International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Comparative Study of Effect of Stress on Pulse Rate and Sleep Pattern in Medical and Non-Medical Students

Dr. Pooja Chaurasia[1], Dr. Berendra Yadav[2], Dr. Ravindra K Verma[3], Dr. Amit Upadhyay[4], Dr. Priyank Verma[5]

[1]MD, Assistant Professor, Department of Physiology, MRAMC Ambedkarnagar.
[2]MD, Associate Professor, Department of Physiology, MRAMC Ambedkarnagar.
[3]PhD, Assistant Professor, Department of Physiology, MRAMC Ambedkarnagar.
[4]MD, Associate Professor, Department of Physiology, ASMC, Sultanpur.
[5]MD, Associate Professor, Department of Paediatrics, ASMC Sultanpur.

Corresponding Author:

Dr. Pooja Chaurasia
MD, Assistant Professor,
Department of Physiology,
MRAMC Ambedkarnagar.
Email:
poojachaurasia21.pc@gmail.com

Received: 21-06-2026
Accepted: 15-07-2026
Available online: 30-07-2026

ABSTRACT

Background- Stress can affect both physiological functioning and the quality of sleep in students. Therefore, this study compared perceived stress, pulse rate, and sleep pattern among medical and non-medical students.
Obbjective- To compare the effects of stress on pulse rate and sleep patterns among medical and non-medical students.
Material & Methods- A total of 400 students aged 17–21 years were enrolled in this cross-sectional comparative study, including 200 medical students from S.N. Medical College, Agra, and 200 non-medical students from Agra College, Agra. The participants' perceived stress was evaluated using the Perceived Stress Scale. Pulse rate was measured for one full minute using the three-finger method. Sleep pattern was classified as disturbed or normal based on complaints of inadequate sleep duration, early-morning awakening, difficulty falling asleep, or interrupted sleep. Categorical data were analysed using the chi-square test, while the mean pulse rate was compared between the medical and non-medical groups using an unpaired t-test.
Result- Medical students showed a greater proportion of moderate and high perceived stress compared with non-medical students, and this difference was statistically significant ($p<0.0001$). Their mean pulse rate was also higher, measuring 81±6.5 beats/minute versus 76±6 beats/minute in the non-medical group. The between-group comparison using an unpaired t-test confirmed a highly significant difference in pulse rate ($p<0.0001$). Sleep disturbance was likewise reported more frequently among medical students, with the difference between the two groups reaching statistical significance ($p<0.0001$).
Conclusion- Moderate and high perceived stress were observed more frequently in medical students than in their non-medical counterparts. Significant differences were also observed in pulse rate and sleep patterns between the two groups.

Keywords*: Stress; perceived stress; pulse rate; sleep pattern; medical students; non-medical students.*

INTRODUCTION:

Stress arises when a disturbance in bodily equilibrium demands physiological or psychological adjustment. It may arise from changes in the external environment that disturb the body's internal milieu or from dysfunction within one or more organ systems [1]. The stress process comprises an initiating stressor and the body's subsequent response to it. Exposure to stressors may produce physiological consequences, including biological, cellular, and tissue-level alterations [2].

Stressors may originate from either the external or internal environment. External stressors include environmental changes such as extreme temperatures, as well as major life events, academic or occupational demands, interpersonal conflicts, financial difficulties, and overloaded schedules that provide insufficient time for rest. Internal stressors may include

infections, elevated blood glucose levels, personal attitudes, negative expectations, intolerance of uncertainty, rigid thinking, self-critical thoughts, perfectionism, and a tendency to perceive situations in extreme or black-and-white terms. Many stressors are predominantly psychological and are influenced by an individual's perception of present circumstances and expectations regarding future events. They do not necessarily involve a direct physical change in the environment. Loss of an important relationship, financial strain, unfavourable neighbourhood conditions, discrimination, and other social threats may also act as significant sources of stress [3–6]. The interaction between external challenges and internal thought processes determines the intensity with which stress is experienced by an individual.

Academic stress is considered a useful model of psychological stress in humans and can help in studying psychoneurohormonal changes among students [7]. Students face many issues like heavy syllabus, language barrier problems, frequent exams, homesickness, high parental expectations, lack of free time for fun, and bad food in the mess/hostel.

