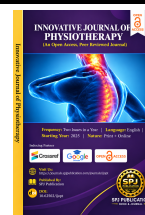




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Mini Review

Influence of Physical Activity and Sleep Quality on Musculoskeletal Pain Among Young Adults

¹Subham Singh

¹Nopany Institute of Healthcare Studies (NIHS), Kolkata (WB), India

ABSTRACT

***Corresponding Author:** Subham Sing, Nopany Institute of Healthcare Studies, Kolkata (WB), India.

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Background: Musculoskeletal pain is a common concern among young adults and may affect physical functioning, academic performance, occupational productivity, and quality of life. Physical activity and sleep quality are potentially modifiable factors that may influence pain development, persistence, and recovery.

Objective: This mini-review examines the relationship between physical activity, sleep quality, and musculoskeletal pain among young adults, emphasizing relevant mechanisms, clinical implications, and research priorities.

Review: Regular physical activity supports muscular conditioning, physical function, and general health, whereas prolonged sedentary behaviour and inadequate recovery may contribute to musculoskeletal complaints. Poor sleep quality has been associated with increased pain susceptibility and an elevated risk of chronic musculoskeletal pain. Evidence also indicates a potentially bidirectional relationship between sleep disturbances and persistent pain. These associations may be influenced by psychological stress, sedentary behaviour, ergonomic exposures, and individual differences in pain processing.

Conclusion: Physical activity and sleep quality should be considered together when assessing musculoskeletal health in young adults. However, direct evidence establishing causal relationships within this specific age group remains limited. Longitudinal studies and controlled trials are required to determine whether interventions combining exercise, sedentary-behaviour reduction, and sleep improvement provide additional benefits for pain prevention and management.

Keywords: Physical Activity, Sleep Quality, Musculoskeletal Pain, Young Adults, Sedentary Behaviour, Physiotherapy, Pain Perception.

INTRODUCTION

Musculoskeletal pain involving the neck, shoulders, back, and extremities is an important health concern among young adults. University students and young professionals may experience prolonged sitting, repetitive activities, extended screen exposure, irregular sleep schedules, and considerable academic or occupational demands. The coexistence of these behavioural exposures may contribute to musculoskeletal discomfort and functional limitations. Physical activity is essential for maintaining muscular strength, endurance, joint mobility, and physical capacity. Evidence from systematic reviews suggests that exercise can improve pain and physical function in several chronic pain conditions, although the magnitude of benefit varies across populations and interventions. ^[1] Insufficient sleep may affect pain perception, emotional regulation, fatigue, and recovery. Prospective evidence also suggests that sleep disturbances and chronic musculoskeletal pain may influence one another over time. ^[2] Understanding these relationships is relevant to physiotherapy because pain management may require attention to behavioural and lifestyle factors in addition to local physical impairments.

PHYSICAL ACTIVITY AND MSK PAIN

Physical activity encompasses structured exercise, sports, walking, cycling, active transportation, and movement performed during daily activities. Appropriate physical activity supports musculoskeletal conditioning and may improve movement tolerance and functional capacity. Exercise may also influence pain through physiological adaptation, improved psychological well-being, and changes in pain modulation.^[3] Insufficient physical activity may contribute to reduced muscular endurance and physical conditioning. When combined with prolonged sedentary behaviour, it may be associated with discomfort during sustained postures, repetitive movements, or demanding daily activities. Young adults who spend substantial time studying or working at computers may experience neck, shoulder, and lower-back symptoms alongside limited opportunities for movement. Nevertheless, sedentary behaviour and physical inactivity are distinct exposures. An individual may meet recommended exercise targets but still spend much of the day sitting.

Similarly, prolonged sitting does not independently establish the cause of pain. Ergonomic conditions, psychosocial stress, previous injuries, workload, and individual susceptibility may contribute to the observed associations. The relationship between physical activity and pain is also influenced by exercise intensity and progression. Sudden increases in training volume, repetitive loading, inadequate recovery, or inappropriate technique may provoke symptoms. Consequently, physiotherapy interventions should emphasize individualized exercise selection, progressive loading, adequate recovery, and symptom monitoring rather than simply increasing activity without considering functional capacity.

