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Effect of Stress on Academic Performance among Undergraduate Medical Students, a Follow-up Study

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Abstract

Background

Studying medicine is perceived as being stressful, and a high level of stress may have a negative effect on cognitive functions and learning.

Objectives:

To determine the effect of stress on the academic performance of medical students, as well as the prevalence of different forms of stress among medical students.

Subjects and Methods:

A follow up study comprising a questionnaire survey, The Medical Student Stressor Questionnaire (MSSQ), offered to the same student cohort to complete at 2 time- points, at their third- and sixth-year medical school, in 2019 and 2022 respectively. The study included 652 students who completed the questionnaire twice. The predictors for significant impact of demographic factors on stressors and the correlation between students score and various stressors were studied. Statistical analysis was performed to compare MSSQ scores between third- and sixth-year data.

Results:

Results showed a significant difference between student scores at the academic time-point compared to their scores at the clinical time-point (p= 0.035). A significantly higher percentage of severe stress was found among students at their clinical point compared to those of their academic point as regards to all forms of stress except the academic related stress. Whereas a significantly lower percentage of mild to moderate stress was found among students as regards to all forms of stress except the academic related stress. Only academic related stress was negatively correlated to students' scores. All other stressors studied were positively correlated to students' scores. All studied demographic factors have significant impact on stressors ($P < 0.05$).

Conclusions:

Over time, medical students developed more severe stress related to all forms of stress except the academic one. Reasons behind this decreased academic stress over the years need to be identified with further studies.

Keywords:

Undergraduate, medical students, Stress, MSSQ, academic performance

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Introduction

Studying medicine is perceived as being stressful. Stress can be defined as the sum of physical, mental and emotional tensions or strains that are experienced by a person [1]. The endocrinologist Hans Selye employed the term "stress" for representing the effects of any element that gravely threatens homeostasis; which signifies keeping our internal milieu constant despite a changing environment. The term "stressor" refers to the actual or perceived threat to an organism which will respond to it by a "stress response" [2]. Stress response is characterized by manifestations of mental and physical strain, as depression or hypertension [3].

Selye has published a model of stress which classifies stress into eustress and distress. Eustress enhances function (physical or mental), whereas distress is a persistent stress that has not resolved by coping mechanisms or adaptation and may lead to anxiety or depression [4].

Research established that chronic exposure to stress leads to physical, mental and emotional disturbance of students [5,6], such as sleep and appetite disorders, decreased attention, diminished academic achievements, low self-esteem of students and finally affects students' personal growth [7]. On the other hand, stress can lead to enhanced performance which could be caused by either the environmental context [8] or students adopting mechanisms to cope with stress [9].

There are multiple factors influencing stress among medical students [10]. Previous research demonstrated that during their undergraduate years, medical students experience stress [11, 12] that increases with years [13], and can be related to matters including, financial or social issues, health problems, or academic difficulties [14]. Studies indicated that early year's medical student's stress relates to academic factors more than social factors [15]. sources of academic stress for students may include; tests and exams, heavy workload, content heavy subjects and difficulty in understanding such content, inability to manage time, poor marks and deficient skills in medical practice [16].

Considering that some stressors may have a significantly different rank compared to others [17,18], this study aimed at determining the effect of stress on the academic performance, as well as the persistence or progression of different forms of stress among medical students along 3 years.

Subjects and Methods

A cross sectional follow up study was carried out during the period of academic year 2019 for third year medical students through academic year 2022 as they become on the sixth year, Faculty of Medicine, Zagazig University, Egypt. The timing of the data collection was crucial and selected to be in the winter vacation between the two semesters. A comprehensive sample of all students was targeted in this study. Out of total 722 student starts the first questionnaire and enrolled in the study, only 652 students completed the second questionnaire and were included in Data analysis (who completed the questionnaire twice). The validated Medical Students Stressor Questionnaire (MSSQ) was used for third year medical students, and repeated on their sixth year [19]. The purpose, of the study was explained to the respondents and students were invited to be included in the study voluntarily and anonymously. These students were given codes and they were identified by them all through the study. In the first invitation to fill out the questionnaires, these codes were provided to the students and kept in their files and after two years, the same codes were sent with the invitations and they were asked to link with their same previous input. Ethics Review Committee reviewed and study was waived. Iinformed consent was obtained from the students to participate in the study after full explanation of the process of participation and the freedom to withdraw at any time. Since the students represent a vulnerable group, it was ensured that the research group are not among the teaching staff of these students or had no direct contact with any of them.

