International Journal of Clinical & Biomedical Research
Vol 11, Issue 1, 2026.

Sumathi Publications
Original Article

Prevalence of stress and its correlation with cognition among medical students

Subhashri Soundirarajan[1] Tamilselvan Kuppusamy[2] Mathan kaliaperumal[3] Perumal Manoharan[4] Jothi Marie Feula[5]

[1]*Associate Professor, Department of Physiology, Tagore Medical college and hospital, Chennai, India*
[2]*Professor & Head, Department of Physiology, Sri Venkateshwara Medical College Hospital and Research Centre, Pondicherry, India*
[3]*Professor & HOD, Department of Psychiatry, Indira Gandhi Medical College and research Institute, Pondicherry, India*
[4]*Associate Professor, Department of Dermatology, Panimalar Medical College, Chennai, India.*
[5]*Assistant Professor, Department of Physiology, All India Institute of Medical sciences, Madurai, India.*

Abstract

Stress is highly prevalent among medical students due to academic demands, clinical responsibilities, and psychosocial factors. Persistent stress has been linked to impaired cognitive performance and long-term neuropsychological consequences. However, objective assessment of cognition in relation to stress among medical undergraduates remains limited. Stress was assessed using MSSQ-40 which evaluates six stressor domains, and categorized as mild, moderate, high, and severe. For correlation analysis, 125 students were recruited and subjected to cognitive assessment using auditory P300 event-related potentials recorded at the Cz electrode placement. The overall prevalence of stress (high + severe categories) was 53.37%. Academic-related stressors (72.8%) and teaching-learning related stressors (69.0%) were the most predominant domains. Statically significant differences in mean stress scores across phases were observed for academic related, teaching learning, Social related and group activities related stressor ($p < 0.05$). P300 latency showed a significant positive correlation with academic related ($r=0.28$, $p=0.04$), teaching learning ($r=0.31$, $p=0.02$), Drive related ($r=0.527$, $p<0.001$), and group activities related stressor ($r=0.39$, $p<0.001$). More than half of the medical students experienced significant stress, predominantly academic related factors. Higher stress levels were associated with prolonged P300 latency, suggesting stress-related cognitive slowing. Early identification and targeted interventions may help improve both mental well-being and cognitive performance among medical undergraduates.

KEYWORDS: Stress; MSSQ-40; Medical students; P300; Cognition; Event-related potentials.

Introduction

Stress can be defined as mental, physical, emotional and psychological disturbance causing an exaggerated and detrimental harmful physiological response [1, 2]. The term stress has become widespread recognition in the last few decades [3], it has emerged as a major concern medical students as they exposed to highly demanding and complex curriculum making them to be in a highly stressful environments [2]. A Study in Ethiopia reported that stress was a major problem in medical students influencing their academic performances; it also found to be associated with year of study, family income and substance uses [1]. Numerous studies conducted across India and other countries have consistently reported an increased prevalence of stress among the medical students [1, 2, 4 -7]. Identified contributors include high parental expectations, voluminous curricula, overcrowded lecture halls, dissatisfaction with teaching methods, and multiple psychosocial factors such as peer pressure, lack of leisure time, financial problems, interpersonal conflicts, aspirations for higher studies and family problems [1, 8].

Persistent stress among medical students has

Correspondence: **Dr. Subhashri Soundirarajan,** Associate Professor, Department of Physiology, Tagore Medical College and Hospital, Chennai, India. Email: subhashri.dr@gmail.com

eISSN: 2395-0471
pISSN: 2521-0394

been linked to increased number of drop outs over long term, to depression and cognitive decline [1, 9]. Cohort studies in middle aged people have further shown that long term psychological stress are increases the risk of dementia especially Alzheimer's disease in future [8, 10]. Stress also been linked in the pathogenesis of various neurodegenerative, cardiovascular, psychiatric diseases and plays an important role in the development further disease condition [3, 11]. An experimental animal studies revealed that on exposing to chronic stress results impaired in memory and cognitive functions, accompanied by decrease in α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) and N-methyl-d-aspartate (NMDA) receptors in prefrontal cortex [12] .