Stress is frequently associated with multiple physiological and behavioural effects like anxiety, depression, tension, headache, alteration in peak expiratory flow rate, body mass index, sleep pattern, food habits, bowel patterns and increased intake of coffee among others. Chronic stress may also reduce lung function, and studies have reported differences in peak expiratory flow rate between individuals experiencing chronic stress and normal subjects [8].

During stress, the levels of norepinephrine and growth hormone increase [9]. These hormonal changes promote lipolysis and glycogenolysis and may increase myocardial contractility, heart rate, cardiac output, and blood pressure [10]. Academic stress may therefore be regarded as a naturally occurring form of stress in humans and is associated with increased activity of the sympathetic nervous system.

Persistent psychological stress increases the risk of several health problems and may contribute to cardiovascular disorders [11], neurological and psychiatric conditions, and sleep-related difficulties [12]. Since pulse rate reflects autonomic activity and sleep patterns may be affected by psychological stress, their assessment can help in understanding the physiological and behavioural effects of stress among students.

MATERIAL AND METHODS:

The present manuscript reports a separate analysis of previously unpublished outcome parameters obtained from the same cohort described in an earlier publication on stress and headache among medical and non-medical students. The earlier report focused on headache, whereas the present analysis evaluates pulse rate and sleep pattern in relation to perceived stress.[21]

Study design and setting

This cross-sectional comparative study was conducted in the Department of Physiology, S.N. Medical College, Agra, after obtaining ethical clearance from the Institutional Ethics Committee of the college. The study was carried out from 1 January 2017 to 30 June 2018.

Thus, there is a total of 400 medical and non-medical students who are 18-21 years old. In this study, the population is comprised by medical students who were chosen from S.N. Medical College, Agra, and non-medical students who are studying at Agra College, Agra.

Study groups

Participants were classified into two study groups. Group A consisted of medical students from S.N. Medical College, Agra, while Group B included non-medical students from Agra College, Agra.[21]

Sampling technique

A multistage stratified random sampling method was used to recruit students from both institutions.

Assessment of perceived stress

The level of stress experienced by the participants was assessed using the Perceived Stress Scale. The scale, developed in 1983, is a self-administered questionnaire designed to evaluate how individuals perceive different situations in their lives as stressful. The items require respondents to report their thoughts and emotional experiences over the previous month. The questionnaire was completed by each participant as a self-assessment measure.

Measurement of pulse rate

For the pulse-rate determination, every subject sat comfortably while their forearm was semi-pronated, and their wrist was slightly bent backwards. The pulse was taken using the three-finger technique, and the beats were counted for one minute. The arterial pulse is a passive distension of the arterial walls that occurs when blood is pumped from the left ventricle into the systemic circulation. The normal pulse rate is between 60-100 beats per minute, with the average being

72 beats per minute. A pulse rate below 60 beats per minute is described as bradycardia, whereas a pulse rate higher than 100 beats per minute is called tachycardia.

Assessment of sleep pattern
Sleep pattern was assessed on the basis of the history provided by the participants and was classified into two categories:

Disturbed sleep: Presence of one or more complaints, including inadequate sleep duration, early-morning awakening, difficulty falling asleep, or interrupted sleep.

Undisturbed sleep: Absence of all the above complaints.

Inclusion criteria
1. Were aged between 17 and 21 years.
2. Were enrolled as medical or non-medical students.
3. Were either male or female.
4. Voluntarily agreed to participate after receiving detailed information about the study.

Exclusion criteria
1. Were unwilling to participate.
2. Had any systemic disorder or chronic illness.
3. Had any identifiable precipitating factor for acute stress.

Administrative permission and participant information
Permission to conduct the study was obtained from the Principal and Head of the Department of S.N. Medical College, Agra, and from the concerned authorities of Agra College, Agra. Each selected student was informed about the nature and purpose of the study before participation.

Statistical analysis
The gathered information was entered into a Microsoft Excel spreadsheet and analyzed using SPSS 20 software. The chi-square test was used to analyze the data. A p-value less than 0.05 was considered statistically significant.