The World Health Organization recommends that adults undertake 150–300 minutes of moderate-intensity aerobic physical activity or 75–150 minutes of vigorous-intensity activity weekly, alongside muscle-strengthening activities involving major muscle groups on at least two days per week.^[4-6] These recommendations support overall health and should be adapted to individual needs. They should not be interpreted as a specific dose proven to prevent all forms of musculoskeletal pain.

SLEEP QUALITY AND MSK PAIN

Sleep quality involves more than sleep duration; it also includes sleep continuity, perceived restfulness, sleep

initiation, and daytime functioning. Poor sleep may manifest as difficulty falling asleep, frequent awakenings, non-restorative sleep, or daytime fatigue. These problems may interfere with physical recovery, concentration, emotional regulation, and tolerance of everyday demands. A systematic review and meta-analysis by Runge et al. examined prospective associations between sleep problems and chronic musculoskeletal pain in adults. Across 16 articles representing 11 study populations and 116,746 participants, baseline sleep problems were associated with increased odds of chronic musculoskeletal pain in the short term (odds ratio [OR] 1.64, 95% confidence interval [CI] 1.01–2.65) and long term (OR 1.39, 95% CI 1.21–1.59). The authors also found evidence suggesting that existing chronic musculoskeletal pain may increase the risk of subsequent sleep problems, although certainty differed between outcomes^[7-10]

These findings support an association between sleep disturbances and persistent pain, but they should be interpreted cautiously. The review included adults across broader age groups, and the reported estimates cannot be assumed to apply directly to young adults. Furthermore, observational evidence cannot establish that sleep disturbances independently cause musculoskeletal pain. Several mechanisms may explain the relationship. Inadequate sleep may alter pain sensitivity, emotional responses, stress regulation, and central nervous system processing. Fatigue may also reduce physical activity and impair daily functioning. Conversely, pain-related discomfort may delay sleep onset, interrupt sleep, and reduce perceived sleep quality. These processes may reinforce one another, potentially contributing to persistent symptoms.

INTERACTIONS BETWEEN PHYSICAL ACTIVITY, SLEEP, AND PAIN

Physical activity and sleep quality may interact through behavioural, physiological, and psychological pathways. Regular physical activity can support general well-being and sleep, whereas inadequate sleep may contribute to fatigue and reduced motivation to exercise. Musculoskeletal pain may further restrict movement and interfere with rest, creating a potentially self-perpetuating cycle. For example, a young adult with recurrent neck discomfort may reduce exercise, remain seated for longer periods, and experience disturbed sleep. Subsequent fatigue and increased pain sensitivity may make physical activity more difficult. Although this pathway is plausible, the sequence and strength of these

relationships may differ between individuals and cannot be assumed from cross-sectional associations alone. Psychological distress, academic pressure, anxiety, depressive symptoms, screen exposure, and ergonomic factors may influence both sleep and pain. Physical activity may also be affected by employment, access to recreational facilities, and individual health conditions.^[11-14] These variables should therefore be considered when examining the independent and combined associations of sleep and activity with musculoskeletal symptoms. A critical distinction is that an association between poor sleep and pain does not prove that sleep improvement alone will resolve symptoms. Similarly, evidence supporting exercise for some chronic pain conditions does not establish that every activity or exercise programme will be equally effective. Research should determine whether interventions targeting both behaviours produce additional benefits compared with approaches addressing either factor individually.^[15-19]

IMPLICATIONS FOR PHYSIOTHERAPY PRACTICE

Physiotherapists can incorporate physical activity patterns, sedentary behaviour, sleep complaints, and functional limitations into a comprehensive assessment of young adults with musculoskeletal pain. Such an approach may identify modifiable factors that are not apparent when evaluation focuses exclusively on the painful body region. Individualized management may include progressive strengthening, aerobic exercise, movement breaks during prolonged sitting, ergonomic education, and advice regarding regular sleep routines.^[20-24]