The MSSQ grouped stressors into six domains: Academic related stressors (ARS), Intrapersonal and interpersonal related stressors (IRS), Teaching and learning-related stressors (TLRS), Social related stressors (SRS), Drive and desire related stressors (DRS) and Group activities related stressors (GARS) [19].

Mild score denoting that it does not cause any stress. Even if it does, it just causes mild stress. Moderate score indicates that it reasonably causes stress. However, it can be managed well. High score indicates that it causes a lot of stress. The emotions seem to be disturbed by it. The daily activities are mildly compromised due to it. Sever score indicates that it severely causes stress. It disturbs emotions badly. The daily activities are compromised due to it.

Data about the age in years, score gained previous year, and marital status was also obtained.

Statistical Analysis

Data was entered and analysed using SPSS version 22.0. Means (± SD) were computed for continuous and proportions for categorical variables. We grouped the questionnaire results into two groups, mild/moderate and high/severe, for statistical comparison between the two-year scores. Kendall's Correlation was used to find out the relation between students' score and various stressors. McNemar test was used to find the difference between third- and sixth-year stress level. To control for potential confounding, multivariate analyses

forwarded stepwise (Wald) method were conducted to determine the independent predictors of stressors. For each variable, adjusted prevalence odds ratio (OR), and the 95% CI were presented and computed directly from the logistic regression. The level of statistical significance was defined as $P \leq 0.05$.

Results

Only 652 students completed the second questionnaire and were include in data analysis [51.4% males (335/652) and 48.6% (317/652) females] who answered the questionnaire twice: the first during the third year and the second during the sixth year. Their mean age (SD) of enrolled students during their third year in years was 19.5 (0.95) and during the sixth year was 22.3(1.67). Only 12.6% (82/652) was ever married during third year with slight increase to 15.6% (102/652) during their sixth year.

There was a significant change of the score of the studied students; where p= 0.035. (Figure1), there is a significant increase in the "fair", "very good" and "excellent" scores while there was a significant decrease in "Good" score when the sixth-year students were compared to the third-year students' scores.

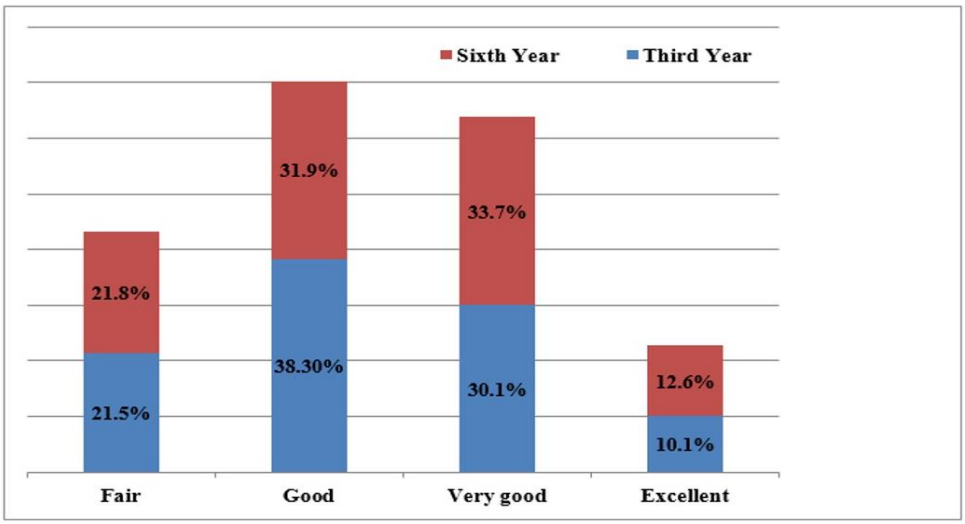

Fig. 1: Distribution of the studied students according to their academic grades obtained in the previous year

