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General

Stress among Medical Students Presented with an EEG at Suranaree University of Technology, Thailand

Areerat Siripongpan[1], Theeranit Namkunee[1], Peerapong Uthansakul[2], Talit Jumphoo[2], Pumin Duangmanee[2]

[1] Institute of Medicine, Suranaree University of Technology, Nakon Ratchasima, Thailand, [2] Institute of Engineering, Suranaree University of Technology, Nakon Ratchasima, Thailand

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Purpose

A high level of stress among medical students is perceived as stress caused by strenuous medical programs and medical school is an extremely stressful environment, to begin with. For this reason, identifying stressors facing medical students is expected to enhance medical school lecturers' understanding, leading to a provision of assistance for adequate supervision. The purposes of this study were to investigate stress levels in daily life and the electroencephalogram (EEG) characteristics during daily life and pre-examination period of 2nd-year medical students at Suranaree University of Technology (SUT), Thailand, and to compare the EEG characteristics between these two periods.

Methods

Medical Student Stressor Questionnaire (MSSQ) was used as a research instrument to collect data from sixty medical students. After that, EEG was administered in two periods for these studies (in daily life (baseline) and pre-examination 1 week). Paired t-test was used for analyzing the difference in the EEG characteristics in the 2 periods.

Results

The results indicated that the stress levels among medical students were mild (3.33%), moderate (53.33%), and high (43.33%). Academic Related Stressor (ARS) was found to be the main cause of stress among the subjects. All had a beta wave in 2 periods.

Conclusion

In conclusion, stress among medical students can alter brain function as measured by EEG. The findings could assist medical schools in better understanding medical students' stress levels and planning how to teach in order to improve student achievement.

INTRODUCTION

Distinct types of stress have different meanings.[1] It can relate to real-life events or situations such as unemployment or divorce. It also refers to the ways in which people think, feel, and react to things. Others define stress as symptoms that emerge when a person's demand for stimuli from the environment outweighs their ability to control those stimuli or symptoms that arise in response to an unspecific danger.[2,3]

Prior research indicated that medical students experience more stress than the general population and have high-stress levels. When there was poor sleep, eating habits, a lack of capacity to manage time, dissatisfaction with social life and academic experience, and limited family support, stress levels were higher.[4,5] High levels of stress lead to negative thoughts and make it difficult to learn.[6] Females had a higher prevalence of stress than males. Perceived stress was linked to ethnicity and intrapersonal characteristics. The relationship between stress levels and gender reveals that the stressful ones have a significant impact on the feminine gender.[7–10] Relationship concerns, exams, students' personality traits, having difficulty in interactions with those around them, and disagreements with others are all stressful for medical students, according to another study.[7,11–13] Medical students have also been found to be stressed by the patient's exposure to illness or death, as well as inter/intra-personal conflict and the inability to deliver acceptable responses to the patient.[14] These students are more concerned about their future, have a higher level of anxiety about their graduation test results, the failure of medical school management, a lack of career planning aid, and evaluation operational demands.[5,15] Furthermore, stress has an impact on the well-being of medical students who are pursuing medical education. Stress in medical school is more likely to predict mental health issues later in life, which require treatment.[16,17] To date, a variety of techniques have been employed to assess medical students'

stress levels. Medical Student Stress Questionnaire (MSSQ) is an intriguing instrument for measuring stress.[18,19] The central nervous system and physiological responses to stress are also important.[20] In a study using electroencephalography (EEG) to detect stress in students, they discovered that EEG has a substantial link with stress, and that EEG is a non-invasive technique tool for measuring stress.[17] Because the EEG dominates beta frequencies, the electrical activity in the brain (measured by EEG) has exhibited a desynchronized pattern between stress and strongly stimulated emotions. The EEG has demonstrated alpha wave in a non-stressful state.[21] The stress of normal medical students was measured by changes in brain waves during the examination period, which revealed changes in brain waves when medical students took the exam.[22]

This study focused on the significance of stress among medical students. Medical students in their second year are studying medical topics for the first time. As they tackle increasingly challenging subjects and more specifics, they must modify how they split their study time. It has the potential to put them in a stressful situation. As a result, the researchers want to examine the electroencephalogram (EEG) characteristics of 2nd-year medical students during daily life and pre-examination at Suranaree University of Technology (SUT) in Thailand. The outcomes of this study can be used for instructional purposes and as a stress measurement tool. Medical schools can also use this material to help their students.