Sleep-related guidance may address consistent bedtimes, a suitable sleep environment, and reduction of stimulating activities near bedtime. Persistent or severe sleep disturbances may warrant further assessment by an appropriate healthcare professional. Clinical monitoring should include pain intensity, functional disability, sleep quality, activity levels, and participation in daily activities. Exercise should be progressed according to individual capacity and clinical presentation. Where symptoms are persistent or unexplained, assessment should also consider alternative clinical causes rather than attributing pain solely to inactivity or poor sleep. Although these strategies are clinically reasonable, evidence is insufficient to conclude that a combined exercise-and-sleep intervention is universally superior to established condition-specific care. Comparative clinical trials are necessary to establish the effectiveness, feasibility, and appropriate components

of integrated interventions.

RESEARCH GAPS AND FUTURE DIRECTIONS

Further research should prioritize young-adult populations, particularly university students and early-career professionals. Longitudinal studies could clarify whether poor sleep and low physical activity precede musculoskeletal pain or primarily develop in response to existing symptoms. Measurement quality is another important consideration. Self-reported activity and sleep questionnaires are practical but may be affected by recall and reporting bias. Future studies could combine validated questionnaires with wearable activity monitors, objective sleep measurements where appropriate, standardized pain assessments, and functional outcome measures.

Researchers should distinguish structured exercise from total physical activity and sedentary time. Studies should also assess pain location, duration, intensity, and related disability while accounting for potential confounders, including psychological distress, screen exposure, ergonomic conditions, and previous musculoskeletal injury. Finally, randomized controlled trials could compare usual care, exercise-based interventions, sleep-focused interventions, and combined programmes. Such research would help establish whether improvements in sleep and activity have independent, additive, or interactive effects on pain and physical functioning. Transparent reporting and appropriate adjustment for confounding are essential for translating findings into evidence-based physiotherapy practice.

CONCLUSION

Physical activity and sleep quality are important, potentially modifiable factors in musculoskeletal health. Appropriate physical activity supports physical conditioning and may improve pain-related function, while poor sleep is associated with an increased risk of chronic musculoskeletal pain in adult populations. Evidence also suggests that sleep disturbances and persistent pain may influence one another. However, the strength and direction of these relationships specifically among young adults remain insufficiently established. Physiotherapy assessment should consider activity patterns, sedentary behaviour, sleep quality, and functional outcomes together. Well-designed longitudinal studies and controlled trials are needed to determine whether integrated lifestyle interventions improve musculoskeletal pain and disability beyond standard care.

