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Research Article

Association Between Sleep Quality, Musculoskeletal Pain and Physical and Psychosocial Well-Being Among Employees Working from Home

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Abstract: COVID-19 has perplexed the world into an unexpected state of affairs. With the implementation of nationwide lockdown, people have begun to 'Work for Home' in many employment sectors. Though the policy has managed to keep people safe from the devastating effects of the virus, it has, however, imposed most employees into a sedentary lifestyle. The current situation has resulted in disordered sleep, musculoskeletal pain, physical and psychosocial well-being decline due to irregular work hours, and mental health issues due to corona phobia. The current study aims to find the correlation between sleep duration, musculoskeletal pain, and physical and psychosocial well-being in employees working from home during the COVID-19 pandemic lockdown. One hundred fifty-three samples from the North India region were studied in a correlation study. Subjects working from home for at least one month or more and only due to COVID-19 lockdown were excluded, while those with any musculoskeletal, cardiovascular or neurological disorder were excluded. Questionnaires employed were Pittsburg Sleep Quality Index (PSQI) (for sleep quality), Chronic Pain Grade Questionnaire (CPGQ) (for pain intensity), and Short Form-12 (SF-12) Questionnaire (for physical and psychosocial well-being). Scores were calculated, and Pearson's correlation was found. One hundred fifty-three samples (mean age= 32.73±5.55, mean height=167±9.22, mean weight=67.2±13.7, mean BMI=23.9±3.97) were evaluated, which revealed a higher negative correlation coefficient value between MSK pain intensity and PCS value (-0.535) describing that the pain increased with deterioration in sleep, and sleep quality and MCS value (-0.423) stating that the psychosocial well-being worsened with the decline in sleep quality; while a highly positive correlation was established with the sleep quality and pain intensity scores (0.420) depicting that pain degraded the physical well-being. A weak correlation was reported in the relationship between the intensity of MSK pain with sleep quality (-0.218) and PCS score (-0.323), suggesting no significant impact (significant at the 0.01 level (2-tailed). A significant correlation has been established between sleep quality, the intensity of musculoskeletal pain, and the physical and psychosocial well-being of employees working from home during the COVID-19 pandemic lockdown.

Keywords: Work From Home, COVID-19, Sleep Quality, Pain, Well-Being

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1. INTRODUCTION

Corona virus disease 2019 (COVID-19) is caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) and represents a potentially fatal disease of great global public health importance. The first COVID-19 case in China can be traced back to 17th November 2019, though only confirmed as a novel corona virus in early January 2020. The first case outside of China was reported on 13th January 2020. Since then, the virus has spread all across the globe. It was reported in India on 30 January 2020 in Kerala [1]. Initially, India had witnessed only imported cases of COVID-19 with limited local transmission to their immediate contacts. But with time, this has changed and now we are on the verge of community transmission [2]. The manifestations of COVID-19 include respiratory symptoms such as dyspnoea, cough, upper respiratory tract congestion, general fever, myalgia, and fatigue, with some cases progressing to pneumonia, cytokine storm, cardiac problems, and even death. The risk factors that majorly lead to death are advancing age, cardiovascular diseases, hypertension, and diabetes mellitus [3]. A major step taken to battle this marauding virus was to declare a nationwide lockdown. This has helped keep the numbers of infections and death low in a densely populated country like India. Although India's lockdown has helped limit the health crisis, the complete shutdown of all economic activities except essential services has created an economic crisis. To counter this, the unlocking began with industrial activities that have been resumed with adequate social distancing, hygiene, and other safety norms using methods like alternate shifts, etc. Wherever possible, individuals are advised to work from their respective homes. This enabled the economy to recommence functioning and constrain the negative impact of COVID-19[4]. 'Work from home' has imposed a sedentary lifestyle upon individuals, contributing to adverse health effects and increased disease risk. Chronic musculoskeletal pain is associated with sleep disturbances such as sleep latency, insomnia, and insufficient sleep. Other studies have also shown that pain described a large share of variation in the relationship between musculoskeletal pain and sleep disturbances. Chronic musculoskeletal pain is also reported to adversely affect the well-being and quality of life [5, 6]. The current situation of working from home has led to a disruption of sleep patterns due to irregular work hours and mental health issues due to general corona phobia [7]. The proposed study aims to provide newer insights into associations between three aspects, i.e., sleep duration, musculoskeletal pain, and physical and psychosocial well-being. Considering the present scenario, incorrect posture, imbalanced work timings and the extended comfort of one's home have caused a perceived decline in general health in individuals working from home. The following flowchart shows how psychological stress factors can consequently result in musculoskeletal troubles [8].
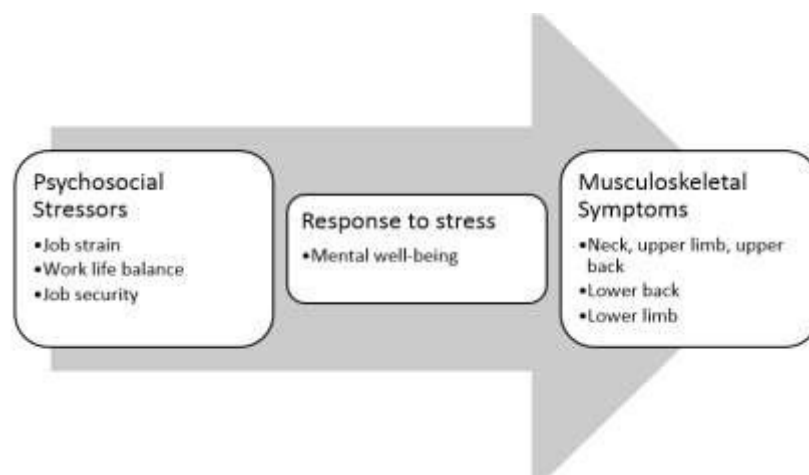
Fig.1: Impact of psychosocial stress factors in producing musculoskeletal symptoms

