite athletes.	Cross-sectional study.	Non-parametric Kruskal-Walli's test, Shapiro–Wilk test, Friedman test, the two-way ANOVA and chi-square test were used.	Negative consequences of Covid-19 lockdown were observed on the athletes' sleep health.
(Kurniarobbi et al., 2022) Indonesia	126 (N=65 male, N=61 female) adolescent athletes	Researcher developed.	Adolescent athletes.	Cross-sectional study.	Fisher's test, logistic regression test and chi-square tests were applied.	It was difficult to achieve adequate sleep for adolescent athletes during Covid-19 lockdown.
(Romdhani, Rae, et al., 2022) Tunisia	3911 athletes (1764 female and 1442 male elite athletes)	PSQI and ISI.	Sports participation was measured through descriptive criteria.	Cross-sectional study.	paired sample t-test, ANOVA and Multiple linear regression analyses were used.	Decrease in sleep health and increase in insomnia resulted during Covid-19 lockdown in athletes.
(Elce et al., 2022) Italy	Forty-six participants out of which (N=21) were trained non-professional participant whereas (N=25) were professional athletes.	MEQ, ESS and PSQI.	Professional athletes	Cross-sectional study.	Shapiro Wilk test, Mann–Whitney test, Fisher's test, multivariate logistic regression analysis and chi-square were applied.	Professional athletes faced a prolonged latency to fall asleep during Covid-19.
(Vinu, 2021) India	514 university athletes (296 male/218 female).	ASBQ.	Student athletes.	Cross-sectional study.	paired sample t-test was used.	Sleep behaviour of sportspersons was influenced negatively during COVID-19 pandemic in India.
(Romdhani, Fullagar, et al., 2022) Tunisia	1,454 elite athletes out of which 843 were male and 610 were female, were part of this study	PSQI and ISI.	Elite athletes.	A retrospective, international, cross-sectional, web-based study.	Bonferroni post-hoc test, T-test and ANOVA was used.	Elite athletes suffered increased sleeplessness and lower sleep health during the pandemic.

(Vinu & Panbilnathan, 2021) India	550 university athletes (300 male/250 female) in India.	PSQI.	Student athletes	Cross-sectional study.	From the collected data Percentile was calculated.	Sleep distraction was higher in athletes due to Covid-19 lockdown.
(Facer-Childs et al., 2021) Australia	375 athletes out of which N= 123 male and N= 252 female were selected from Australia.	1. MCTQ.	Athletes belonging to different clubs, regions and elite athletes.	Cross-sectional study.	Pearson's chi-squared tests, Kendall–Theil Sen Siegel nonparametric linear regressions, and Wilcoxon signed rank test were applied.	Increase in sleep duration resulted during lockdown period.
(Beranek et al., 2022) Australia	285 Community level tennis players (N= 156 male, N= 128 females) were part of this study.	SHI and SST.	Participants with once a weak tennis play regularly were made part of this study.	Cross-sectional study.	Kendall's Tau B Correlation analysis, Shapiro–Wilk test and Kruskal–Wallis's tests were applied.	Community-level players of tennis that resided in Australia observed increased sleep health during this pandemic.
(Filice, 2022) Canada	107 adults (47 rowing athletes and 60 triathletes from Canada.	PSQI.	Adult athletes	Mixed method (Qualitative and Quantitative).	N/A	The average score achieved from PSQI is 5.82, that indicates poor sleep health.
(Mon-López et al., 2020) Spain	187 participants out of which 66 were women and 121 were men.	Likert scale for sleep quality.	Elite athletes.	Cross-sectional study.	Two-step hierarchical regression, Shapiro–Wilk test, P.S t test and I.S t test were used	Negative sleep health arose during pandemic.
(Chandler et al., 2021) United States of America	401 student-athletes (136 male and 260 female) were part of this study.	PSQI.	Student-athletes.	Cross-sectional, retrospective and descriptive study.	Chi-squared test and Yates' continuity correction were used.	It was observed that athletes slept for longer durations but still recorded negative sleep health.
(Ellis et al., 2022) United States of America	575 participants (N= 249 male and N= 326 female)	Researcher developed.	Young athletes.	Cross-sectional and descriptive study.	Statistical analyses included the utilization were Mann-Whitney U, Wilcoxon signed-rank	Improved sleep health and increased sleep duration was recorded during Covid-19 lockdown in young athletes.