METHODS

1. PARTICIPANTS

A cross-sectional study was conducted in the Institute of Medicine at the Suranaree University of Technology in Thailand, from March to April 2019. All participants (n=60) replied. The Research Ethics Committee at Suranaree University of Technology (Thailand) gave this study their official ethical permission, Approval EC COA No. 99/2561. All subjects have given their written consent.

2. ASSESSMENT TOOLS

A questionnaire used as a research instrument to collect data from participants contains sub-parts as follows:

1) Sociodemographic data (gender, age, habitat, doctor of medicine program, underlying disease, and grade point average)

2) Medical Student Stressor Questionnaire (MSSQ).[23] MSSQ contains 40 items (different stressor groups. The MSSQ can be divided into 6 groups: Academic Related Stressors (ARS), Social Related Stressors (SRS), Intrapersonal and interpersonal Related Stressors (IRS), Teaching and Learning-Related Stressors (TLRS), Drive and desire Related Stressors (DRS), and Group Activities Related Stressors (GARS). All scores were summarized. MSSQ scoring interpretation can be seen in Table 1.

EEG was performed in a regular research environment after medical students completed the questionnaires. There was no examination stress, referred to as "baseline EEG." The EEG was then repeated for a week before the examination, called "pre-examination stress EEG."

Table 1. MSSQ interpretation

Scores Range	Interpretation
0.00 – 1.00	Mild
1.01 – 2.00	Moderate
2.01 – 3.00	High
3.01 – 4.00	Severe

Table 2. EEG frequency bands

Frequency	EEG rhythm	Neural functions and behaviors
~ 4 Hz	Delta	Sleep (non-REM)
4 – 8 Hz	Theta	Sleep, drowsiness
8 – 13 Hz	Alpha	Physical relaxation, mental inactivity
13 – 30 Hz	Beta	Mental activity, arousal, strained
> 30 Hz	Gamma	High-level information processing

An electroencephalogram (EEG) is a one-minute recording of electrical activity at the scalp's surface. From high to low frequency, waves are split into four frequency bands: delta, alpha, beta, and gamma.[24] As indicated in Table 2, each brand has its unique characteristics and reflects distinct functions of the brain and neurological system. Each frequency was classified and analyzed using power spectrum analysis. The EEG energy of each frequency was visualized using brain map analysis.

3. STATISTICAL ANALYSIS

Sociodemographic variables were reported with descriptive statistics. Statistical software SPSS, version 17, was used for statistical analysis. The different obtained EEG waves were theta (4 – 8 Hz), alpha (8 – 13 Hz) and beta (13 – 30 Hz), and gamma (> 30 Hz). A paired t-test was used to compare the frequency of EEG in different settings.

RESULTS

A total of 60 participants completed the questionnaire. Most of them were females (n=32, 53.33 %) and 28 participants (46.67%) were males. Table 3 exhibited that the average age of the participants was 19.93 years (S.D. = 0.76).

The ARS of 2.46 (High), IRS of 1.70 (Moderate), TLRS of 1.66 (Moderate), SRS of 1.89 (Moderate), DRS of 1.31 (Moderate), and GARS of 1.98 (Moderate) were the stressor scores measured by MSSQ. Medical students had the highest average stressors in academic-related stressors, as illustrated in Figure 1.