REFERENCES

- Geneen LJ, Moore RA, Clarke C, Martin D, Colvin LA, Smith BH. Physical activity and exercise for chronic pain in adults: an overview of Cochrane Reviews. *Cochrane Database Syst Rev*. 2017;4(4):CD011279. <https://doi.org/10.1002/14651858.CD011279.pub3>
- Runge N, Ahmed I, Saueressig T, Perea J, Labie C, Mairesse O, et al. The bidirectional relationship between sleep problems and chronic musculoskeletal pain: a systematic review with meta-analysis. *Pain*. 2024;165(11):2455–2467. <https://doi.org/10.1097/j.pain.0000000000003279>
- World Health Organization. WHO guidelines on physical activity and sedentary behaviour. Geneva: World Health Organization; 2020. <https://www.who.int/publications/i/item/9789240015128>
- Hayden JA, Ellis J, Ogilvie R, Malmivaara A, van Tulder MW. Exercise therapy for chronic low back pain. *Cochrane Database Syst Rev*. 2021;9(9):CD009790. <https://doi.org/10.1002/14651858.CD009790.pub2>
- Chang JR, Fu SN, Li X, Li SX, Wang X, Zhou Z, et al. The differential effects of sleep deprivation on pain perception in individuals with or without chronic pain: a systematic review and meta-analysis. *Sleep Med Rev*. 2022;66:101695. <https://doi.org/10.1016/j.smrv.2022.101695>
- Schrimpf M, Liegl G, Boeckle M, Leitner A, Geisler P, Pieh C. The effect of sleep deprivation on pain perception in healthy subjects: a meta-analysis. *Sleep*. 2015;16(11):1313–1320. <https://doi.org/10.1016/j.sleep.2015.07.022>
- Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. *J Pain*. 2013;14(12):1539–1552. <https://doi.org/10.1016/j.jpain.2013.08.007>
- Kredlow MA, Capozzoli MC, Hearon BA, Calkins AW, Otto MW. The effects of physical activity on sleep: a meta-analytic review. *J Behav Med*. 2015;38(3):427–449. <https://doi.org/10.1007/s10865-015-9617-6>
- Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med*. 2020;54(24):1451–1462. <https://doi.org/10.1136/bjsports-2020-102955>
- Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back pain is and why we need to pay attention. *Lancet*. 2018;391(10137):2356–2367. [https://doi.org/10.1016/S0140-6736\(18\)30480-X](https://doi.org/10.1016/S0140-6736(18)30480-X)
- Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *Lancet*. 2018;391(10137):2368–2383. [https://doi.org/10.1016/S0140-6736\(18\)30489-6](https://doi.org/10.1016/S0140-6736(18)30489-6)
- Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C, et al. The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis*. 2014;73(6):968–974. <https://doi.org/10.1136/annrheumdis-2013-204428>
- Hoy D, March L, Woolf A, Blyth F, Brooks P, Smith E, et al. The global burden of neck pain: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis*. 2014;73(7):1309–1315. <https://doi.org/10.1136/annrheumdis-2013-204431>
- Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, et al. Nonpharmacologic therapies for low back pain: a systematic review for an American College of Physicians clinical practice guideline. *Ann Intern Med*. 2017;166(7):493–505. <https://doi.org/10.7326/M16-2459>
- Qaseem A, Wilt TJ, McLean RM, Forciea MA. Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of Physicians. *Ann Intern Med*. 2017;166(7):514–530. <https://doi.org/10.7326/M16-2367>
- Lautenbacher S, Kundermann B, Krieg JC. Sleep deprivation and pain perception. *Sleep Med Rev*. 2006;10(5):357–369. <https://doi.org/10.1016/j.smrv.2005.08.001>
- Mork PJ, Nilsen TIL. Sleep problems and risk of fibromyalgia: longitudinal data on an adult female population in Norway. *Arthritis Rheum*. 2012;64(1):281–284. <https://doi.org/10.1002/art.33346>
- Tremblay MS, Aubert S, Barnes JD, Saunders TJ, Carson V, Latimer-Cheung AE, et al. Sedentary Behavior Research Network (SBRN)—terminology consensus project process and outcome. *Int J Behav Nutr Phys Act*. 2017;14:75. <https://doi.org/10.1186/s12966-017-0525-8>
- Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep*. 1985;100(2):126–131. <https://pubmed.ncbi.nlm.nih.gov/3920711/>
- Cohen SP, Vase L, Hooten WM. Chronic pain: an update on burden, best practices, and new

- advances. *Lancet*. 2021;397(10289):2082–2097. [https://doi.org/10.1016/S0140-6736\(21\)00393-7](https://doi.org/10.1016/S0140-6736(21)00393-7)
21. Foster NE, Hill JC, O'Sullivan P, Hancock M. Stratified models of care. *Best Pract Res Clin Rheumatol*. 2013;27(5):649–661. <https://doi.org/10.1016/j.berh.2013.10.005>
22. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *Lancet*. 2017;389(10070):736–747. [https://doi.org/10.1016/S0140-6736\(16\)30970-9](https://doi.org/10.1016/S0140-6736(16)30970-9)
23. National Academies of Sciences, Engineering, and Medicine. Sleep disorders and sleep deprivation: an unmet public health problem. Washington (DC): National Academies Press; 2006. <https://doi.org/10.17226/11617>
24. World Health Organization. Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age. Geneva: World Health Organization; 2019. <https://www.who.int/publications/i/item/9789241550536>

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