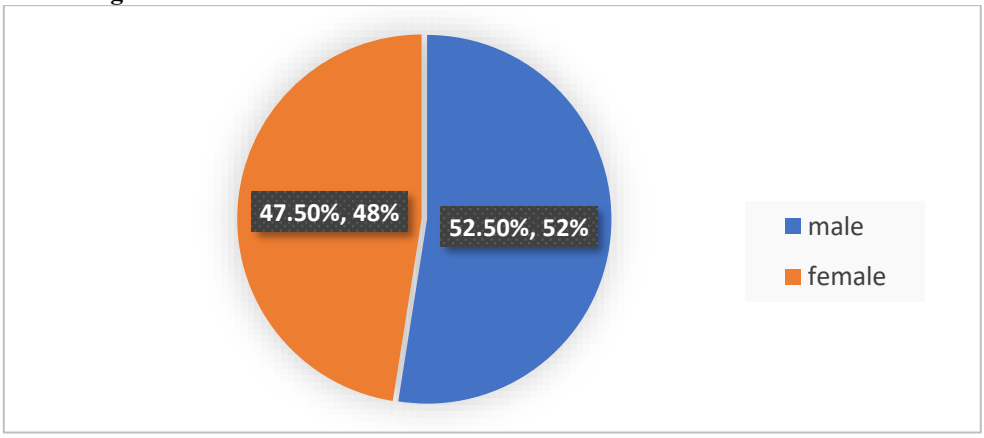
RESULTS:
The distribution of perceived stress in this cohort has been reported previously and is summarised here only to provide context for the analysis of pulse rate and sleep pattern.[21]

A total of 400 students were included in the study, comprising 200 medical students and 200 non-medical students. In each group, 105 (52.5%) participants were male and 95 (47.5%) were female, giving a male-to-female ratio of approximately 1.1:1. The gender distribution was identical in both groups (Table 1; Figure 1).

Table 1. Gender wise distribution of all study participants.

Gender	Medical students (N=200) n (%)	Non-medical students (N=200) n (%)
Male	105 (52.5)	105 (52.5)
Female	95 (47.5)	95 (47.5)

Figure 1. Gender wise distribution of medical and non-medical students

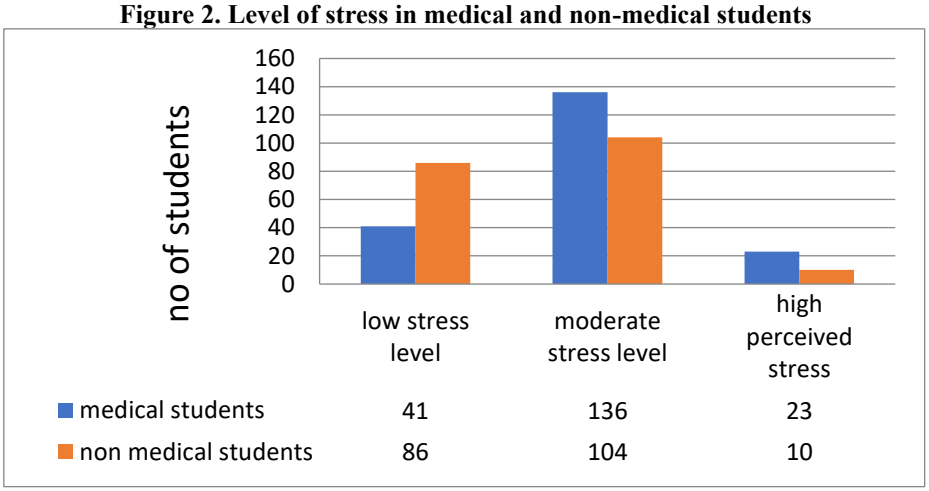


Among medical students, 41 (20.5%) had low stress, 136 (68.0%) had moderate stress, and 23 (11.5%) had high perceived stress. Among non-medical students, 86 (43.0%) had low stress, 104 (52.0%) had moderate stress, and 10 (5.0%) had high perceived stress. Moderate and high perceived stress were more frequent among medical students, whereas low stress was more common among non-medical students. The difference in stress-level distribution between the two groups was statistically significant (χ^2=25.33, df=2, p<0.0001) (Table 2; Figure 2).