The relationship between musculoskeletal pain and sleep duration has been extensively studied by many researchers, and a positive correlation has been established between the two. Sleep deprivation has been testified to have a detrimental impact on the quality of life. Studies signify that musculoskeletal pain worsens pain levels, psychological health status, and physical functionality [9]. Henceforth, we propose the understated hypotheses – H1: There is a statistically significant correlation between sleep quality, musculoskeletal pain, and physical and psychosocial well-being.H0: There is no statistically significant correlation between sleep quality, musculoskeletal pain, and physical and psychosocial well-being.
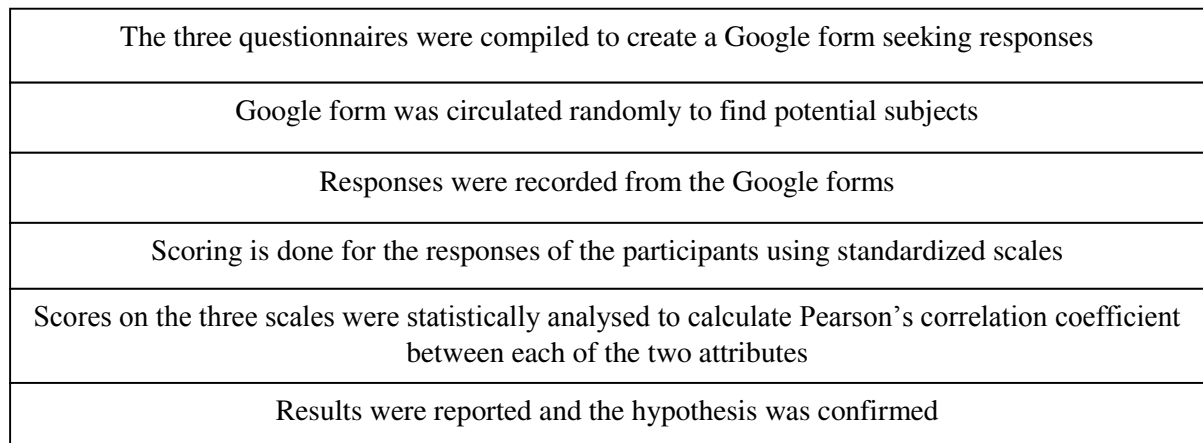
2. MATERIALS AND METHODS

One hundred fifty-three subjects from the North India region working from home during the COVID-19 pandemic lockdown participated in a correlation study. The subjects were selected by the sample of convenience and snowball sampling methods. Subjects in the age group, 25-45 years of both genders, were included those who had been WFH for at least one month or more and only due to COVID-19 lockdown. Those with musculoskeletal, cardiovascular, or neurological disorders, illness, injury, or disability were excluded. Incomplete or incorrectly filled response forms were also rejected. Questions from three reliable and validated questionnaires were included. The Pittsburg Sleep Quality Index was used to determine a quantified measure of sleep quality. The Chronic Pain Grade Questionnaire evaluated the intensity of musculoskeletal pain and the Short Form-12 instrument measured the physical and psychosocial well-being of the subjects in the study. The form was circulated via online messaging platforms such as WhatsApp, Facebook, Instagram, LinkedIn, etc. Participants filled out the

questionnaire upon their will after filling in an option asking for consent. The participants' responses were recorded through Google forms in an Excel sheet. Appropriate scoring was done according to the norms stated in the scales. The scores of the patients on each of the three scales were used for statistical analysis to calculate the correlation between the domains in the context. The protocol is displayed in Figure 2.

