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Original Article

Physiology Section

Comparison of Cognitive Performance, Stress, Body Mass Index, and Lung Functions in Exercising and Non Exercising Medical Students: A Cross-sectional Study

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ABSTRACT

Introduction: Stress is an inherent part of the human experience, especially among medical students, due to academic pursuits and social commitments. The present study explores the intricate relationship of cognition with perceived stress levels, lung function, and Body Mass Index (BMI) in exercising and non exercising medical students.

Aim: To find out and compare the levels of stress, cognition, BMI, and lung function in exercising and non exercising medical students.

Materials and Methods: This cross-sectional study was conducted at the Department of Physiology, JSS Medical College, Constituent College of JSSAHER, Mysuru, Karnataka, India over a span of two months from February 2021 to April 2021. It included 110 participants categorised into an exercising group and a non exercising group. Stress and cognition were measured using the Perceived Stress Scale 10 (PSS-10) and the Modified Mini-mental State Examination (3MS), respectively. The BMI was calculated using Quetelet's index. Pulmonary function was measured using a computerised spirometer. Associations were determined using a Student's t-test, with $p<0.05$ considered significant.

Results: The mean PSS-10 score for exercising students (11.36±3.67) was significantly lower compared to non exercising students (20.71±4.61). The 3MS score of exercisers (97.33±1.73) was significantly higher compared to non-exercisers (94.02±1.40). The mean values of pulmonary functions namely Forced Expiratory Volume 1 (FEV1) (3.43±0.71 L), Forced Vital Capacity (FVC) (3.88±0.76 L), and FEV1/FVC (87.94±2.73%) in exercisers, were significantly better than the values for non-exercisers: FEV1 (3.00±0.67 L), FVC (3.48±0.71 L), and FEV1/FVC (85.86±2.75%). The mean BMI of exercisers (21.45±1.43 kg/m^2) was significantly lower than that of non-exercisers (23.03±1.35 kg/m^2).

Conclusion: Participants who exercise regularly have better cognition, lower stress levels, a healthier BMI, and better lung function than their non exercising counterparts.

Keywords: Academic stress, Mental well-being, Modified mini mental state examination, Perceived stress scale, Physical activity

INTRODUCTION

The students of the present generation experience a lot of stress as they need to face a very competitive society. Stress, an inescapable facet of life, affects individuals in diverse ways at various stages of life. Studies have shown that medical students experience a lot of stress compared to other students [1]. Inability to cope with stress can lead to depression and trigger suicidal thoughts. Hans Selye classified stress into eustress and distress. Eustress is a positive response to a stressor that has a beneficial effect on health, while distress is negative and can cause a decline in cognition [2]. Due to stress, there is a decline in performance both in clinical practice and classrooms among medical undergraduates. Students face academic pressure and anxiety due to unsettling apprehension about their future. They bear a substantial burden of stress across social, emotional, and physical dimensions, exacerbated by familial challenges, which can significantly impact their cognition. Cognition is defined as the mental process of thinking, learning, remembering, being aware of surroundings, and using judgement. Stress not only impacts the body but also profoundly influences an individual's emotions, thoughts and behaviours [1]. Unfortunately, this burden of stress can drive students towards the perilous path of addiction to substances like drugs, alcohol, and cigarettes, resulting in a plethora of serious health complications [3]. The quality of life during the medical course should be given equal importance. Being stress-free improves the quality of life and cognitive performance during the years of education, which will help in future practice in the treatment of patients. Stress also leads to many debilitating disorders such as diabetes mellitus, asthma, heart disease, Alzheimer's disease, depression, headaches, and obesity [4].

Stress causes the release of cytokines such as Interleukin-1 beta (IL-1β), Tumour Necrosis Factor alpha (TNF-α), or IL-6 within the hypothalamus, hippocampus, or prefrontal cortex after exposure to either acute or chronic stress, leading to inflammation of the Central Nervous System (CNS) and a decrease in cognition [5]. Engaging in physical activities like sports, cycling, running, swimming, and other cardiovascular exercises offers students an effective way to cope with stress. Studies have shown that regular exercise helps reduce stress through various mechanisms, and individuals who effectively manage and overcome stress tend to show reduced levels of depression and anxiety, resulting in improved cognitive function [6,7]. In the current era dominated by smartphones, an increasing number of individuals have become addicted to mobile phones due to rapid technological advancements. Consequently, this dependence has resulted in decreased physical activity and a sedentary lifestyle, contributing to weight gain and increased susceptibility to obesity [8]. Physical inactivity leads to a higher BMI in individuals. While physical activity alone cannot maintain BMI and body fat percentage, it does reduce the risk of being overweight and having a high body fat percentage [9]. A higher BMI is also associated with many health risk factors such as hypertension, lipid metabolism disorders, insulin resistance, and other health risks.