Table 2. Level of stress among medical and non-medical students: Perceived Stress Scale

S. No.	Level of Stress	Score	Medical students (N=200) n (%)	Non-Medical students (N=200) n (%)
1	Low (A)	0-13	41 (20.5)	86 (43)
2	Moderate (B)	14-26	136 (68)	104 (52)
3	High perceived (C)	27-40	23 (11.5)	10 (5)
Chi square test =25.33; df =2; p value =<0.0001				

Figure 2. Level of stress in medical and non-medical students

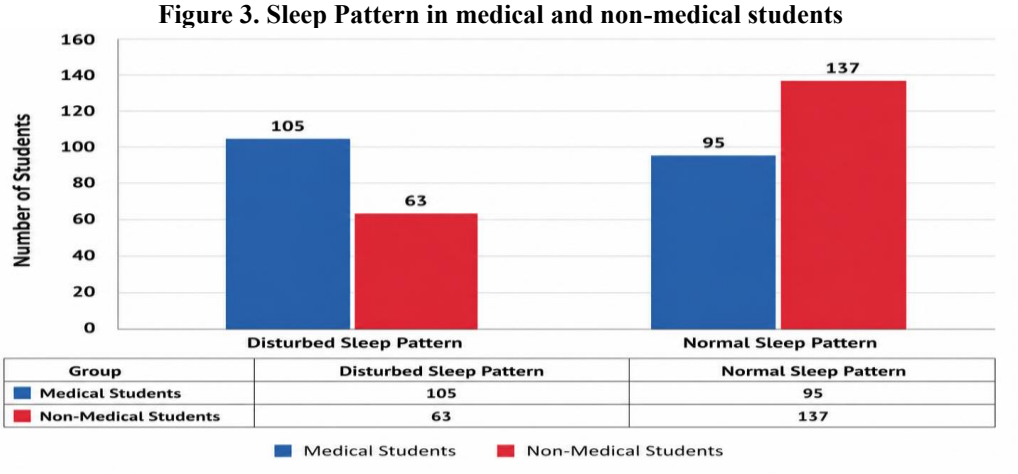


Disturbed sleep was reported by 105 (52.5%) medical students and 63 (31.5%) non-medical students. In contrast, normal sleep was reported by 95 (47.5%) medical students and 137 (68.5%) non-medical students. Thus, disturbed sleep was more common among medical students, while normal sleep was more frequent among non-medical students. The difference in sleep pattern between the groups was statistically significant (χ^2=18.1, df=1, p<0.0001) (Table 3; Figure 3).

Table 3. sleep pattern among Medical and Non-Medical students:

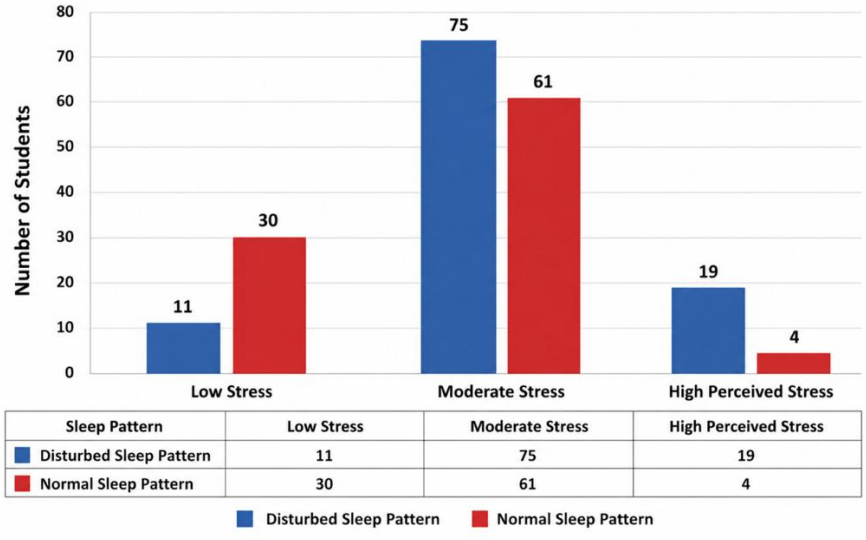
S. No.	Sleep pattern	Medical students (N=200) n (%)	Non-Medical students (N=200) n (%)
1	Disturbed	105 (52.5)	63 (31.5)
2	Normal	95 (47.5)	137 (68.5)
Chi square test =18.1; df =1; p value =<0.0001			