Figure 2 illustrates significant change of the percentages of all forms of stressors from the third year towards sixth year either decreased or increased. The decreased stressors percentages were: severe academic related stressor (from 53.7% to 23.9%, p=0.000), mild to moderate interpersonal related stressors (from 70.9% to 61.0%, p=0.000), mild to moderate teaching and learning related stressors (from 64.1% to 54.9%, p=0.015), mild to moderate social related stressors (from 76.7% to 59.2%, p=0.000), mild to moderate drive and desire related stressors (from 80.7% to 66.3%, p=0.001) and mild to moderate group activities related stressors (from 67.8% to 57.4%, p=0.000). The increased severe and high-level stressors were: interpersonal related stressors (from 29.1% to 39.0%, p= 0.000), teaching and learning related stressors (from 35.9% to 45.1%, p= 0.015), social related stressors (from 23.3% to 40.8%, p=0.000), drive and desire related stressors (from 19.3% to 33.7%, p= 0.001) and group activities related stressors (from 32.2% to 42.6%, p= 0.000). Also, mild to moderate academic stressors has increased from 46.3% to 76.1% (p=0.000).

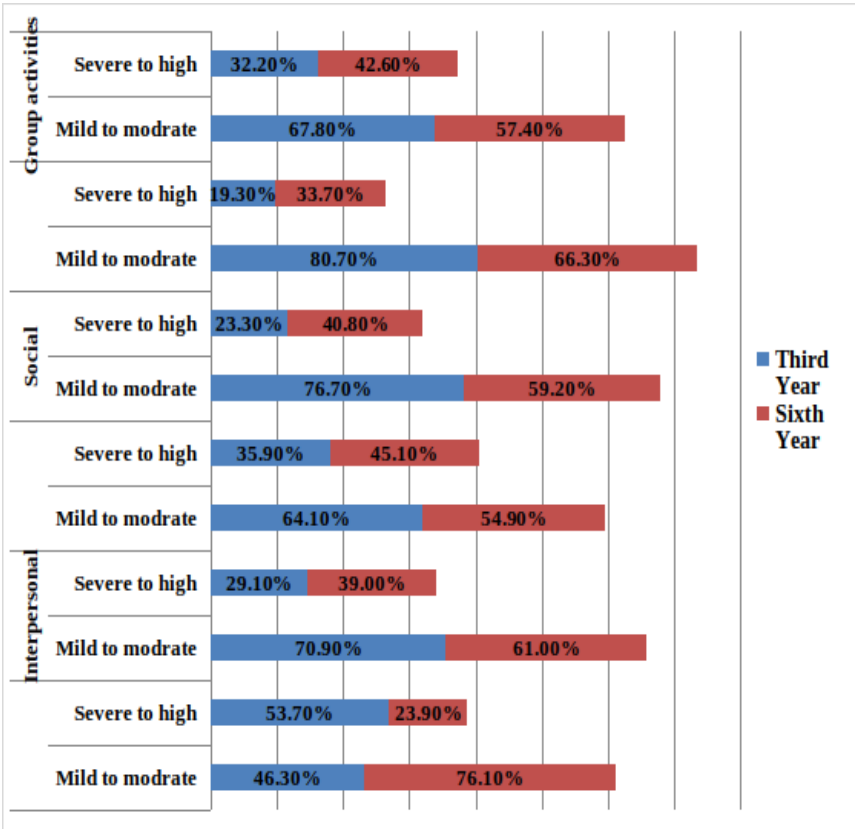

Fig.2: Change of the percentages of all forms of stressors from the third year towards sixth year