The three questionnaires were compiled to create a Google form seeking responses
Google form was circulated randomly to find potential subjects
Responses were recorded from the Google forms
Scoring is done for the responses of the participants using standardized scales
Scores on the three scales were statistically analysed to calculate Pearson's correlation coefficient between each of the two attributes
Results were reported and the hypothesis was confirmed

Fig 2: Flowchart of Protocol

2.1 Ethical Approval

All the data were obtained after informed consent was given by the participants with free will to withdraw their involvement from the study. Participants were encouraged to provide honest responses to the best of their knowledge, with privacy guaranteed. No names were asked in the questionnaire, and the data obtained was used solely for scientific and research purposes. The institution has given the approval to conduct and publish the study.

1. STATISTICAL ANALYSIS

Data was collected through Google Forms and recorded in MS Excel 2007. Data were analyzed in SPSS software version 21.

2. RESULT

Pearson's correlation coefficient was calculated for the sleep quality and intensity of musculoskeletal pain, sleep quality and physical well-being, sleep quality and psychosocial well-being, the intensity of musculoskeletal pain and physical well-being, and the intensity of musculoskeletal pain and psychosocial well-being. One hundred fifty-three subjects working from home during the COVID-19 pandemic lockdown participated in the study. The mean age of the participants was 32.73 ± 5.55 (range 25-45 years). Out of 153, there were 92 male and 61 female participants. The average height of the participants is 167 ± 9.22. The mean weight was found to be 67.2 ± 13.7. Mean BMI of the population is 23.9 ± 3.97. ($p < 0.0001$). Mean values are depicted in the Table 1 and Figure 3.

Comparison of Gender
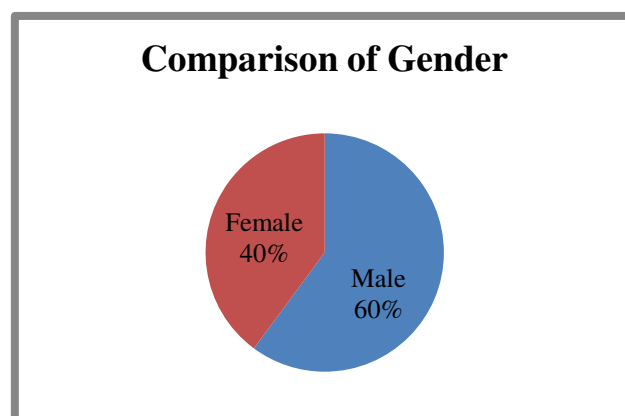
Female 40%
Male 60%

Fig 3: Comparison of Gender

Table 1: Demographic Details									
Total subjects	Gender		Age	Height	Weight	BMI	Physical Activity		
	Male	Female					Yes	No	%age
153	92	61	32.73±5.55	167±9.22	67.2±13.7	23.9±3.97	64	89	41.8%

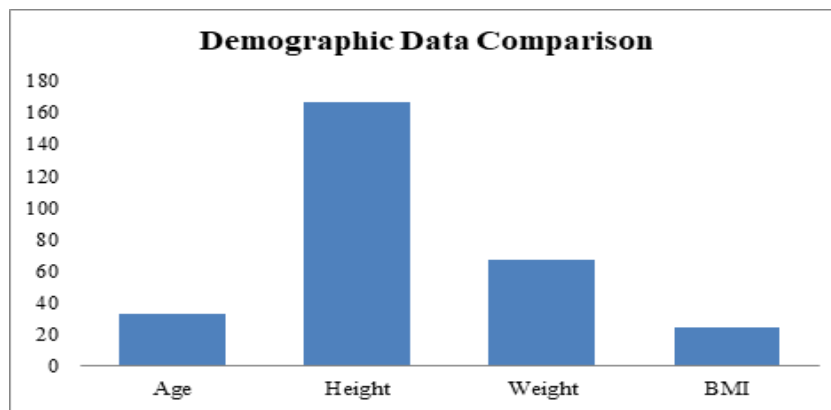*Values are mean ± SD; n=153; p values <0.0001.*
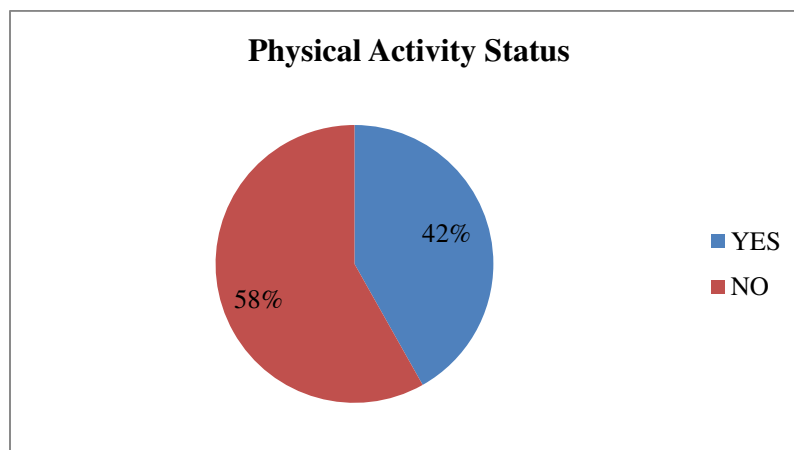
Fig 4: Demographic Data Comparison