Figure 3. Sleep Pattern in medical and non-medical students



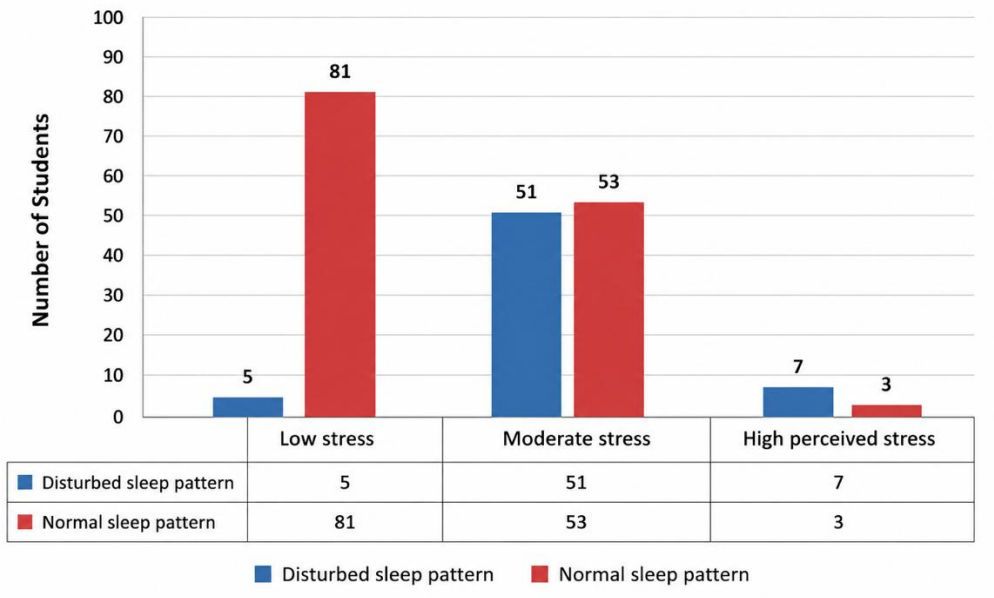
Among medical students, disturbed sleep was observed in 11 students with low stress, 75 with moderate stress, and 19 with high perceived stress. Normal sleep was observed in 30, 61, and 4 students in the corresponding stress categories, respectively (Figure 4). Among non-medical students, disturbed sleep was reported by 5 students with low stress, 51 with moderate stress, and 7 with high perceived stress, whereas normal sleep was reported by 81, 53, and 3 students, respectively (Figure 5).

Figure 4. Level of stress and sleep pattern in medical students



Sleep Pattern	Low Stress	Moderate Stress	High Perceived Stress
Disturbed Sleep Pattern	11	75	19
Normal Sleep Pattern	30	61	4

Figure 5. Level of stress and sleep pattern in non-medical students



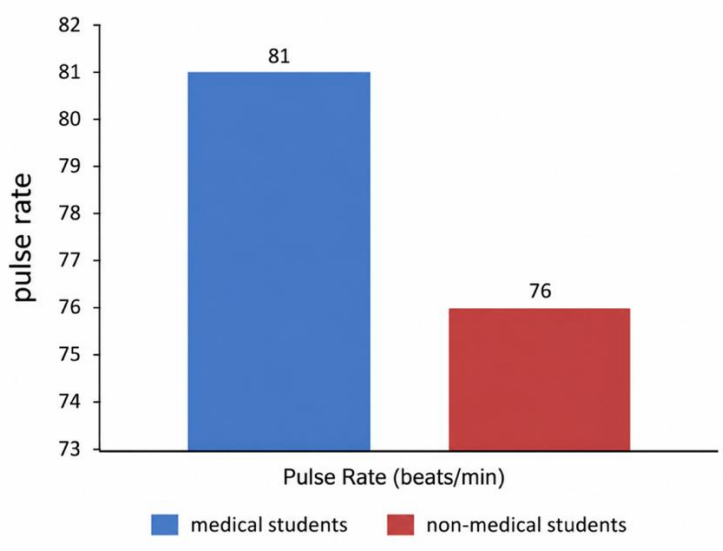
	Low stress	Moderate stress	High perceived stress
Disturbed sleep pattern	5	51	7
Normal sleep pattern	81	53	3

The mean pulse rate was 81±6.5 beats/min in medical students and 76±6 beats/min in non-medical students. The mean pulse rate was significantly higher among medical students than among non-medical students ($p<0.0001$) (Table 4; Figure 6).