N.B. p-value significant at ≤ 0.05 level

The present work reveals significant correlation between students' scores and the following stressors: academic (r= -0.220, p=0.029), interpersonal (r= 0.100, p= 0.037), social (r= 0.342, p= 0.013), derive and desire (r= 0.128, p= 0.029) and group related stressors (r= 0.215, p= 0.000). (Table 1)

Table 1: Correlation between students score in each section of the questionnaire and various stressors

	Correlation Coefficient	Significance
-Academic related stressor	-0.220*	0.029
-Interpersonal related stressor	0.100*	0.037
-Teaching and learning related stressor	0.125	0.056
- Social related stressor	0.342*	0.013
- Derive and desire related stressor	0.128*	0.029
- Group related stressor	0.215**	0.000

*Correlation is significant at the 0.05 level (two tailed).

** Correlation is significant at the 0.01 level (two tailed).

The predictors for significant impact of demographic factors on stressors were sex, age, marital status and score (Table 2)

Table 2: Multivariate logistic regression analysis of predictors for significant impact of demographic factors on stressors

	KAP#		
	OR	95% CI for OR	*p*-value
Sex	2.5	1.8-2.9	0.014*
Age	5.6	3.2–9.8	0.002*
Marital status	3.7	3.3-4.8	0.001*
Score	4.1	1.3–5.9	0.010*

OR = odds ratio; CI = confidence interval; * P value is significant if P < 0.05.
Dependent variable encoding: negative = 0, positive = 1
#R2 =0.786

Discussion

The medical student is exposed to various stressors in the undergraduate phase which is particularly challenging in the medical field [20]. In Egypt; local data about psychological morbidity among medical students are scarce. Results of two research studies suggest that anxiety and depression have reached high rates among medical students [21, 22]. Many studies suggested carrying out a study with a cohort of students investigating their stress levels at different time periods, as well as the associated factors [23, 24]. The present study is the first follow up study that is carried out in Egypt for this purpose.

The present study showed a significant increase in the "fair", "very good" and "excellent" scores among students at their clinical point compared to those of their academic point (figure 1), which concurs with the significantly lower percentage of severe academic related stress at the clinical point in contrary to all other forms of stress (figure 2). Academic related stressors refer to any university, scholastic, educational or student events causing students to feel stressed [25]; 46.30% of 3rd year students experienced mild to moderate ARS compared to 76.10% of the 6th year students, while severe ARS was experienced by 53.70 % of 3rd year students compared to and 23.90% of the 6th year students. These findings oppose other studies findings reporting that medical students' major stressors were academic related [17, 18, 25]. In fact, this can be justified by the fact that as the medical students progress from academic to clinical years, they change perspective and start to experience pressure specific to Medicine beside the general pressures, placing their academic concern in a less stressful rank. The review of Shauna et al., (2000) supports this justification as it reports that medical trainees experience Medicine-specific pressure such as life and death matters and 24-hour schedules alongside with the regular stressors as, confidence deficit, economic issues, fatigue and interpersonal stressors; claiming for a sensitive and specific measurement tool specially designed for this population to be appropriate to the particular demands of this discipline [26].

Furthermore, only academic related stress was negatively correlated to students' scores, all other stressors were positively corelated to students' scores (table 1). Therefore, this study may sustain the concept that enhancement of learning can occur with an optimal level of stress, while health problems can result from excess stress [27], in other words; stressors other than academic might be considered as motivating elements.

In this study it appears from the decreased ARS along the years that students developed some coping strategies to overcome ARS. Shauna et al., (2000) stated that stress experienced by students develops during the transition from graduating high school to university, leaving their comfort zone, and that physiological and psychological adverse effects may result from maladaptive behaviours. Students deal with this transition in different coping ways; either positive ways that might include emotional support, physical activity, prayers, strategizing, positive thinking etc., or in negative ways like self-criticism, negative expression, addiction etc. and when students choose to react to stress in positive ways this leads to healthy outcomes of physical and mental clarity and wellbeing. This appears in the present study as a positive correlation between student scores and all types of stress except the ARS that probably was avoided by students in their clinical years as a strategy to overcome the known adverse effect of this specific type of stress, whereas all other types of stress appear to have been playing a motivational role as they were increasing along the years and positively corelating with student scores.