					and Kruskal-Wallis tests.
(Abdulrazzaq, 2022) Iraq	60 wrestlers from Baghdad's national team were part of this study.	Researcher developed.	Elite athletes.	Cross-sectional study.	N/A	Increase in morning sleep hours whereas decrease in night sleep hours were observed in wrestlers.
(da Silva Santos et al., 2021) Brazil	15 young badminton athletes (N= 6 men and N= 9 female) of Brazilian Badminton Confederation.	Tri-axial accelerometer.	Elite athletes.	Quasi-experimental study.	Shapiro–Wilk test, the Wilcoxon test and paired t test were used.	No significant differences in sleep parameters were observed.

Abbreviations: "PSQI = Pittsburgh Sleep Quality Index; ISI = Insomnia Severity Index; MEQ = Morning-ness Evening-ness Questionnaire; ESS = Epworth Sleepiness Scale; ASBQ = Sports persons' sleep behaviour Questionnaire; µMCTQ = Ultra-Short Munich Chrono-type Questionnaire; SHI = Sleep Health Index; SST = Sleep Satisfaction Tool; NOS = Newcastle-Ottawa Scale; JBI (CASP) = Critical Appraisal Checklist for Quasi-Experimental Studies;"

Attributes of the Studies

Cross-Sectional Studies (N=12)

The elected articles were further classified as very good (N=1), good (N= 4), satisfactory (N=7) and un-satisfactory (N=2) (See table 2. A. for details). Mostly studies used snowball sampling technique (Parker, Scott, & Geddes, 2019) to select the participants. Among these 12 selected studies, one of the studies was classified as very good quality study (Romdhani, Rae, et al., 2022). This study used most reliable and valid physical activity measures, controlled for all confounding factors and also provided with a sufficient response rate.

Given the utilization of a valid and reliable self-reported tool to evaluate physical activity, four studies were classified as high-quality studies. These articles also had command on highly significant confounding variables except two studies. Out of the twelve selected cross-sectional studies, a total of seven were evaluated as meeting satisfactory standards in terms of overall quality. All of these articles possessed unsatisfactory size of sample and were also lacking representativeness of samples. However, these studies had all other factors controlled.

Table 2
Quality evaluation of articles using (NOS).

	Selection			Comparability		Outcome			
	1	2	3	4	5	6	7		
Study	Sample representativeness *	Size of sample *	Non-respondents *	Ascertainment of the disclosure **	Confounding factors are controlled **	Assessment of the consequences **	Statistical test *	Quality score out of 10	Quality evaluation
Very Good									
(Romdhani, Rae, et al., 2022)	*	*	*	**	**	*	*	9	Very Good
Good									
(Kurniarobbi et al., 2022)	-	*	-	**	**	*	*	7	Good

(Vitale et al., 2021)	*	*	*	**	*	*	*	8	Good
(Romdhani, Fullagar, et al., 2022)	-	*	-	**	**	*	*	7	Good
(Facer-Childs et al., 2021)	*	*	*	**	*	*	*	8	Good
Satisfactory									
(Filice, 2022)	-	*	-	**	*	*	-	5	Satisfactory
(Beranek et al., 2022)	-	*	-	*	*	*	*	5	Satisfactory
(Mon-López et al., 2020)	-	*	-	**	*	*	*	6	Satisfactory
(Chandler et al., 2021)	-	*	-	**	*	*	*	6	Satisfactory
(Elce et al., 2022)	-	*	-	**	*	*	*	6	Satisfactory
(Ellis et al., 2022)	-	*	-	*	*	*	*	5	Satisfactory
(Vinu, 2021)	-	*	-	**	-	*	*	5	Satisfactory
Un-satisfactory									
(Abdulrazzaq, 2022)	-	*	-	**	-	*	-	4	Un-satisfactory
(Vinu & Panbilnathan, 2021)	-	*	-	**	-	*	-	4	Un-satisfactory

"Quality Rating procedure:
Very Good Studies: 9-10 points
Good Studies: 7-8 points Satisfactory Studies: 5-6 points
     Unsatisfactory Studies: 0 to 4 points"

Quasi-experimental studies (N=1): -

The only quasi-experimental study (da Silva Santos et al., 2021) was assessed using JBI (CASP) (Institute, 2016) (See Table 2.B for details). The study consisted of a total of 15 young badminton athletes out of which (N=6) were male whereas (N=9) were women. The age of these participants ranged from 15-21 years. This study was conducted in Brazil. This was the only study out of the selected eligible studies that used direct measures (triaxial accelerometer) to assess the sleep health in athletes. This study used a clearer research question, participants were included in other groups for comparison other than exposure, valid and reliable tools to assess sleep health and exposure were used, most important confounding variables were controlled, the outcomes were also reliable and valid statistical tools were used for examination.