Fig 5: Physical Activity Status of the Population

Physical activity status of the population has been described in Table 1, where 64 people reported that they engaged in performing some kind of physical activity (such as aerobic exercise, yoga, brisk walking, cycling, etc.) for a minimum for 20 minutes 5 days a week during this period, while 89 didn't engage in any considerable physical activity, accounting to prevalence of 41.8% and is revealed by Figure 5.
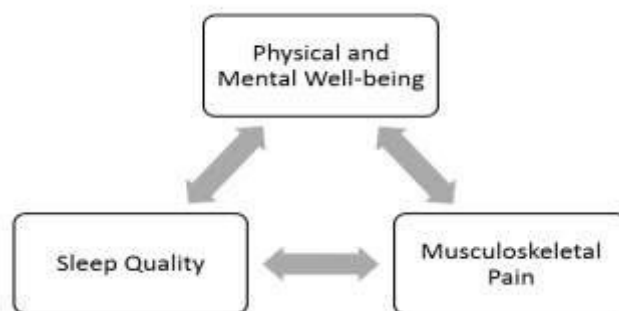

*Fig. 6 sthe hows a statistical model depicting the association between the three variables.* [10]

Fig.6: Statistical model for the relationship between sleep quality, musculoskeletal pain, and physical and mental well-being.

Table 2: Correlation between the variables.				
Pearson Correlation	PSQI	Pain intensity	PCS	MCS
PSQI	1	.420**	-.218**	-.423**
Pain Intensity	.420**	1	-.535**	-.323**
PCS	-.218**	-.535**	1	.152
MCS	-.423**	-.323**	.152	1
**. Correlation is significant at the 0.01 level (2-tailed).				

The statistical analysis of the outcome measures dictated significant correlations between the various variables of concern.

3.1 Sleep Quality vs. Intensity of MSK Pain

**Correlation between PSQI and Intensity of MSK pain**
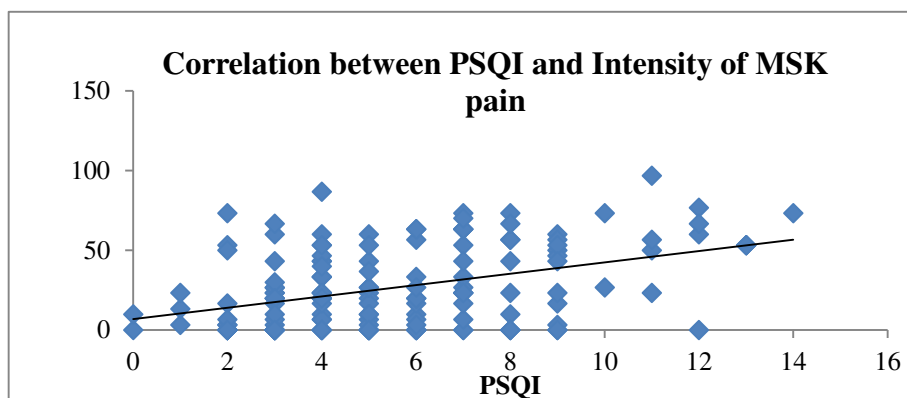
The correlation between sleep quality and the intensity of MSK pain was found to be 0.420. This suggests a moderately positive correlation between the variables. Thus, an increase in pain intensity score produces significant sleep disturbance. This is shown in Figure 7.

Fig 7: Correlation between sleep quality and intensity of MSK pain.

3.2 Sleep Quality vs. Physical Well-Being

The correlation between sleep quality and physical well-being accounted for -0.218 concluding a weakly negative correlation between the two. This implies that physical well-being deteriorates with higher scores on PSQI, which indicates poor sleep quality and is depicted by Figure 8.

Correlation between PSQI and PCS
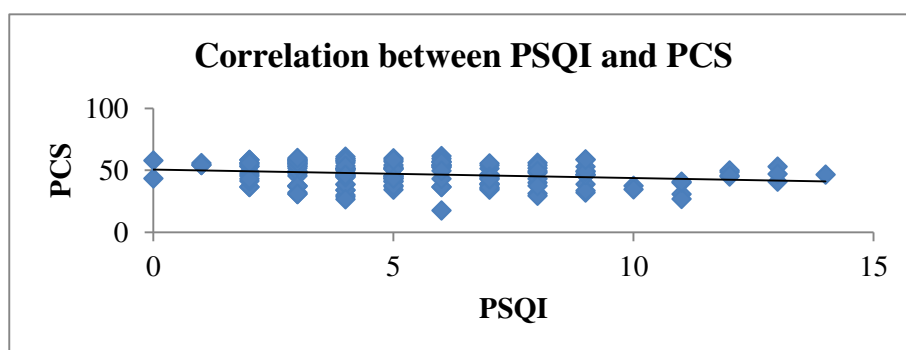
Fig 8: Correlation between sleep quality and physical well-being.