The MSSQ was divided into 4 categories (mild, moderate, high, and severe stress). The stress levels among medical students were mild (n=2, 3.33%), moderate (n=32, 53.33%), and high (n=26, 43.33%).

According to Table 4, the mean frequency of EEG waves in everyday life (baseline EEG) was compared to EEG during

Table 3. Demographic data Demographic and clinical features of respondent

Characteristics	N	%
Gender		
Male	28	46.67
Female	32	53.33
Average Age (Years) ± S.D.	19.93	0.76
Habitat		
Nakhon Ratchasima	21	35.00
Chaiyaphum	9	15.00
Buriram	11	18.33
Surin	14	23.33
Others	5	8.33
Doctor of Medicine Program		
Collaborative Project to Increase Production of Rural Doctor (CPIRD)	38	63.33
One District One Doctor (ODOD)	16	26.67
Consortium of Thai Medical Schools (COTMES)	6	10.00
Underlying disease		
No	56	93.33
Yes	4	6.67
Grade point average	3.48	0.36
2.01 - 2.50	2	3.33
2.51 - 3.00	2	3.33
3.01 - 3.50	22	36.67
Above 3.50	34	56.67

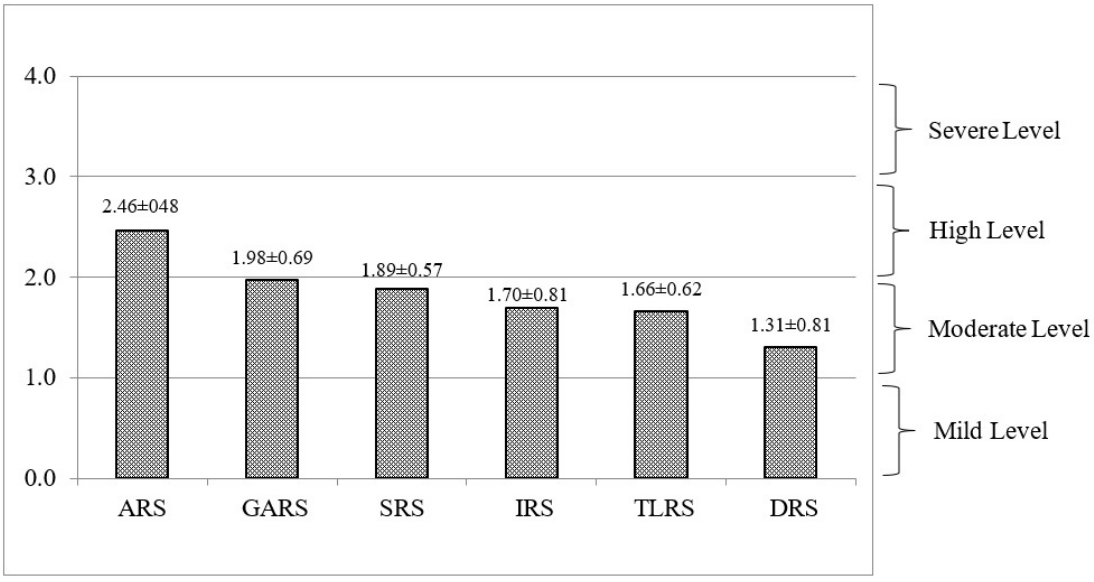

Figure 1. The average Stressors of medical students

Note : Academic Related Stressors: ARS, Group Activities Related Stressors: GARS, Social Related Stressors: SRS, Intrapersonal and interpersonal Related Stressors: IRS, Teaching and Learning-Related Stressors: TLRS, Drive and desire Related Stressors: DRS

1 week of pre-examination stress. The baseline EEG showed beta wave in the mild and moderate stress groups, while the EEG wave during assessment stress 1 week showed beta wave. The mild stress group exhibited a statistically significant difference in frequency. However, the difference in the moderate group was not statistically significant.