BMI is an important factor in assessing cognition [10]. Research has shown that a higher BMI is linked to higher stress levels. Stress releases cortisol, and high cortisol levels are strongly associated with obesity. Additionally, a higher BMI is linked to cognitive decline [10,11]. Physical activity increases an individual's functional vital capacity and helps maintain lung function [12]. Stress often drives people to smoke cigarettes, which can decrease lung function and lead to severe diseases like chronic obstructive pulmonary disease. Impaired lung function is known to cause cognitive decline [13].

The present study focuses specifically on medical students in India, providing insights into a demographic that may face unique stressors and lifestyle challenges. It conducts a comprehensive examination of various factors, including stress levels, cognition, BMI, lung function, and physical activity habits, which is rare in studies of medical students. By highlighting the role of exercise in stress management, the study introduces a potentially innovative approach to addressing stress among this population, particularly in cultures where physical activity may not be traditionally emphasised. The aim of the study was to find out and compare the levels of stress, cognition, BMI, and lung function in exercising and non exercising medical students. The findings could have significant public health implications, informing targeted interventions to improve the well-being of medical students by reducing stress, enhancing cognitive function, and promoting healthier lifestyles.

MATERIALS AND METHODS

This cross-sectional study was conducted between February 2021 and April 2021 in the Department of Physiology, JSS Medical College, Constituent College of JSSAHER, Mysuru, Karnataka, India. Ethical clearance was obtained from the Institutional Ethical Committee with the number JSSMC/IEC/220121/13STS/2020-21 and written informed consent was obtained from all participants prior to the study.

Sample size calculation: The sample size for the present study was calculated using the formula

$$\frac{4pq}{d^2} = \frac{4\times86.23\times13.77}{10\times10} = 48$$

based on a previous study among medical students that reported a stress prevalence of 86.23% [14]. Therefore, the required sample size was determined to be 48. Considering a non response rate of 10%, which equals four participants, the final sample size was calculated as 52 participants. Since the study involved two groups, 52 participants were to be selected from each group. In total, 110 participants were recruited for this study. Based on the inclusion and exclusion criteria, the 110 participants were allocated to either the exercising group (n=55) or the non exercising group (n=55).

Inclusion criteria:

- **Exercising group:** Participants between the ages of 18 and 24 years, who exercise regularly or play sports for at least five hours a week, have normal blood pressure and a normal BMI [15].
- **Non exercising group:** Participants between the ages of 18-24 years, who do not exercise regularly or play sports, have normal blood pressure and a normal BMI.

Exclusion criteria: Participants with any mental disorder, acute illness, smokers, and participants who were on medication or consumed alcohol were excluded from the study.

Study Procedure

The data were collected from participants in the human physiology lab of the Department of Physiology. Social distancing of six feet was maintained, and it was ensured that participants properly sanitised their hands before data collection.

- Information about age, sex, smoking habits, alcoholism, any mental disorder, any acute illness, and whether the participants were on drugs was collected in the personal history. Individuals with smoking habits, mental disorder, alcoholism, any acute illness, or who were on drugs were excluded from the study.
- The weight and height of the participants were measured using a weighing scale and stadiometer, respectively, and the values were entered into Excel sheets. The BMI of the participants was calculated using Quetelet's index [16]. Individuals with a BMI of more than 25 kg/m^2 were excluded from the study.
- Blood pressure was recorded using a mercury sphygmomanometer on the right arm in a sitting posture after ten minutes of rest. A total of three readings were taken, and the average of the readings was calculated. Individuals with hypotension and hypertension were excluded.
- The stress levels of the participants were assessed using the PSS-10, a self-assessment test [17]. The PSS-10 consists of ten questions, with each question worth four marks. A higher score indicates higher stress levels. Stress levels can be categorised as low (0-13), moderate (14-26), and high (27-40) using the PSS-10. Participants were questioned and graded based on their answers according to the PSS-10. The frequency of stress levels was calculated in the two groups and compared.
- The cognition of the participants was evaluated using the Modified Mini-mental State Examination (3MS) [18]. The 3MS test consists of 15 sections and is scored out of a total of 100 marks. A higher score indicates better cognition. Participants were questioned, and a score was assigned based on their answers.
- The lung function of the participants, namely FVC, FEV1 and FEV1/FVC ratio, was measured using an Innotech computerised spirometer [12]. The computerised spirometer utilises a mouthpiece through which the participants exhale and inhale air. Due to the Coronavirus Disease-2019 (COVID-2019) pandemic, a separate single-use disposable pulmonary function test filter mouthpiece (Spirosafe) was employed for each participant to prevent contamination and reduce the risk of COVID-19 transmission. The filter used is 99.99% efficient in preventing contamination. All necessary precautions were taken to avoid contamination. The mouthpiece, along with the filter, was connected to the computerised spirometer, which provided readings after conducting the test using the respiscan software installed on the computer. Participants were instructed to inhale with maximal effort, and exhale forcefully and rapidly with maximal effort into the mouthpiece attached to the computerised spirometer. Participants were guided to exhale for at least three seconds. FVC represents the volume of air exhaled forcefully and rapidly with maximal effort following a maximal inspiration, while FEV1 is the fraction of FVC exhaled during the first second of the pulmonary function test. Following the test, measurements for FVC, FEV1 and FEV1/FVC ratio were recorded.

