

Psychological Determinants of Academic Success in Anatomy: The Interplay of Anxiety, Depression, and Self-Esteem on Anatomy Examination Scores among Second-Year Medical Students

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Abstract

Objective: This study was conducted to determine the prevalence, inter-relationships, and determinants of self-esteem, anxiety and depression, and their impact on academic performance in Anatomy among second-year medical undergraduates of Rajarata University of Sri Lanka (RUSL).

Methods: An analytical cross-sectional study was conducted among 184 second-year students selected based on total population sampling strategy. Data collection was done using a self-administered questionnaire containing GAD-7, Beck's Depression Inventory (BDI) and Rosenberg Self-esteem Scale, along with questions to gather demographic information, Anatomy modular assessment grades and students' perceptions. Data were analyzed using Pearson correlation, t-test and ANOVA.

Results: Among 184 participants, majority (65.8%) were females. Anatomy final score ranged from 26.69 to 76.34 with a mean of 55.56 (± 8.48). Female students performed significantly better than male students ($p < 0.05$). Mean scores for self-esteem, anxiety and depression were 28.14 ± 3.47 (scale 10-40), 6.33 ± 4.07 (scale 0-21), and 9.66 ± 7.46 (scale 0-63), respectively, with no significant gender differences. Self-esteem correlated negatively with anxiety ($r = -.336$, $p < 0.001$) and depression ($r = -.355$, $p < 0.001$), and positively with Anatomy final score ($r = .245$, $p = 0.001$). Anxiety correlated positively with depression ($r = .570$, $p < 0.001$). Significant association of depression was noted with the economic status and English language proficiency. Majority (71.7%) reported frequent module-based exams affected mental health. Peer support (83.7%) and faculty/staff support (95.1%) were perceived positively.

Conclusion: High self-esteem correlated with better performance in Anatomy and lower levels of anxiety and depression. Though severe psychological distress is uncommon, perceived pressure from frequent module-based exams and socioeconomic factors call for institutional review and targeted mental health support.

Keywords: Academic Performance; Anatomy Education; Mental Health

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Introduction

Medical education programs are highly demanding creating significant stress on students that influences their physical and psychological well-being as well as their academic performance. Students' academic achievements and their mental health are of great importance because these not only affect their own wellbeing but also the quality of care they provide to patients as medical trainees and practitioners. Academic achievement and anxiety during undergraduate medical training were reported to predict the medical competence, career satisfaction, levels of stress and burnout, and the overall quality of life among medical practitioners (1,2). Understanding the psychological factors affecting medical students is crucial for developing interventions to support their academic progression and holistic development as a future medical professional. During the early years of undergraduate medical education program, the students are exposed to number of potential stressors related to academic programs which can have a negative impact on their psychological wellbeing and academic performance. These students are likely to perceive stress caused by high information load, change in teaching strategies, self-directedness of the academic program, comparison with peers, fear of failure and time limitations (3). Additionally, some factors specifically related to academic programs in Anatomy such as dissection laboratory experiences have been reported as additional factors that contributes to psychological and emotional distress including anxiety, depression and poor self-esteem among medical students at the early stage of the course (4, 5). Anxiety is a prevalent psychological response among medical students at all stages, which is characterized by feeling of tension and nervousness primarily resulting from the intensive academic load and

high-stakes assessments. A recent meta-analysis reported a global anxiety prevalence of 33.8% (95% confidence interval of 29.2–38.7%) among medical students (6). While a moderate level of anxiety can be motivational, excessive anxiety can impair cognitive functioning and diminish academic performance (7). Moreover, the demanding nature of medical training, with extended hours of study/training, sleep deprivation, and reduced social engagement contribute to higher incidence of depression among medical students compared to the general public. It manifests with a cluster of symptoms including persistent low mood, loss of interest, and decreased energy (8). A meta-analysis conducted in 2016, reported a global prevalence of depression amongst medical students of 28.0% (95% confidence interval 24.2–32.1%) with higher rates of depression among female students and first-year medical students. A significant decline in the rate of depression was demonstrated as the students' progress through the undergraduate medical courses (9). Self-esteem, described as 'individuals' subjective evaluation of own worth' also plays a crucial role in academic success. Medical students with high self-esteem are more likely to adopt well to the academic challenges, which may serve a protective function against anxiety and depression. Conversely, chronic anxiety and depression can lead to gradual decline in self-esteem, creating a vicious cycle that increase academic difficulties (10-12). As discussed above, the existing literature demonstrates the global significance, and landscape regarding psychological health and its impact on academic success in medical education. However, many studies were focusing on a single psychological variable, leaving a gap in our understanding of how these different psychological factors interact. Furthermore, existing research often focuses on general

academic outcomes, but there is a paucity of data specifically targeting Anatomy, a foundational subject with unique cognitive and emotional demands. Therefore, this study was conducted to evaluate the level of self-esteem, anxiety, and depression, their determinants and inter-relationship, and to evaluate how these psychological factors influence academic performance in Anatomy among second-year medical students of the Rajarata University of Sri Lanka.