3.3 Sleep Quality vs. Psychosocial Well-Being
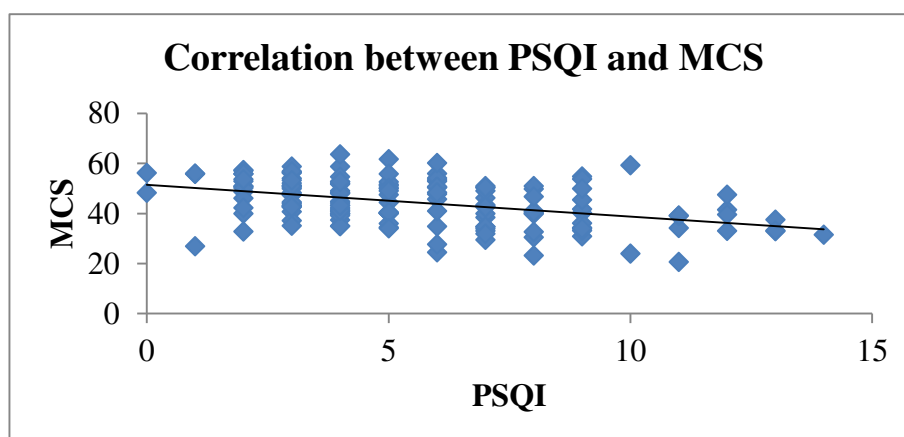
Correlation between PSQI and MCS

Figure 9 shows that a correlation of -0.423 was found between sleep quality and mental component score of scale, which indicates that the deterioration in sleep produced disturbances the psychological and social well-being.

Fig 9: Correlation of sleep quality and psychosocial well-being

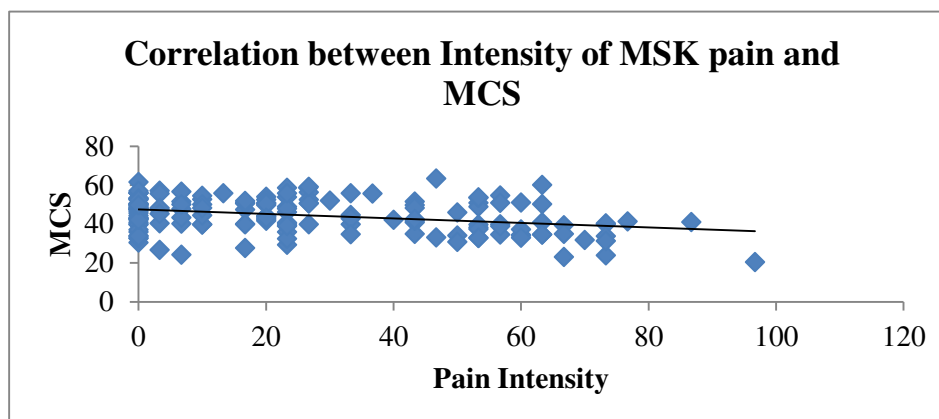### 3.4   Intensity of MSK Pain vs. Physical Well-Being

Correlation between Intensity of MSK pain and PCS
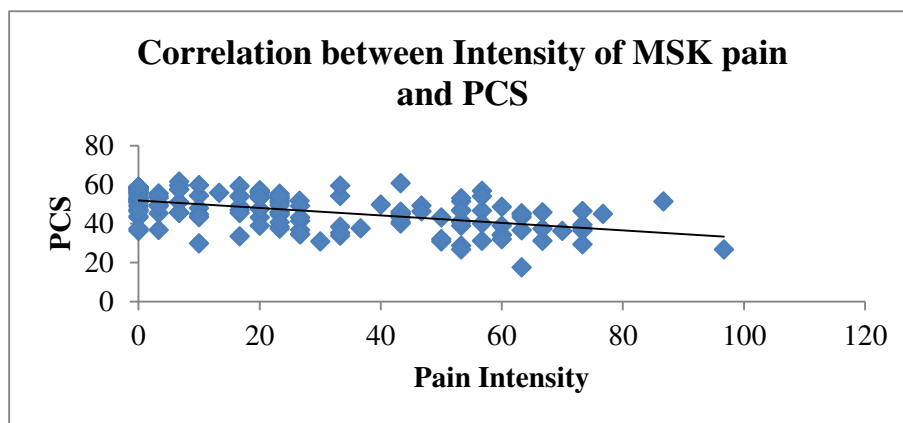
Significant correlation of -0.535 was also obtained between MSK pain intensity and physical component score of the SF-12 scale, indicating a decline in physical well-being with an increment in pain intensity as shown in Figure 10.