Table 3
Quality evaluation of Quasi-experimental study using JBI (CASP)

Author	Evident research question	Comparisons of participants	Inclusion of participants in any comparison group excluding exposure	Was there a comparison group?	Multiple measurements of the outcome	Was follow up complete?	Comparison of the outcome	Reliability of the outcomes	Statistical tool	Percentage %	Quality rating
(da Silva Santos et al., 2021)	*	*	*	*	*	-	*	*	*	**88%**	**Good**

"Very poor (below 50%); **Satisfactory** (50-69%); **Good** (70-89%); **Very good** (90-100%)**"**

Discussions

The main intent behind the conduction of this analytical research was to assess the consequences that Covid-19 lockdown may have laid on athletes' sleep health by reviewing the existing literature. The studies included participants that were elite, sub-elite, professional, young, adolescents, adult and community level athletes and belonged to more than 49 countries. The results of the assessed articles showed conflicting or inconclusive findings. It was observed that 69% of these studies (Chandler et al., 2021; Elce et al., 2022; Filice, 2022; Kurniarobbi et al., 2022; Mon-López et al., 2020; Romdhani, Fullagar, et al., 2022; Romdhani, Rae, et al., 2022; Vinu, 2021; Vitale et al., 2021) showed reduced sleep health among athletes whereas 23% of these studies (Beranek et al., 2022; Ellis et al., 2022;

Facer-Childs et al., 2021) expressed the inverse. Only 7% studies (da Silva Santos et al., 2021) portrayed no effect. Considering these findings, there is a notable tendency to propose that Covid-19 lockdown may have exerted a negative influence on athletes' sleep health, as the majority of the studies align with this perspective.

An unusual aspect found in this research was the increase in total sleep time but decrease in overall sleep health of student athletes in USA (Chandler et al., 2021). Rise in the hours of total sleep has always been associated with positive sleep health (Chaput et al., 2018). However, this was not the case during Covid-19 lockdown as stated in this study (Chandler et al., 2021). A major factor that appears to be effecting the sleep health even after the increase in total sleep time seems to be decrease in night sleep hours and increase in morning sleep hours (Abdulrazzaq, 2022). Although we are not sure, however this might be a factor due to which even after having increased total sleep time during the pandemic athletes still had negative sleep health.

There is also a possibility that factors including limitation in exercise and physical activities, increased screen time, increase in anxiety, stress and depression due to the spread of negative news such as deaths and losses during pandemic through social media and other sources might have played a vital part in effecting athletes' sleep health (Armaou et al., 2020; Ellis et al., 2022; Facer-Childs et al., 2021). Subsequently, it was also observed that those athletes who effectively upheld their pre-Covid routines appeared to have retained sleep health (Keemss, Sieland, Pfab, & Banzer, 2022). Therefore, we can assume that increased or maintained physical activity might have either positive or no effect on the sleep health of athletes respectively.

Previous analytical researches on general populations' sleep health during Covid-19 highlighted increased insomnia in participants that were directly affected by it (Jahrami et al., 2022). However, these results could not justify the fact that Covid-19 lockdown would also have affected identically on the sleep health of athletes as well. Therefore, an analytical study was mandatory in this regard to assess the influence of Covid-19 lockdown on athletes' sleep globally. This systematic review also brought several crucial insights and has allowed a number of proposals/recommendations for future research. Future studies should be conducted on the highest ranked athlete population i.e., Olympic gold medallists and in countries like United Kingdom, Russia, China, etc., as these countries are considered to have a high athlete population.