Interpersonal related stressors refer to stressful episodes between two or more individuals that involve fights, arguments, negative attitudes, an uncomfortable pressure during a talk or an activity, and concern about hurting

somebody's sentiments [28]; 70.90% of 3rd year students experienced mild to moderate IRS compared to 61% of 6th year students while 29.10 of 3rd year students experienced severe IRS compared to 39% of the 6th year students. This significant increase of IRS among the 6th year students should be addressed, as there is evidence that the interpersonal stress may lead to grave consequences. A high score in this domain is a potent predictor of suicidal ideation [29].

Medical curriculum is very stressful leading to many negative outcomes [30]. Severe stress related to Teaching and learning has also increased among the 6th year students; 64.10% of 3rd year students experienced mild to moderate IRS compared to 54.90% of 6th year students while 35.90 of 3rd year students experienced severe IRS compared to 45.10% of the 6th year students [19].

Social related stressors generally relate to free time with friends and family, working with public/ patients, working interruption by others. They refer to any form of societal and community relationships that can cause stress. Severe SRS has also significantly increased among the 6th year students; 76.70% of 3rd year students experienced mild to moderate IRS compared to 59.20% of 6th year students while 23.30 of 3rd year students experienced severe IRS compared to 45.80% of the 6th year students. This may imply that studied students had difficulty in spending time in community and social activities [25].

Drive and desire related stressors generally relate to reluctance to study medicine due to many reasons. It refers to any force (internal or external) that influence one's thoughts, emotions, attitude and behaviour, consequently causing stress [30]. Severe Drive and desire related stressors has also significantly increased among the 6th year students; 80.70% of 3rd year students experienced mild to moderate IRS compared to 66.30% of 6th year students while 19.30 of 3rd year students experienced severe IRS compared to 33.70% of the 6th year students. This might be due to demotivation; as this finding in the 6th year is unlikely to be caused by the other possible causes of this type of stress such as not being one's choice to study medicine for example.

Group activities related stress (GARS) generally relates to participation in group presentations or discussions. Severe GARS has also significantly increased among the 6th year students; 67.80% of 3rd year students experienced mild to moderate IRS compared to 57.40% of 6th year students while 32.20 of 3rd year students experienced severe IRS compared to 42.60% of the 6th year students. According to Muhamad and Ahmad (2010), those perceiving it as causing moderate stress, have a risk as double as high than those who perceived it as causing mild to moderate stress in developing distress. Therefore, the significant increase in severe GARS found in this study might elevate the risk of distress even more.

Limitations

The study did not investigate the coping strategies used by the students to be able to overcome different types of stress. This would have clarified how students of this cohort managed to alleviate academic related stress, whereas all other types of stress became significantly severe.

Also, other independent factors affecting students' stress such as accommodation (if they are native to the city or from another one), living at their own houses versus dorms, and living with their families versus families abroad/to another town, financial status, being Native to the country versus international student, all of these are data that we recommend doing them in future studies.

Conclusion:

Over time, medical students in this study developed more severe stress related to all forms of stress except the academic one. Thus, approaching the end of clinical years of study, academic stress is the only form of stress that decreases. There is a persistent increase of all other forms of stresses. Reasons behind this decreased academic stress over the years need to be identified. Stressors other than academic might be considered as motivating elements. It is essential for educators in the medical field to be aware of causes, levels and prevalence of different types of stress among medical students at different time points of their study period, as it affects not only their health but their academic achievement as well. Being a follow up study enabled observing the perceived stress at two critical points of time ensuring valid temporal results, therefore avoiding other studies limitations; carrying out their studies at one point of time, thus limiting the ability of generalizing their findings to other periods of time and threatening the temporal validity of the study.

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Ethical approval:

An ethical approval number 676 in 1-Oct-2024 was obtained from the corresponding university.

Conflict of interest:

No conflict of interest among all coauthors and no other relationships or activities that could appear to have influenced the submitted work.

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