Fig 10: Correlation of intensity of MSK pain and physical well-being

3.5   Intensity of MSK Pain vs. Psychosocial Well-Being

The correlation between the MSK pain intensity and mental well-being was weak compared to the PCS, calculated to -0.323. This is depicted in Figure 11, that increased intensity has a weakly negative correlation with MCS value, and increased pain intensity contributes little to mental health issues in the population.

Correlation between Intensity of MSK pain and MCS

Fig 11: Correlation of intensity of MSK pain and psychosocial well-being

3.   DISCUSSION

The purpose of the current study was to determine the association between sleep quality, musculoskeletal pain, and physical and psychosocial well-being in employees working from home under the hypothesis that a significant correlation was present between the considered variables. One hundred fifty-three individuals in the age group of 25-45 years were included in the study that answered the various questions to determine the status of the attributes in the population. The results revealed a significant correlation between all the variables. Higher negative correlation coefficient values were obtained between MSK pain intensity and PCS value and sleep quality and MCS value, while a highly positive correlation was established with the sleep quality and pain intensity scores. A weak correlation was reported in the relationship between the intensity of MSK pain with sleep quality and PCS score. The study outcomes show that the quality of sleep had a significant correlation with the pain intensity, suggesting that the increased pain intensity in the individuals caused a significant

worsening in the quality of sleep of the participants. A considerable correlation between the quality of sleep and the psychological health of the employees was found, and hence the employees' psychological health was the foundation. The weak correlation between pain intensity scores and MCS value indicates that pain does not affect psychological health as much as it affects self-reported physical health. Recent studies in the COVID-19 pandemic era on employees working from home and the general population depict findings similar to our study. In accordance with results, an early study on the Italian population revealed a significant association between disrupted sleep and adversely affected mental QoL.[11, 12] A vicious cycle of mental strain and sleep disturbance was advocated by reasoning the neuroendocrine and behavioral responses and the physiological response to strain. Humans are 'biopsychosocial' beings and more or less perceive stress due to a lack of social presence.[13] An increase in the psychological strain due to the COVID - 19 pandemic conditions is said to be a major cause of sleep disturbance. WFH has been suggested as a predictive factor of decline in

sleep quality as individuals spend about ¼ of the day using the internet for work and leisure.[14] Also, poor psychological health and anxiety were found to be significantly related to sleep disturbance which supports the current study.[15] A notable rise in insomnia/sleep disturbance, daytime sleepiness, and nightmares propounded an association with psychological health. This was reasoned due to the phobia of infection from the COVID-19 coronavirus and the symptoms of the disease. Self-isolation and quarantine were also the major factors that caused a devastating impact on the mental and physical health of the individuals staying at home. As employees could not demarcate the boundaries between home and work, there has been a rise in difficulty between the engagement of workload, which accompanies increased stress levels, disrupted sleep, and an increased incidence of musculoskeletal pain.[16] Working from home also poses challenges such as loneliness, procrastination, lack of social support, and work overload, to name a few that adversely affect the working individual's mental health, thereby having a working individual's impact on sleep and pain perception.[17] Even in populations such as students, which involve long hours of sitting for the digital mode of studying, also show decreased physical activity, unsatisfactory sleep quality, a rise in negative perception of emotions, and increased musculoskeletal pains.[18] Correlation between the incidence of musculoskeletal pain and the amount of time devoted to using electronic devices has also been established.[19] Introduction of the term 'coronaphobia' as a parameter to be considered while studying populations affected by the COVID-19 pandemic was proven to be a predictor of disturbed sleep, increased musculoskeletal pain, and declined mental well-being being interrelated.[7,20] Higher incidence of pain was reported in subjects who had complaints of disturbed sleep, showcasing the link between the two. Earlier studies done by other researchers also show similar findings. In a view to finding predictors of MSK pain, studies describe that poor sleep quality strongly affects moderate and severe MSK pain. Depression, among other mental health issues, was also significantly associated with the occurrence and intensity of MSK. A chief factor, among many others, could be the sedentary lifestyle and lack of physical activity that was evident in the population of Punjab, as stated by the author.[21] This coincides with our study and points out that reduced physical activity could be one of the predictors of pain incidence in individuals working from home and could be responsible for the associated physical and mental health deterioration and disturbed sleep. The cause-and-effect relationship between pain and sleep has been well described, where prevailing sleep deficiency causes increased pain which in turn, further disturbs sleep, establishing a bi-directional connection between the two. Experimental studies on healthy pain-free populations in whom sleep deprivation was induced also demonstrated a sharp perception of pain and lower pain thresholds.[6] A possible explanation of increased MSK pain observed in the population working from home is due to long working hours on computers/laptops with lower regard to appropriate ergonomic posture. This causes prolonged contraction of the back muscles impairing the supply of blood to the muscle tissues. This inflicts an ischemic response, followed by edema and aggregation of debris that will bring about the "pain spasm".[22, 23] On the contrary, no significant correlation between the degree of sleep disorder and severity of pain and QoL in patients with obstructive sleep apnoea syndrome and chronic pain was reported.[24] However, they supported the vicious cause-and-effect cycle of sleep and pain. Gender-specific differences were reported pertaining to