STATISTICAL ANALYSIS

The values were tabulated in an Excel sheet accordingly. Statistical analysis was conducted using Statistical Package for the Social Sciences (SPSS) software version 25.0 to compare the parameters between exercising and non exercising participants. Quantitative data were expressed in terms of mean and standard deviation. The Student's t-test was applied to determine any association, and the results were considered statistically significant at a p-value less than 0.05.

RESULTS

The mean PSS-10 score of exercising participants (11.36±3.67) was significantly lower than that of non exercising participants (20.71±4.61) [Table/Fig-1].

Variable	Group	Mean	Standard deviation	p-value
PSS-10 score	Exercising	11.36	3.67	<0.001
	Non exercising	20.71	4.61	

[Table/Fig-1]: Perceived Stress Scale 10 (PSS-10) score of exercising and non exercising participants.
Test used: Student's t-test; p-value less than 0.05

In the current study population, 42 individuals (76.36%) who exercised reported low stress levels, while 45 individuals (81.81%) who did not exercise experienced moderate stress levels. Notably, no individuals in the exercising group reported high stress levels, whereas 8 individuals (14.54%) in the non-exercising group reported high stress levels [Table/Fig-2].

Variable			Exercising or non exercising	
			Exercising	Non exercising
PSS-10 categories	Low	Count	42	2
		% within category	76.36%	3.63%
	Moderate	Count	13	45
		% within category	23.63%	81.81%
	High	Count	0	8
		% within category	0.0%	14.54%

[Table/Fig-2]: Categorisation of exercising and non exercising participants into different stress categories as per PSS-10 scale.

The mean 3MS score of exercising participants (97.33±1.73) was significantly higher than that of non exercising participants (94.02±1.40) [Table/Fig-3].

Variable	Group	Mean	Standard deviation	p-value
3MS score	Exercising	97.33	1.73	<0.001
	Non exercising	94.02	1.40	

[Table/Fig-3]: Modified Mini-Mental Status Examination (3MS) score of exercising and non-exercising participants.
Test used: Student t-test; p-value less than 0.05

The mean values of pulmonary functions, namely FEV1 (3.43±0.71 L), FVC (3.88±0.76 L), and FEV1/FVC (87.94±2.73%) in exercisers, were significantly better than the values for FEV1 (3.00±0.67 L), FVC (3.48±0.71 L), and FEV1/FVC (85.86±2.75%) in non-exercisers [Table/Fig-4].

Variables	Group	Mean	Standard deviation	p-value
FVC	Exercising	3.88 L	0.76	0.005
	Non exercising	3.48 L	0.71	
FEV1	Exercising	3.43 L	0.71	0.002
	Non exercising	3.00 L	0.67	
FEV1/FVC	Exercising	87.94 %	2.73	<0.001
	Non exercising	85.86 %	2.75	

[Table/Fig-4]: Pulmonary functions of exercising and non-exercising participants.
Test used: Student t-test; p-value less than 0.05

The mean BMI of exercising participants (21.45±1.43 kg/m^2) was significantly lower than that of non exercising participants (23.03±1.35 kg/m^2) [Table/Fig-5].