Conclusion

The main motive due to which this systematic review was carried out was to find out whether Covid-19 lockdown effected negatively or positively or were there no effects on the sleep health of athletes. In light of these findings, it is evident that there is a notable tendency to propose that sleep health of athletes has been significantly compromised due to Covid-19 lockdown, as majority of the studies corroborate this viewpoint. However, as most of these studies used indirect methods to assess sleep health therefore these findings are considered to be weak. Hence, further researches should be conducted using direct approaches and techniques to appraise sleep health in athletes in order to present stronger evidence to fill this research gap.

References

Abdulrazzaq, Z. T. (2022). The effect of COVID-19 lockdown on Iraqi wrestlers. *Journal of Medicine and Life, 15*(8), 963.

Adams-Prassl, A., Boneva, T., Golin, M., & Rauh, C. (2022). The impact of the coronavirus lockdown on mental health: evidence from the United States. *Economic Policy, 37*(109), 139-155.

Armaou, M., Konstantinidis, S., & Blake, H. (2020). The effectiveness of digital interventions for psychological well-being in the workplace: A systematic review protocol. *International journal of environmental research and public health, 17*(1), 255.

Beranek, P., Cruickshank, T., Girard, O., Nosaka, K., Bartlett, D., & Turner, M. (2022). Sleep health of Australian community tennis players during the COVID-19 lockdown. *PeerJ, 10*, e13045.

Chandler, A. J., Arent, M. A., Cintineo, H. P., Torres-McGehee, T. M., Winkelmann, Z. K., & Arent, S. M. (2021). The impacts of COVID-19 on collegiate student-athlete training, health, and well-being. *Translational Journal of the American College of Sports Medicine, 6*(4), e000173.

Chaput, J.-P., Dutil, C., & Sampasa-Kanyinga, H. (2018). Sleeping hours: what is the ideal number and how does age impact this? *Nature and science of sleep, 10*, 421.

Cooper, C. B., Neufeld, E. V., Dolezal, B. A., & Martin, J. L. (2018). Sleep deprivation and obesity in adults: a brief narrative review. *BMJ open sport & exercise medicine, 4*(1), e000392.

da Silva Santos, A. M., Rossi, F. E., Dos Santos Nunes de Moura, H., de Sousa Junior, A. V. M., Machado, D. C., Neves, L. M., . . . Freitas Junior, I. F. (2021). COVID-19 pandemic impacts physical activity levels and sedentary time but not sleep quality in young badminton athletes. *Sport Sciences for Health, 17*(4), 969-977.

Elce, A., Daniele, A., Loperto, I., De Coppi, L., Sangiorgio, A., Vivona, A., . . . Nigro, E. (2022). COVID19 Pandemic and Physical Activity: An Observational Study on Sleep Quality and Anxiety. *Sports, 10*(3), 44.

Ellis, H. B., Ulman, S. M., Wagner, K. J., Carpenter, C. M., Gale, E. B., Shea, K. G., & Wilson, P. L. (2022). Youth athletes sleep more, practice less, and may lose interest in playing sports due to social distancing mandates. *Preventive Medicine Reports, 26*, 101722.

Facer-Childs, E. R., Hoffman, D., Tran, J. N., Drummond, S. P., & Rajaratnam, S. M. (2021). Sleep and mental health in athletes during COVID-19 lockdown. *Sleep, 44*(5), 261.

Filice, P. (2022). *The COVID-19 pandemic and lockdowns impacted the sleep and performance of rowers and triathletes.* unpublished, Thesis Master of Science, University of Toronto

Gualano, M. R., Lo Moro, G., Voglino, G., Bert, F., & Siliquini, R. (2020). Effects of Covid-19 lockdown on mental health and sleep disturbances in Italy. *International journal of environmental research and public health, 17*(13), 4779.

Herzog, R., Alvarez-Pasquin, M., Diaz, C., Del Barrio, J., Estrada, J., & Gil, A. (2013). Newcastle-Ottawa Scale adapted for cross-sectional studies. *BMC Public Health, 13*, 154.

Institute, J. B. (2016). Checklist for quasi-experimental studies (non-randomized experimental studies). *The Joanna Briggs Institute critical appraisal tools for use in JBI systematic reviews*, 2019-2005.

Jahrami, H. A., Alhaj, O. A., Humood, A. M., Alenezi, A. F., Fekih-Romdhane, F., AlRasheed, M. M., . . . BaHammam, A. S. (2022). Sleep disturbances during the COVID-19 pandemic: a systematic review, meta-analysis, and meta-regression. *Sleep medicine reviews*, 101591.