The medical student's stress Questionnaire - 40 (MSSQ-40), is a reliable tool for assessing stress among medical students, with high consistency for the 40 item stress scale [4]. Long-latency event-related brain potentials (ERP) are presents sensitive neurophysiological approaches for the assessment of cognitive functions. ERP comprise of most prominent late positive complex P300 that peaks at approximately 300ms and is closely related to cognitive processes [13,14]. P300 latency and amplitude reflects various domains of cognition including decisions making, expectations, plans, strategies, associations and memories [14].

Although numerous studies have quantified stress among medical students, evidence linking stress to objective neurophysiological association measures such as P300 remain limited. Therefore, the present study was undertaken to estimate the prevalence of stress among medical students using MSSQ-40, to assess cognitive function using P300 event-related potentials, and to examine the association between stress levels and cognitive performance.

Materials and Methods

This descriptive cross-sectional study conducted among the medical students of a private teaching institute in Puducherry. Prior approval was obtaining from scientific research committee and institutional ethics committee. To study the prevalence of stress all the students perusing MBBS who are willing to participate was recruited. A total of 411 medical students participated in the stress assessment phase of the study. To study the correlation of stress and cognition, a subsample of 125 students was selected, based on sample size was calculated by using Open-epi software version 3, considering the expected prevalence rate as 91.1% , 5% α error, and a 95% confidence interval [4].

All healthy medical students aged 18 – 25 years enrolled in the MBBS Programme were included in the study. Students taking medicines pertaining to any psychiatric illness or neurological illness, students with high BMI and students having any metabolic and endocrine diseases were excluded. After obtaining written informed consent, students from all phases of MBBS excluding Phase I and Compulsory rotatory residential internship.

Assessment of stress: all participants were asked to answer the medical students stress questionnaire (MSSQ-40), a validated instrument consisting of 40 items grouped into six domains.

Academic related stressors (ARS): Include examination systems, marks, assessment methods, grading methods, vast content to be studied, and lack of time to do revision time.

Intrapersonal and interpersonal related stressors (IRS): Related self-conflict, poor motivation to study and conflict with teachers, colleague, and staffs.

Teaching and learning-related stressors (TLRS): Task given by teachers, teacher's competency, feedback and academic support by teachers.

Social related stressors (SRS): Quality time spent with family and friend, working with the public and doctor patient's interactions, private time.

Drive and desire related stressors (DRS): All of those internal or external forces which caused to influence on the human's attitude, emotion, though, behavior etc.

Group based activities related stressors (GARS): All group events and contact with colleagues.

The items that formed the scale were answered on a 5 point scale ranging from 0 to 4 and an increase in value meant a higher level of stress. High harmonious relationship, high instrumental, and moderate autonomy students had higher individual mean scores in all domains. Individual student-level mean scores were graded into mild (0.01–1), moderate (1.01–2), high (2.01–3) and severe (3.01–4) stress categories for each domain.

Cognitive assessment (P300 event related potential): For correlation analysis, 125 students with equal gender distribution & equal no of students in all phases of MBBS (excluding Phase I and CRRI). Participants were evaluated in the research laboratory of the Physiology Department for recording of P300 evoked potential. Scalp recording were obtained using disc electrodes. Two reference electrodes are attached to left and right mastoid, designated as A1 and A2 respectively, one active electrode on vertex labelled as Cz and one as ground electrode to forehead termed as Fpz. Electrodes were connected to a junction box and cognitive evoked potential P300 responses were recorded following standard procedures.

Statistical analysis: Data were analyzed using SPSS software version 19.0 Categorical variables including gender, severity of stress categories were expressed as frequency and percentage with 95% confidence intervals. Continuous variables were tested for normality using Shapiro–Wilk test. As MSSQ domain scores showed non-normal distribution across phases, the Kruskal–Wallis test was used to compare mean stress scores among Phase II, III, and IV students. Where significant differences were identified, post-hoc pairwise comparisons with Bonferroni correction were applied. Pearson's correlation coefficient (r) was used to determine the association between MSSQ domain scores and P300 latency values were normally distributed. Strength of correlation was interpreted as: 0–0.25: weak; 0.26–0.50: moderate; 0.51–0.75: strong; 0.75: very strong. A p-value <0.05 was considered statistically significant.