Variable	Group	Mean	Standard deviation	p-value
BMI	Exercising	21.45 (kg/m^2)	1.43	<0.001
	Non exercising	23.03 (kg/m^2)	1.35	

[Table/Fig-5]: Body Mass Index (BMI) of exercising and non-exercising participants.
Test used: Student t-test; p-value less than 0.05

DISCUSSION

Cognition, stress, BMI, and lung function were assessed among exercising and non exercising groups of young medical students in the present study. The frequency of stress in medical students is 58.07% as per the present study. Another study showed that 63% of medical students were stressed in a Saudi Arabian Medical College, which showed similar results to this study [19]. Similarly, 42.5% of medical students were stressed in a Mangaluru-based Medical College [20]. The mean PSS-10 score of all participants (n=110) across the groups was 16.04±6.27 in this study. The mean PSS score in a study in Bengal Medical College was 18.26±6.37 in students [21]. The present study is in agreement with similar studies [19-21] conducted earlier, which proves that the majority of medical students are affected by stress.

The PSS-10 score was assessed and compared among exercising and non exercising participants. The mean PSS-10 score of exercising participants was 11.36±3.67 and that of non exercising participants was 20.71±4.61. This indicates that stress was higher in non exercising participants, which was statistically significant. Thus, proving that exercising reduces stress through different mechanisms. One possible mechanism is that with exercise, there is a release of endorphins, which reduces the level of stress hormones like cortisol and adrenaline. Exercise positively influences stress management by modulating hormonal responses and the release of neurotransmitters such as dopamine and serotonin in the brain. These neurotransmitters significantly impact mood and behaviour, ultimately contributing to stress reduction. There is also a probability that exercise serves as a break from stressors [22]. A separate study demonstrated that individuals who did not engage in regular exercise exhibited a more pronounced decline in positive affect following stress-inducing tasks, whereas regular exercisers demonstrated better emotional resilience in both scenarios [6].

In the present study, on cross-tabulation and categorisation of perceived stress, the percentage of non exercising participants in the moderate category was 81.81% compared to 23.63% of physically active participants. The percentage of high-stress levels in non exercising participants was 14.54%, while it was 0% in exercising participants. A similar study conducted on 300 participants has shown the overall prevalence of high-stress levels and low physical activity to be 29.7% and 35%, respectively [23]. The results of the present study are in agreement with the earlier study [23], proving that non-exercisers are prone to developing higher levels of stress.

The mean 3MS score of exercising individuals was significantly higher (97.33±1.73) than that of non exercising participants (94.02±1.40). This indicates that exercising participants have better cognition than non exercising participants, as exercise promotes cognitive and synaptic neuroplasticity [7]. Consistent with the present study findings, other research exploring the relationship between physical activity and cognition in both exercising and non exercising individuals revealed that those who engaged in regular exercise demonstrated higher scores on the Mini-mental Status Examination (MMSE). There was a notable difference (p<0.001) in the scores of individuals of both sexes who exercised compared to those in the non exercising group, with the exercised individuals achieving higher scores [24]. The present study demonstrates that participants with lower stress scores have better cognition, as exercising participants have higher mean 3MS scores and lower PSS scores compared to non exercising individuals with high PSS and lower 3MS scores. A similar study showed significance when comparing stress and cognition, indicating that individuals with higher stress levels scored lower in MMSE than those with lower stress scores [25,26]. This proves that higher stress levels are related to cognitive decline.

In the present study, the mean BMI of exercising participants was 21.45±1.43 kg/m^2, while that of non exercising participants was 23.03±1.35 kg/m^2. The BMI of the exercising participants was significantly lower than that of the non exercising participants, falling within the normal range. However, despite this significance, physical activity alone cannot maintain BMI and body fat percentage but can reduce the risk of being overweight and having a high body fat percentage [9]. In this study, participants who exercised regularly had lower stress levels and BMIs. A similar study indicated that high stress levels are associated with higher BMIs and an increased risk of being overweight and obese [10,11]. Participants who exercised regularly exhibited better 3MS values in this study, suggesting improved cognition. A similar cross-sectional study with middle-aged men showed similar results, indicating that higher BMIs were associated with lower cognitive scores after adjusting for psychosocial parameters [10]. Therefore, regular exercise helps in maintaining a healthy BMI, reducing stress levels, and improving an individual's cognition.