Joiner, W. J. (2018). The neurobiological basis of sleep and sleep disorders. *Physiology, 33*(5), 317-327.

Keemss, J., Sieland, J., Pfab, F., & Banzer, W. (2022). Effects of COVID-19 lockdown on physical performance, sleep quality, and health-related quality of life in professional youth soccer players. *Frontiers in Sports and Active Living, 4*.

Kurniarobbi, J., Chikih, C., Andeansah, M., Lestari, R., & Sukendar, I. (2022). Athletes sleep duration during COVID-19 pandemic and its relationship with health condition. *International Journal of Public Health, 11*(1), 61-68.

Leone, M. J., Sigman, M., & Golombek, D. A. (2020). Effects of lockdown on human sleep and chronotype during the COVID-19 pandemic. *Current Biology, 30*(16), R930-R931.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group*, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine, 151*(4), 264-269.

Mon-López, D., de la Rubia Riaza, A., Hontoria Galán, M., & Refoyo Roman, I. (2020). The impact of Covid-19 and the effect of psychological factors on training conditions of handball players. *International journal of environmental research and public health, 17*(18), 6471.

Moskalewicz, A., & Oremus, M. (2020). No clear choice between Newcastle–Ottawa Scale and Appraisal Tool for Cross-Sectional Studies to assess methodological quality in cross-sectional studies of health-related quality of life and breast cancer. *Journal of clinical epidemiology, 120*, 94-103.

Panchal, U., Salazar de Pablo, G., Franco, M., Moreno, C., Parellada, M., Arango, C., & Fusar-Poli, P. (2021). The impact of COVID-19 lockdown on child and adolescent mental health: systematic review. *European child & adolescent psychiatry, 32*, 1-27.

Parker, C., Scott, S., & Geddes, A. (2019). *Snowball sampling.* SAGE research methods foundations.

Ramar, K., Malhotra, R. K., Carden, K. A., Martin, J. L., Abbasi-Feinberg, F., Aurora, R. N., . . . Rowley, J. A. (2021). Sleep is essential to health: an American Academy of Sleep Medicine position statement. *Journal of Clinical Sleep Medicine, 17*(10), 2115-2119.

Romdhani, M., Fullagar, H. H., Vitale, J. A., Nédélec, M., Rae, D. E., Ammar, A., . . . Bragazzi, N. L. (2022). Lockdown duration and training intensity affect sleep behavior in an international sample of 1,454 elite athletes. *Frontiers in physiology*, 953.

Romdhani, M., Rae, D. E., Nédélec, M., Ammar, A., Chtourou, H., Al Horani, R., . . . Driss, T. (2022). COVID-19 Lockdowns: A worldwide survey of circadian rhythms and sleep quality in 3911 athletes from 49 countries, with data-driven recommendations. *Sports Medicine, 52*(6), 1433-1448.

van Andel, S., Cole, M. H., & Pepping, G.-J. (2017). A systematic review on perceptual-motor calibration to changes in action capabilities. *Human movement science, 51*, 59-71.

Vinu, W. (2021). Disparities in Sportspersons' Sleep Behaviour due to COVID-19 Pandemic Lockdown in India. *Asian Journal of Applied Science and Technology (AJAST), 5*(2), 134-139.

Vinu, W., & Panbilnathan, A. (2021). Mobile Phone Usage on Change of Athletes Sleep Behaviour because of COVID-19 Pandemic Lockdown in India. *Advances in Research, 22*(5), 1-6.

Vitale, J., Borghi, S., Codella, R., Lastella, M., Nedelec, M., Banfi, G., & La Torre, A. (2021). Are elite track and field athletes on track? The impact of COVID-19 outbreak on sleep behavior and training characteristics. *Biology of Sport, 38*(4), 741-751.

Wang, C., Tripp, C., Sears, S. F., Xu, L., Tan, Y., Zhou, D., . . . Ho, C. (2021). The impact of the COVID-19 pandemic on physical and mental health in the two largest economies in the world: a comparison between the United States and China. *Journal of behavioral medicine, 44*(6), 741-759.

Yaseen, Z., Jathol, I. & Muzaffar, M. (2020). Covid-19 and its Impact on South Asia: A Case Study of Pakistan, *Global International Relations Review*, III(I), 20-26.