Results

Table 1. Severity of stress among medical students in Different stressor domains

Stressor domain	ARS N (%)	IRS N (%)	TLRS N (%)	SRS N (%)	DRS N (%)	GARS N (%)
Mild	26 (6.2)	62 (15.0)	51 (12.3)	72 (17.6)	119 (28.9)	99 (24.1)
Moderate	86 (21.0)	162 (39.3)	77 (18.7)	115(28.0)	83 (20.1)	127 (30.8)
High	203 (49.4)	168 (40.8)	209 (50.8)	175(42.6)	158 (38.5)	140 (34.0)
Severe	96 (23.4)	20 (4.9)	75 (18.2)	48 (11.8)	51 (12.5)	46 (11.1)

The distribution of stress severity across six MSSQ domains is presented in Table 1. ARS showed the highest proportion of high 49.4% and severe stress 23.4%, followed by Teaching and Learning Related Stressors TLRS with 50.8% high stress. Drive and Desire Related Stressors (DRS) had comparatively higher mild stress (28.9%). When high and severe categories were combined, ARS 72.8% and TLRS 69.0% were the predominant stress domains of stress among students as shown in Table 1.

Table 2. Mean score of stressor Domain in MSSQ among different phases of medical students

Stressor domain	Phase II MBBS	Phase III MBBS	Phase IV MBBS	P value
ARS	2.52 ± 0.02	2.31 ± 0.74	2.79 ± 0.59	0.000**
IRS	1.95 ± 0.55	1.77 ± 0.98	1.91 ± 0.77	0.13
TLRS	2.35 ± 0.87	1.73 ± 0.94	1.86 ± 0.09	0.000**
SRS	1.58 ± 0.59	1.63 ± 0.82	2.02 ± 1.03	0.000**
DRS	1.74 ± 1.03	1.68 ± 1.06	1.96 ± 1.38	0.117
GARS	1.78 ± 0.76	1.94 ± 0.91	2.08 ± 1.30	0.048*

Data presented as Mean ± SD

Table 2 shows the comparison of mean stress scores among Phase II, III, and IV MBBS students. A statistically significant difference was observed for ARS (p<0.001), TLRS (p<0.001), SRS (p<0.001) and GARS (p=0.048). Phase IV students demonstrated higher mean scores for ARS, SRS, and GARS compared to earlier phases. No significant difference was observed for IRS (p=0.13) and DRS (p=0.117)

Table 3. Correlation of stress level with P300 among medical students

Stressor domain	r Value	P value
ARS	0.28	0.04*
IRS	0.03	0.80
TLRS	0.31	0.02*
SRS	0.01	0.94
DRS	0.527	0.00*
GARS	0.39	0.00*

Table 3 shows the correlation between MSSQ stress domains and P300 latency. Significant positive correlations were observed for ARS (r=0.28, p=0.04), TLRS (r=0.31, p=0.02), DRS (r=0.527, p<0.001), and GARS (r=0.39, p<0.001). These findings indicating that higher stress scores were associated with increased P300 latency. No significant correlation was found for IRS and SRS (p>0.05).

Discussion

This is a descriptive cross-sectional study assessing the prevalence of stress among medical students using MSSQ-40 questionnaire. The WHO has declared positive mental health to be the "foundation for well-being and effective functioning for both the individual and the community" [7]. After COVID -19 pandemic there is threatening increase in the prevalence of stress and depression across the globe. A study shows that more than 50 % of the population there is some sort of mental health disturbance like anxiety, stress and depression after COVID-19 [15]. The level of stress among the university students and adolescents also shows an overwhelming increase day by bay due to competition life [16,17]. That too for medical students with vast portions and lack of clinical exposure the stress level would have been more.

In the present study, students with mild and moderate level of stress were classified as not experiencing significant stress, whereas those with high and serve were considered to be truly stressed. Around 53.37 % of students who participated in our study had stress. This closely aligned with finding of other studies stress among the medical students in India, shows that pooled prevalence rate of stress was 51.3% [5]. This percentage is similar to a study conducted in Ethiopia which also says that stress among the medical students had a negative impact on their academic performance [1]. Few studies showed that the percentage was even high up to 95% [1,4].

Notably, domain wise stress percentage it shows

that 73% of students have ARS stress, 46% had interpersonal and intrapersonal related stress, 69% had TLRS, 40% had social related stress, and 51% DRS and 42% had group activities related stress. In our study we found that higher percentages of stress among students were related to academic stressors (ARS). This in in accordance with the previous studies [4,18]. Next to academic related stressor it is the teaching learning related stressor (TLRS) which caused more percentage of stress. SRS, GARS & DRS contributed less in compared to others. Students not able to accommodate with vast curriculum and less time, frequent exams and also high expectations of the parents and patients, and time may be the cause of high level of stress.