The lung function tests in the exercising group were better than those in the non exercising group in this research. The mean FEV1, FVC and FEV1/FVC of exercising participants were 3.43±0.71 L, 3.88±0.76 L, and 87.94±2.73%, respectively. Meanwhile, the mean FEV1, FVC and FEV1/FVC of non exercising participants were 3.00±0.67 L, 3.48±0.71 L, and 85.86±2.75%, respectively. There was a significant difference between the two groups regarding FVC, FEV1 and FEV1/FVC. The present study demonstrates that exercising participants have higher FVC, FEV1 and FEV1/FVC values, indicating better cognition. Importantly, better lung function is associated with increased cognitive performance [13,27]. This supports the idea that regular exercise improves lung function, thereby reducing the risk of cognitive decline, likely attributed to improved brain oxygenation and reduced inflammation.

Engaging in regular exercise not only enhances students' cognitive abilities but also reduces stress levels, maintains a healthy BMI, and improves lung function when compared to their non exercising peers. Therefore, incorporating recreation and sports into the curriculum for medical students can help them manage stress, improve their physical health, and enhance cognitive functions. Additionally, it can promote teamwork and communication skills, which are valuable in the medical field.

This study has significant clinical implications for medical education and student well-being. It emphasises the issue of stress among medical students and the need for proactive interventions to mitigate its adverse effects on mental health and academic performance. By promoting physical activity as a coping mechanism for stress reduction, educators and healthcare providers can support students in managing stress effectively. Additionally, the study emphasises the negative consequences of sedentary behaviour on physical and mental health, suggesting the importance of educating students about healthy lifestyle habits.

Limitation(s)

The study's cross-sectional design limits the ability to establish causal relationships between exercise habits and the measured outcomes. Longitudinal studies would provide better evidence of the impact of exercise on stress, cognition, BMI, and lung function over time. While the study compares exercising and non exercising groups, there may be other confounding variables, such as diet, sleep habits, or socio-economic status, which could potentially influence the outcomes of interest.

CONCLUSION(S)

The prevalence of stress is notably elevated, especially among medical students who do not exercise regularly. Perceived stress levels are significantly higher in non exercising students compared to their regularly exercising counterparts. The number of students in the moderate to high stress category in the non exercising group is remarkably higher than that in the exercising group. Individuals who exercise regularly have effective stress management, leading to reduced stress levels. Furthermore, the cognitive abilities of the exercising group are better than those of the non exercising group, highlighting the positive impact of consistent physical activity on cognitive well-being. This association suggests that individuals who maintain low stress levels, a healthy BMI, and optimal lung function through regular exercise experience heightened cognitive functioning.

While academic performance is undoubtedly crucial, equal emphasis should be placed on enhancing the quality of life during the years of education. A stress-free environment not only contributes to an improved quality of life but also enhances cognitive performance, shaping future healthcare practitioners to better serve and treat their patients.

REFERENCES

[1] Anuradha R, Dutta R, Raja JD, Sivaprakasam P, Patil AB. Stress and stressors among medical undergraduate students: A cross-sectional study in a private medical college in Tamil Nadu. Indian J Community Med [Internet]. 2017;42(4):222-25. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5682722/.

[2] Lazarus RS. From psychological stress to the emotions: A history of changing outlooks. Annu Rev Psychol [Internet]. 1993;44(1):01-22. Available from: https://www.annualreviews.org/doi/pdf/10.1146/annurev.ps.44.020193.000245.

[3] Saxena SK, Mani RN, Dwivedi AK, Ryali VSSR, Timothy A. Association of educational stress with depression, anxiety, and substance use among medical and engineering undergraduates in India. Ind Psychiatry J. 2019;28(2):160-69.

[4] Mariotti A. The effects of chronic stress on health: new insights into the molecular mechanisms of brain-body communication. Future Sci OA [Internet]. 2015;1(3):FSO23. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5137920/.

[5] Johnson JD, Barnard DF, Kulp AC, Mehta DM. Neuroendocrine regulation of brain cytokines after psychological stress. J Endocr Soc. 2019;3(7):1302-20.

[6] Childs E, de Wit H. Regular exercise is associated with emotional resilience to acute stress in healthy adults. Front Physiol [Internet]. 2014;5:161. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4013452/.

[7] Mandolesi L, Polverino A, Montuori S, Foti F, Ferraioli G, Sorrentino P, et al. Effects of physical exercise on cognitive functioning and wellbeing: Biological and psychological benefits. Front Psychol [Internet]. 2018;9:509. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5934999/.

[8] Coban D. Investigation of the relationship between smartphone addiction and overweight on university students. Ann Med Res. 2019;26(10):2172-76.