Table 4. Pulse rate among Medical and Non-Medical students:

Parameter	Medical student Mean ± SD	Non-Medical students Mean ± SD	p value
Pulse Rate (beats/min)	81± 6.5	76± 6	<0.0001

Figure 6. Comparison of Pulse rate in medical and non-medical students



DISCUSSION:

The present manuscript reports a separate analysis of sleep pattern and pulse rate among the same cohort of medical and non-medical students previously evaluated for stress and headache. In that earlier report, moderate and high perceived stress were more frequent among medical students than among non-medical students. The same stress distribution was retained in the present analysis to examine its relationship with additional physiological and sleep-related outcomes.[21] Among medical students, 68.0% had moderate stress and 11.5% had high perceived stress, compared with 52.0% and 5.0%, respectively, among non-medical students. Greater academic demands, frequent examinations, fear of failure, prolonged professional training, and expectations from parents and teachers may contribute to the higher stress burden among medical students. However, because the study was cross-sectional, these factors should be regarded as possible explanations rather than confirmed causes.

Similar findings have been reported in other student populations. Jafari et al. observed significantly higher stress among medical students than among students enrolled in engineering, arts, and commerce courses [13]. Abdulghani et al. reported an overall stress prevalence of 63.8%, including severe stress in 25.2% of participants. Among medical students, 75.6% experienced stress, while 54.6% had moderate to high perceived stress [14]. These studies indicate that the structure and demands of medical training may place students under considerable psychological pressure.

The principal new finding of the present analysis was the greater occurrence of disturbed sleep among medical students. Disturbed sleep was reported by 105 (52.5%) medical students, compared with 63 (31.5%) non-medical students. In contrast, normal sleep was more common among non-medical students. Stress may influence sleep through persistent cognitive activity and physiological arousal, which can delay sleep onset, interrupt sleep continuity, and reduce total sleep duration. Prolonged exposure to stress may also produce neurobiological changes that affect adaptation and vulnerability to further stress [15].

Sleep-related difficulties have been reported frequently among medical students. Loayza et al. found insomnia in 28.2% of medical students [16], while Rodrigues et al. reported excessive daytime sleepiness in 39.5% [17]. In an Indian study comparing medical and law students, refreshing sleep was reported by 47.1% of medical students and 60.8% of law students. Initial insomnia occurred more frequently among medical students, whereas law students reported better sleep depth [18]. Although the methods used to assess sleep differed across these studies, their findings support the observation that medical students commonly experience impaired sleep.

The mean pulse rate was also significantly higher among medical students than among non-medical students. Medical students had a mean pulse rate of 81±6.5 beats/min, compared with 76±6 beats/min among non-medical students. Psychological and academic stress may increase sympathetic nervous system activity and catecholamine release, resulting in increased cardiac stimulation and a higher pulse rate. Nevertheless, the observed difference cannot be attributed solely to stress because other factors that influence resting pulse rate were not evaluated in detail.

Sharma et al. reported significant increases in pulse rate and systolic and diastolic blood pressure among medical students during an examination period, suggesting greater autonomic activation under academic stress [19]. Similarly, Elwess and Vogt observed changes in heart rate among students during competitive laboratory exercises, oral presentations, and

examinations [20]. These findings are consistent with the higher pulse rate observed among medical students in the present analysis.

The findings should be interpreted in light of certain limitations. Sleep pattern was classified from self-reported complaints rather than through a validated sleep questionnaire or objective sleep assessment. Pulse rate was measured manually at a single assessment, and factors such as recent physical activity, caffeine intake, emotional state, and time of measurement may have influenced the recorded value. In addition, the cross-sectional design identifies differences and associations but cannot establish a causal relationship between academic stress, sleep disturbance, and pulse rate.

The present analysis therefore indicates that medical students had more frequent sleep disturbance and a higher mean pulse rate than non-medical students. These findings suggest that the greater stress burden observed among medical students may coexist with both sleep-related and autonomic changes, although longitudinal studies are required to clarify the direction and mechanism of these relationships.

CONCLUSION:

The present study found that medical students had a significantly higher pulse rate and a greater prevalence of disturbed sleep than non-medical students. Further studies with larger samples and more detailed assessment methods are required to clarify the relationship between stress, pulse rate, and sleep pattern.

DECLARATIONS:

Conflict of Interest: None declared.

Source of Funding: The study was self-funded.

Ethical Approval: Ethical clearance was obtained from the Institutional Ethics Committee of S.N. Medical College, Agra, before commencement of the study.