higher nociceptive sensitivity in females as an effect of gonadal hormones. A probable reason for the results being inconsistent with our study could be a difference in the population upon which the study has been undertaken, as the present study concerned overtly healthy individuals working from home. The current study had some limitations. The sample size was small and included subjects are only from the North India region. One-on-one data collection was not possible due to the COVID-19 pandemic, and of which some subjects faced issues in understanding the questions. All the responses were obtained from self-reported questionnaires, and no clinical observation or examination of any factor was performed. Access to the Internet and the motivation to respond may also have affected the rate of participation and the elicitation of responses. Further studies involving more subjects pan India can help to understand the outcomes in a focused manner. Gender differences in the incidence and intensity of pain, sleep disturbance, and quality of life can be studied. The incorporation of an intervention protocol that involves a physical activity program and the study of its effect on pain intensity, sleep quality, and physical and psychosocial well-being can be attempted as an extension of the present study.

4.   CONCLUSION

A significant correlation has been established between sleep quality, the intensity of musculoskeletal pain, and the physical and psychosocial well-being of employees working from home during the COVID-19 pandemic lockdown. The alternate hypothesis that there is a statistically significant correlation between sleep quality, musculoskeletal pain, and physical and psychosocial well-being has been proven. In the long run, the study is expected to benefit the management of musculoskeletal pain by correcting the sleep pattern and, in turn, improving the quality of life or the physical, psychological and social well-being. Keeping in mind the increasing prevalence and perceived comfort of working from home being opted over commuting to the workplace, this study will also help evaluate more deep relevant reasons for this association. Use of a targeted physical activity schedule that includes simple and safe home-based exercises, including stretching, strengthening, and balance exercises or a combination of these, along with relaxation, adequate hydration, and eating healthy, can be attempted in the individuals who are working from home to prevent or minimize the incidence and extent of sleep disorders and musculoskeletal pain and thereby, help enhance their well-being.

5.   AUTHOR CONTRIBUTION STATEMENT

The research idea was envisaged by Kanishka, and with prompt inputs from Dr. Manish Kumar and Sumit Tewatia developed, the methodology. Data collection was performed by Kanishka and Sumit Tewatia, while the statistical analysis of the raw data was carried out by Dr. Manish Kumar. The result and discussion was compiled by Kanishka. The manuscript was prepared with the joint efforts of Kanishka and Dr. Manish Kumar and proofread by all the authors.

6.   CONFLICT OF INTEREST

Conflict of interest declared none.

7. REFERENCES

1. Rafiq, D., Suhail, S. A., & Bazaz, M. A. (2020). Evaluation and Prediction of COVID-19 in India: A Case Study of Worst Hit States. *Chaos, Solitons & Fractals*, *139*, 110014. https://doi.org/10.1016/j.chaos.2020.110014

2. Mohanty, A., Kabi, A., Kumar, S., & Hada, V. (2020). Role of Rapid Antigen Test in the Diagnosis of COVID-19 in India. *Journal of Advances in Medicine and Medical Research*, *32*(18), 77-80. https://doi.org/10.9734/jammr/2020/v32i1830657

3. Lai, C.-C.,et al (2020), Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and Corona virus Disease-2019 (COVID-19): The Epidemic and the Challenges. International Journal of Antimicrobial Agents, 55(3), 105924. https://doi.org/10.1016/j.ijantimicag.2020.105924

4. Dev, S. Mahendra, 2020. Addressing COVID-19 Impacts on Agriculture, Food Security, and Livelihoods in India, IFPRI book chapters, in: COVID-19 and global food security, chapter 7, pages 33-35, International Food Policy Research Institute (IFPRI).

5. Baradaran Mahdavi, S., & Kelishadi, R. (2020). Impact of Sedentary Behaviour on Bodily Pain While Staying at Home in COVID-19 Pandemic and Potential Preventive Strategies. Asian Journal of Sports Medicine, 11(2), 1–3. https://doi.org/10.5812/asjsm.103511

6. Kelly, Gráinne A.et al (2011), The Association Between Chronic Low Back Pain and Sleep: A Systematic Review, The Clinical Journal of Pain: February 2011 - Volume 27 - Issue 2 - p 169-181, doi: 10.1097/AJP.0b013e3181f3bdd5

7. Celenay S. T., Karaaslan Y., Mete O. & Kaya D.O.(2020), Coronaphobia, Musculoskeletal Pain, and Sleep Quality in Stay-at Home and Continued-Working Persons during the 3-month COVID-19 Pandemic Lockdown in Turkey, Chronobiology International, DOI: 10.1080/07420528.2020.1815759