[9] Kesavachandran C, Bihari V, Mathur N. Can physical activity maintain normal grades of body mass index and body fat percentage? Int J Yoga. 2009;2(1):26-29.

[10] Cournot M, Marquié JC, Ansiau D, Martinaud C, Fonds H, Ferrières J, et al. Relation between body mass index and cognitive function in healthy middle-aged men and women. Neurology [Internet]. 2006; 67(7):1208-14. Available from: https://pubmed.ncbi.nlm.nih.gov/17030754/.

[11] Chen Y, Liu X, Yan N, Jia W, Fan Y, Yan H, et al. Higher academic stress was associated with increased risk of overweight and obesity among college students in China. Int J Environ Res Public Health [Internet]. 2020;17(15):5559. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7432099/.

[12] Cheng YJ, Macera CA, Addy CL, Sy FS, Wieland D, Blair SN. Effects of physical activity on exercise tests and respiratory function. Br J Sports Med [Internet]. 2003;37(6):521-28. Available from: https://bjsm.bmj.com/content/37/6/521.

[13] Pathan SS, Gottesman RF, Mosley TH, Knopman DS, Sharrett AR, Alonso A. Association of lung function with cognitive decline and dementia: The Atherosclerosis Risk in Communities (ARIC) Study. Eur J Neurol. 2011;18(6):888-98.

[14] Chandan N, Sherkhane MS. Assessment of stress and burnout among medical graduates using PSS-14 and MBI-SS scales. National Journal of Research in Community Medicine. 2017;6(1):044-049.

[15] WHO. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser [Internet]. 2000;894:i-xii, 1–253. Available from: https://pubmed.ncbi.nlm.nih.gov/11234459/.

[16] Khosla T, Lowe CR. Indices of obesity derived from body weight and height. Br J Prev Soc Med [Internet]. 1967;21(3):122-28. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1059084/.

[17] Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: S. Spacapan & S. Oskamp (Eds.), The Social Psychology of Health. Newbury Park, CA: Sage, 1988; 31-67.

[18] Teng EL, Chui HC. The Modified Mini-Mental State (3MS) examination. J Clin Psychiatry [Internet]. 1987;48(8):314-18. Available from: https://pubmed.ncbi.nlm.nih.gov/3611032/.

[19] 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 [Internet]. 2011;29(5):516-22. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3225114/.

[20] Brahmbhatt KR, Nadeera VP, Prasanna KS, Jayram S. Perceived stress and sources of stress among medical undergraduates in a private medical college in Mangalore, India. IJBAR. 2013;4(2):128-36.

[21] Chakraborti A, Ray P, Sanyal D, Thakurta RG, Bhattacharayya AK, Mallick AK, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. Indian J Psychol Med [Internet]. 2013;35(1):29-33. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3701356/.

[22] Fernandes J, Arida RM, Gomez-Pinilla F. Physical exercise as an epigenetic modulator of brain plasticity and cognition. Neurosci Biobehav Rev [Internet]. 2017;80:443-56. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28666827.

[23] Raj S. A study on physical activity and stress levels among undergraduate medical students. J Med Sci Clin Res. 2018;6(3):663-68.

[24] Nemati Karimooy H, Hosseini M, Nemati M, Esmaily HO. Lifelong physical activity affects mini mental state exam scores in individuals over 55 years of age. J Bodyw Mov Ther. 2012;16(2):230-35.

[25] Freidl W, Schmidt R, Stronegger WJ, Irmler A, Reinhart B, Koch M. Mini Mental State Examination: Influence of sociodemographic, environmental and behavioural factors, and vascular risk factors. J Clin Epidemiol. 1996;49(1):73-78.

[26] Leng Y, Wainwright NW, Hayat S, Stephan BC, Matthews FE, Luben R, et al. The association between social stress and global cognitive function in a population-based study: The European Prospective Investigation into Cancer (EPIC)-norfolk study. Psychol Med [Internet]. 2012;43(3):655-66. Available from: https://www.cambridge.org/core/journals/psychological-medicine/article/div-classtitlethe-association-between-social-stress-and-global-cognitive-function-in-a-population-based-study-the-european-prospective-investigation-into-cancer-epic-norfolk-studydiv/1C55AA7F81BC542DC694A7BB2075A27E.

[27] Gu C, Ma M, Xu J, Yuan W, Li R, Guo H, et al. Association between pulmonary ventilatory function and mild cognitive impairment: A population-based study in rural China. Front Public Health. 2022;10:1038576.

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