The mean difference of the stress score of various domains in each phase of MBBS students showed that there significant differences in the stress score for ARS, TLRS, SRS, and GARS. There was a high score for ARS, SRS & GARS in Phase IV MBBS students which can be attributed to huge portions to be covered and they have to deal with the patients during clinical posting and they have to appear for the clinical university exams when compares to other phases. This finding is similar to other studies where the academic related stress was high among the final year medical students. This finding is controversial to a study conducted in Mumbai where the ARS was high among the second year medical students [19]. TLRS showed a high score among the second year MBBS students. This finding is also similar to a study conducted by Kakoli Ghosal [19].

Social related stress and group activity related stress was of high degree among the final year medical students compared to other phases. There was a significant increase in the stress score among the final year students in comparison to other phases. Responsibility to deal with patient issues and able to answer the patients independently and also, they are exam going students, their social interactions increases as they move on to internship. This may be the reason of increased stress score among final year students in our study. Interpersonal and intrapersonal related stress was of mild degree in all the three phases of MBBS students. This is in contrast to study which says that IRS related causes producing stress after academic related stress [2].

The observed correlations between P300 and different stressors: Correlation of the type of stressors with P300, suggests that ARS, TLRS, DRS and GARS are significantly correlated with the cognitive component of evoked potential-P300. P300 will mainly evaluate different fields of cognition such as decision making, expectations, plan, strategies and memories [14]. Investigation found that examination was one of the significant stressor, which influenced first year medical student's cognitive function. Cognitive functions were more impaired in female learners than male counterparts [9]. An introduction to language instruction in the early part of the medical curriculum could alleviate academic stress for our students [9].

A cohort study also reveals that stress during the midlife can increase the chance of dementia in future [8, 10]. Stress reveals that it can lead to neurodegenerative diseases. Stress is known to release corticotropic releasing hormone (CRH) which in turn release corticosteroids. Expose to corticosteroid affect various neuronal modulations mainly in the hippocampal part of brain leading to memory loss and chance of Alzheimer's and multiple sclerosis also increases [3]. It is well known fact that stress is also one of the causal factors for development of hypertension and cardiovascular diseases [11]. So these medical students at their adolescent age group if exposed to high level of stress can lead to many pathological conditions as they grow. Experimental studies also showed that high level of glucocorticoids following stress impairs memory [20]. Few studies on animal also showed that elevated level of noradrenaline during stress can also affect memory [22].

Among the medical students stress has been consistently impact in their academic performance. Also substance abuse is related to stress among the medical students [1]. A study shows that stress related suicidal risk is 2.5 times more in medical professionals than the general population [21]. A recent study reported that in the last decade the prevalence of suicide because of academic stress among the medical students was around 45.2% [22]. These stressors starts as early they enter a medical college.

To mitigate stress and its long term consequences measures to reduce these stressors by conducting foundation courses, regular internal assessments, frequent group discussions, implementing mentor mentee programs providing a environment for a one-to-one interaction with faculty, seminars, parents meeting, early detection and proper counselling sessions with students to alleviate stress can be followed. Such measures not only help in improving their mental health like occurrence of dementia and depression but also prevent cardiovascular illness, hypertension and diabetes in future.

Conclusion

The present study demonstrates that more than 50% of medical student's experiences the significant stress with academic related stressors contributing to the maximum. Additionally, found

that selected stressors are showed significant association with P300 latency. Early detection of stressors and necessary interventions targeting aimed at mitigating modifiable stressors might contribute to building a healthy medical students- academically, physically and mentally. Such measures may potential to reduce academic burden, enhance learning efficiency, and professional skill development. Ultimately promoting healthy medical students produces healthier society.

Limitations: Measurement of biological stress marker, such as serum cortisol level was not measured; it could have provided additional correlation with perceived stress.