8. Wijayanto, T., & Afiah, I. N. (2022). Exploring the mediation role of employees' well-being in the relationship between psychosocial factors and musculoskeletal pain during the COVID-19 pandemic. *Work*, *71*(1), 65–78. https://doi.org/10.3233/wor-210922

9. Chun, M. Y.et al (2018). Association between Sleep Duration and Musculoskeletal Pain. Medicine, 97(50), e13656. https://doi.org/10.1097/md.0000000000013656

10. Sutarto, A. P., Wijayanto, T., & Afiah, I. N. (2022). Exploring the mediation role of employees' well-being in the relationship between psychosocial factors and musculoskeletal pain during the COVID-19 pandemic. Work, 71(1), 65–78. https://doi.org/10.3233/wor-210922

11. Franceschini, C. *et al.* (2020). Poor Sleep Quality and Its Consequences on Mental Health during the COVID-19 Lockdown in Italy. Frontiers in Psychology, 11, 1–15.https://doi.org/10.3389/fpsyg.2020.574475

12. Marelli, S., Castelnuovo, A., *et al.* (2021). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *Journal of neurology*, *268*(1), 8–15. https://doi.org/10.1007/s00415-020-10056-6

13. Karatel, M., Bulut, Z. I., Sari, E. O., Pelin, Z., & Yakut, Y. (2022). The profile of musculoskeletal pain and its associations with sleep quality and depression during the COVID-19 in Turkey. The Korean Journal of Pain, 35(1), 78–85. https://doi.org/10.3344/kjp.2022.35.1.78

14. Ara, T., Rahman, M. M., Hossain, M. A., & Ahmed, A. (2020). Identifying the Associated Risk Factors of Sleep Disturbance during the COVID-19 Lockdown in Bangladesh: A Web-Based Survey. *Frontiers in Psychiatry*, *11*, 1. https://doi.org/10.3389/fpsyt.2020.580268

15. Carbonell, L. P., Meurling, I. J., & Wasserman, D *et al..* (2021). Impact of the novel coronavirus (COVID-19) pandemic on sleep. Journal of Thoracic Disease, 12(2), S163–S175. https://doi.org/10.21037/jtd-cus-2020-015

16. Oakman, J., Neupane, S., Kyrönlahti, S. *et al.* Musculoskeletal pain trajectories of employees working from home during the COVID-19 pandemic. *Int Arch Occup Environ Health* (2022). https://doi.org/10.1007/s00420-022-01885-1

17. Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2020). Achieving Effective Remote Working During the COVID-19 Pandemic: A Work Design Perspective. Applied Psychology, 70(1), 16–59. https://doi.org/10.1111/apps.12290

18. Soylu, Y. (2021). The psychophysiological effects of the COVID-19 quarantine in the college students. Physical Education of Students, 25(3), 158–163. https://doi.org/10.15561/20755279.2021.0303

19. Amro, A. (2021). Musculoskeletal Disorders and Association with Social Media Use Among University Students at the Quarantine Time Of COVID-19 Outbreak. Journal of Physical Medicine &Amp; Rehabilitation Studies, 1(1), 1–6. https://doi.org/10.15744/2767-4584.1.104

20. Grover, S., Sahoo, S., Mehra, A., Avasthi, A. *et al* (2020). Psychological impact of COVID-19 lockdown: An online survey from India. Indian Journal of Psychiatry, 62(4), 354. https://doi.org/10.4103/psychiatry.indianjpsychiatry_427_20

21. Dhillon, H., Khullar, S., & Kaur, G. (2016). Prevalence and Predictors of Chronic Musculoskeletal Pain in the Population of Punjab. International Journal of Health Sciences and Research, 6(12), 248–258. https://www.ijhsr.org/IJHSR_Vol.6_Issue.12_Dec2016/37.pdf

22. Condrowati, Bachtiar, F., Maharani, F. T., &Utari, D. (2020). Musculoskeletal Disorder of Workers during Work from Home on COVID-19 Pandemic: A Descriptive Study. *Proceedings of the International Conference of Health Development. COVID-19 and the Role of Healthcare Workers in the Industrial Era (ICHD 2020)*, 153. https://doi.org/10.2991/ahsr.k.201125.025

23. Beaton D. E., Cole D. C., Manno M. *et al..*, "Describing the burden of upper- extremity musculoskeletal disorders in newspaper workers: What difference do case definitions make?" Journal of Occupational Rehabilitation, vol. 10, no. 1, pp.39–53, 2000.

24. Aytekin, E. *et al.* (2015). Chronic Widespread Musculoskeletal Pain in Patients with Obstructive Sleep Apnea Syndrome and the Relationship between Sleep Disorder and Pain Level, Quality Of Life, and Disability. Journal of Physical Therapy Science, 27(9), 2951–2954. https://doi.org/10.1589/jpts.27.2951