DISCUSSION

The purpose of this study was to examine how stress affects medical students and how it affects their brain waves in everyday life and one week before the exam. Medical students have dealt with academic and psychosocial difficulties

Table 4. Comparison of mean frequency of EEG in different setting

Level of stress (MSSQ)	baseline		pre-examination stress		t	p - value
	Mean	S.D.	Mean	S.D.		
Moderate	**13.34**	**6.32**	**15.97**	**7.18**	**-3.503***	**0.001**
High	14.38	6.25	14.65	5.3	-.422	0.677

in the past. They have also recognized studies and exams as key stressors, as well as their bodily effects.[25] Exams have been proven in earlier studies to be a common source of stress among medical students.[5] The MSSQ was used in this study to categorize stressors experienced by medical students. The findings indicated that they had the highest levels of academic stress, which was consistent with prior research that revealed that academic stress was the most common source factor for nearly two-thirds of students, followed by teaching, learning, and inter/intra-personal stressors.[12,14] From MSSQ, the stress level was categorized into four groups using the MSSQ (mild, moderate, high, and severe stress). The numbers for mild, moderate, and high-stress levels were found to be 2, 32, and 26, respectively. The majority of medical students were under moderate stress, and none were under high stress. This was lower than the proportion reported by medical students at the Nigeria's University of Calabar. However, these findings cannot be compared to those of the above-mentioned study, which investigated preclinical and clinical students. As medical training progresses, stress levels will rise.[9] In contrast to the previous study, medical students had extremely high-stress levels and their stress levels were higher when they had poor sleeping, eating, and time management habits were dissatisfied with their social and academic experiences and had inadequate family support.[4,5] As a result, the medical school curriculum should be designed to reduce academic stress and manage it so that better outcomes in terms of discomfort can be reached.[12]

In addition, the results revealed that students were stressed, but they could adapt to the situation, as evidenced by EEG testing. The characteristics of EEG frequency in medical students have been discovered when researching changes in brain electricity. There was no difference between the two scenarios (normal daily life and 1 week before examination). The presence of beta waves indicated that the brain was active, allowing it to focus on tasks and aiding short-term memory.[26] The ECG in the moderate and high-stress groups was found to be the beta wave in both regular everyday life and one week before the students took the exam. There has been no statistically significant change. Unlike Jena's study, where a significant shift was discovered. Students' stress levels showed that they had a level of stress that can help them adjust and resist stress, a trait known as adaptability.[22] As a result, at the time of the exam, the researchers should conduct a comparative investigation. Because it was the most accurate way to assess stress. The EEG in the normal range and the pre-test were found to differ in this investigation. This could be related to the fact that students were already stressed during class. It also examined changes in electroencephalography (EEG) response when stressed students with an elevated mindset. People can develop a stress-relieving mindset through health-care education. An individual's EEG will demonstrate that they are more responsive in stressful conditions if they have this mindset. As a result, encouraging people to adopt this mindset will lessen the harmful effects of stressful events, such as health deterioration.[27,28] As a result, different stress management techniques should be taught to medical students in order to increase their ability to cope with a difficult professional course.[29]

Furthermore, the medical school should work to improve students' connections, which may help to reduce the stress caused by loneliness, social isolation, and interpersonal conflict. The importance of a stressor should be assessed in each school, taking into account the influence of its unique situation.[4] To avoid such occurrences, preventive mental health care might be made an intrinsic element of routine clinical services for medical students, particularly in their early academic years.[7] As a result, our findings point to the need for more research, possibly employing novel approaches like the EEG analysis methodology, as well as stress management.

CONCLUSION

By measuring changes in brain waves, it has been discovered that medical students have considerable academic stress and that their height increases throughout the exam. According to the findings of this investigation, there was no change in EEG features. However, there was a statistically significant change with beta wave in the moderate group. The brain was activated, according to the characteristics. It has been demonstrated that student stress helps to increase learning in the brain, which can assist medical teachers in better understanding student stress and guiding strategies to improve the academic context, which is critical for student accomplishment.

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