References

1. Chilwant KS. Comparison of two teaching 1. Melaku L, Mossie A, Negash A. Stress among medical students and its association with substance use and academic performance. J Biomed Educ. 2015;2015:149509.
2. Panchu P, Bahuleyan B, Vijayan V. An analysis of the factors leading to stress in Indian medical students. Int J Clin Exp Physiol. 2017;4:48–50.
3. Esch T, Stefano GB, Fricchione GL, Benson H. The role of stress in neurodegenerative diseases and mental disorders. Neuro Endocrinol Lett. 2002;23(3):199–208.
4. Gupta S, Choudhury S, Das M, Mondol A, Pradhan R. Factors causing stress among students of a medical college in Kolkata, India. Educ Health (Abingdon). 2015;28:92–95.
5. Sarkar S, Gupta R, Menon V. A systematic review of depression, anxiety, and stress among medical students in India. J Ment Health Hum Behav. 2017;22:88–96.
6. Kumar SG, Kattimani S, Sarkar S, Kar S. Prevalence of depression and its relation to stress level among medical students in Puducherry, India. Ind Psychiatry J. 2017;26(1):86.
7. Nandi M, Sarkar S, Mondal R, Ghosal M, Hazra A. Stress and its risk factors in medical students: An observational study from a medical college in India. Indian J Med Sci. 2012;66(1):1.
8. Johansson L, Guo X, Waern M, Ostling S, Gustafson D, Bengtsson C, et al. Midlife psychological stress and risk of dementia: A 35-year longitudinal population study. Brain. 2010;133(Pt 8):2217–2224.
9. Pradhan G, Mendinca NL, Kar M. Evaluation of examination stress and its effect on cognitive function among first-year medical students. J Clin Diagn Res. 2014;8(8):BC05–BC07.
10. Nabe-Nielsen K, Rod NH, Hansen ÅM, Prescott E, Grynderup MB, Islamoska S, et al. Perceived stress and dementia: Results from the Copenhagen City Heart Study. Aging Ment Health. 2020;24(11):1828–1836.
11. Pickering TG. Mental stress as a causal factor in the development of hypertension and cardiovascular disease. Curr Hypertens Rep. 2001;3(3):249–254.
12. Yuen EY, Wei J, Liu W, Zhong P, Li X, Yan Z. Repeated stress causes cognitive impairment by suppressing glutamate receptor expression and function in prefrontal cortex. Neuron. 2012;73(5):962–977.
13. Anderer P, Saletu B, Gruber D, Linzmayer L, Semlitsch HV, Saletu-Zyhlarz G, et al. Age-related cognitive decline in the menopause: Effects of hormone replacement therapy on cognitive event-related potentials. Maturitas. 2005;51(3):254–269.
14. Himani A, Tandon OP, Bhatia MS. A study of P300 event-related evoked potential in patients with major depression. Indian J Physiol Pharmacol. 1999;43(3):367–372.
15. Shah SMA, Mohammad D, Qureshi MFH, Abbas MZ, Aleem S. Prevalence, psychological responses and associated correlates of depression, anxiety and stress in a global population during the COVID-19 pandemic. Community Ment Health J. 2021;57(1):101–110.
16. von Keyserlingk L, Yamaguchi-Pedroza K, Arum R, Eccles JS. Stress of university students before and after campus closure in response to COVID-19. J Community Psychol. 2022;50(1):285–301.
17. Halliburton AE, Hill MB, Dawson BL, Hightower JM, Rueden H. Increased stress, declining mental health: Emerging adults' experiences in college during COVID-19. Emerg Adulthood. 2021;9(5):433–448.
18. Punita P, Saranya K, Kumar SS. Effect of gender on six domains of stress in medical students. Int J Curr Res. 2016;8.
19. Ghosal K, Behera A. Study on prevalence of stress in medical students. J Res Med Dent Sci. 2018;6(5):182–186.
20. Lupien SJ, Maheu F, Tu M, Fiocco A, Schramek TE. The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition. Brain Cogn. 2007;65(3):209–237.
21. Pandey SK, Sharma V. Sudden and early death among medical professionals: How to reverse this trend? Indian J Ophthalmol. 2023;71(5):2286–2287.
22. Chahal S, Nadda A, Govil N, Gupta N, Nadda D, Goel K, et al. Suicide deaths among medical students, residents and physicians in India spanning a decade (2010–2019): An exploratory study using online news portals and Google database. Int J Soc Psychiatry. 2022;68(4):718–728.