REFERENCES:

1. Ramachandran VS, editor. *Encyclopedia of the Human Brain*. Vol. 4. USA: Academic Press, Elsevier Science; 2002. p. 450, 463.
2. Steplewski Z, Vogel WH. Total leukocytes, T-cell subpopulation and natural killer cell activity in rats exposed to restraint stress. *Life Sci.* 1986;38(26):2419–2427. doi:10.1016/0024-3205(86)90611-9.
3. Johns LE, Aiello AE, Cheng C, Galea S, Koenen KC, Uddin M. Neighborhood social cohesion and posttraumatic stress disorder in a community-based sample: findings from the Detroit Neighborhood Health Study. *Soc Psychiatry Psychiatr Epidemiol.* 2012;47:1899–1906.
4. Kemeny ME. Psychobiological responses to social threat: evolution of a psychological model in psychoneuroimmunology. *Brain Behav Immun.* 2009;23:1–9.
5. Young M, Schieman S. When hard times take a toll: the distressing consequences of economic hardship and life events within the family–work interface. *J Health Soc Behav.* 2012;53:84–98.
6. Harrell JP, Hall S, Taliaferro J. Physiological responses to racism and discrimination: an assessment of the evidence. *Am J Public Health.* 2003;93:243–248.
7. Lacey K, Zaharia MD, Griffiths J, Ravindran AV, Merali Z, Anisman H. A prospective study of neuroendocrine and immune alterations associated with the stress of an oral academic examination among graduate students. *Psychoneuroendocrinology.* 2000;25(4):339–356.
8. Sitalakshmi R, Poornima KN, Karthick N. The peak expiratory flow rate: the effect of stress in a geriatric population of Chennai—a pilot study. *J Clin Diagn Res.* 2013;7(2):409–410.
9. Mahapatra AB. *Essentials of Medical Physiology*. 4th ed. Kolkata: Current Books International; 2014. p. 333.
10. Shrinivasan K, Mario VZ, Sucharita S. A study of stress and autonomic nervous functions in first-year undergraduate medical students. *Indian J Physiol Pharmacol.* 2006;50(3):257–264.
11. Merz CNB, Dwyer J, Nordstrom CK, Walton KG, Salerno JW, Schneider RH. Psychosocial stress and cardiovascular disease: pathophysiological links. *Behav Med.* 2002;27:141–147.
12. Lupien SJ, McEwen BS, Gunnar MR, Heim C. Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat Rev Neurosci.* 2009;10:434–445.
13. Jafari SM, Zaidi E, Aamir IS, Aziz HW, Din I, Shah MH. Stress level comparison of medical and non-medical students: a cross-sectional study conducted at various professional colleges in Karachi, Pakistan. *Acta Psychopathol.* 2017;3(2):1–6.
14. Abdulghani HM, AlKanhal AA, Mahmoud ES, Ponnamperuma GG, Alfaris EA. Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. *J Health Popul Nutr.* 2011;29(5):516.
15. Lupien SJ, Juster RP, Raymond C, Marin MF. The effects of chronic stress on the human brain: from neurotoxicity to vulnerability and opportunity. *Front Neuroendocrinol.* 2018;49:91–105.

16. Loayza HMP, Ponte TS, Carvalho CG, Pedrotti MR, Nunes PV, Souza CM, et al. Association between mental health screening by self-report questionnaire and insomnia in medical students. *Arq Neuropsiquiatr.* 2001;59(2A):180–185.
17. Rodrigues RN, Viegas CA, Abreu E, Silva AA, Tavares P. Daytime sleepiness and academic performance in medical students. *Arq Neuropsiquiatr.* 2002;60:6–11.
18. Palatty PL, Fernandes E, Suresh S, Baliga MS. Comparison of sleep patterns between medical and law students. *Sleep Hypn.* 2011;13:1–2.
19. Sharma B, Wavare R, Deshpande A, Nigam R, Chandarkar R. A study of academic stress and its effect on vital parameters in final-year medical students at SAIMS Medical College, Indore, Madhya Pradesh. *Biomed Res.*2011;22(3):361–365.
20. Elwess NL, Vogt FD. Heart rate and stress in a college setting. *Bioscene.* 2005;31(4):20–23.
21. Srivastav R, Chaurasia P, Bhardwaj A, Hyanki D. Comparative study of effect of stress on headache in medical and non-medical students. *Int J Physiol.* 2019;7(3):145–149. doi:10.5958/2320-608X.2019.00103.3.