Methods

An analytical cross-sectional study was conducted among second-year medical students at the end of the last semester of their Preclinical academic program (i.e. third semester of the MBBS program) in Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka (FMAS, RUSL). A total population sampling strategy was employed for this study. All second-year medical students in the 2011/2022 batch were invited to participate. From a total population of 208 second-year medical students, 184 students voluntarily participated in the study, which represents a response rate of 88.5%.

A self-administered questionnaire was used to collect data. The questionnaire contained scales with well-established validity that are used to measure the levels of self-esteem, anxiety and depression; Rosenberg Self-esteem Scale, Generalized Anxiety Disorder Assessment (GAD-7) scale and Beck's Depression Inventory (BDI) respectively. A validated Sinhala versions of these scales are available through the Institute for Research and Development, Sri Lanka (<https://ird.lk/>), but the original English versions of these scales were used in the present study because the undergraduate medical programs in FMAS, RUSL is conducted in English. Meta-analyses and reviews of literature on depression, anxiety and self-esteem demonstrate that these

scales have been widely used to measure psychological parameters among students in medical and health profession education courses worldwide (6, 9, 13). The questionnaire also included questions to collect demographic information, and information regarding the factors in the academic environment that are likely affecting their psychological status, and the grades obtained at Anatomy module examinations in the first attempt. Data were collected after a scheduled teaching session in a lecture hall. Following a brief explanation of the study details, consents forms were distributed to all who agreed to participate. Printed questionnaires were distributed to the students who provided consent. Participants completed the instruments independently. Scoring of the Rosenberg Self-esteem Scale, GAD-7 BDI were done using the prescribed procedure of analysis of each scale. Students' self-reported grade for each module examination was assigned a mark out of 100 (mean of the range of marks for each grade). Subsequently, a credit-based weighted average mark in Anatomy was calculated for each student, which is used as the 'final score in Anatomy' in this study. Data analysis was done using IBM Statistical Package for Social Sciences (SPSS) Version 23. Descriptive statistics were calculated for categorical variables (e.g. frequency, proportion) and continuous variables (e.g. mean, standard deviation). Independent samples t-test was performed to compare the means of two independent groups such as gender-based differences in anatomy scores, and scores in anxiety, depression and self-esteem scales. One-way ANOVA test was used to evaluate the impact of categorical self-esteem, depression and anxiety levels on anatomy scores. Furthermore, Pearson correlation analyses were conducted to determine the relationship between anatomy scores and the continuous scores of the self-

esteem, anxiety and depression scales and to determine the interrelationship between these psychological parameters. Statistical significance was determined at $p < 0.05$.

Ethics approval for the study was obtained from the Ethics Review Committee, FMAS, RUSL. (ERC approval number: ERC/2024/17)

Results

A total of 184 students responded with a response rate of 88.5%. Majority (121; 65.8%) were females. Mean Z-score of the General Certificate of Examination Advanced Level (GCE A/L) examination of the participants was 1.9002 (standard deviation (SD) 0.0664). Majority has obtained 'A', 'B' and 'C' grades (35.3%, 25.5% and 28.8% respectively) for at GCE A/L English examination, while 13 (7.1%) and 6 (3.3) students have obtained 'S' and 'F' grades respectively. The final score in Anatomy ranged from 26.69 to 76.34 with a mean score of 55.56 (SD 8.48; Median 55.98). The mean score among female students; 56.97 (SD 7.82) was significantly higher than the mean score among male students; 52.86 (SD 9.07) ($P < 0.05$) (Figure 1).

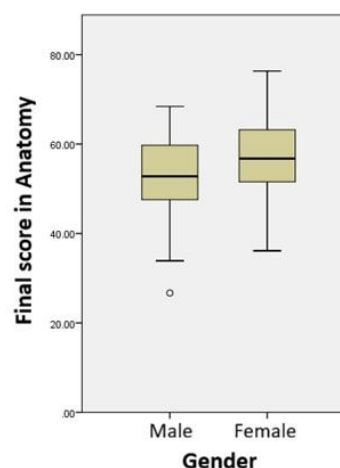


Figure 1: Distribution of the final score in Anatomy among male and female students

Distribution of the level of self-esteem, anxiety and depression among second-year medical students and their interrelationship

Mean value of self-esteem on a scale between 10-40 on Rosenberg Self-esteem Scale was 28.14 (SD 3.47). On the GAD-7 scale, which was used to measure the level of anxiety on a scale between 0-21, the mean value was 6.33 (SD 4.07). The mean value of the level of depression on BDI was 9.66 (SD 7.46) measured on a scale of 0-63 (Table 1). Majority of the participants reported a high level of self-esteem (77.7%), minimal or mild level of anxiety (33.2% and 48.2%), and were categorized as 'normal' on depression scale (66.8%).

Table 1: Distribution of scores in self-esteem, anxiety and depression

	Min - Max	Mean	SD	Median	Mode
Self-esteem	20 - 39	28.14	3.47	28.00	29
Anxiety	0 - 21	6.33	4.07	6.00	7
Depression	0 - 34	9.66	7.46	8.00	9

Eight students (4.3%) reported 'severe anxiety', while another five students (2.7%) reported 'severe depression'. None of the students were found to have 'extreme depression' (Figure 2). There were

no statistically significant differences in the level of self-esteem, anxiety and depression between male students and female students (Figure 3).

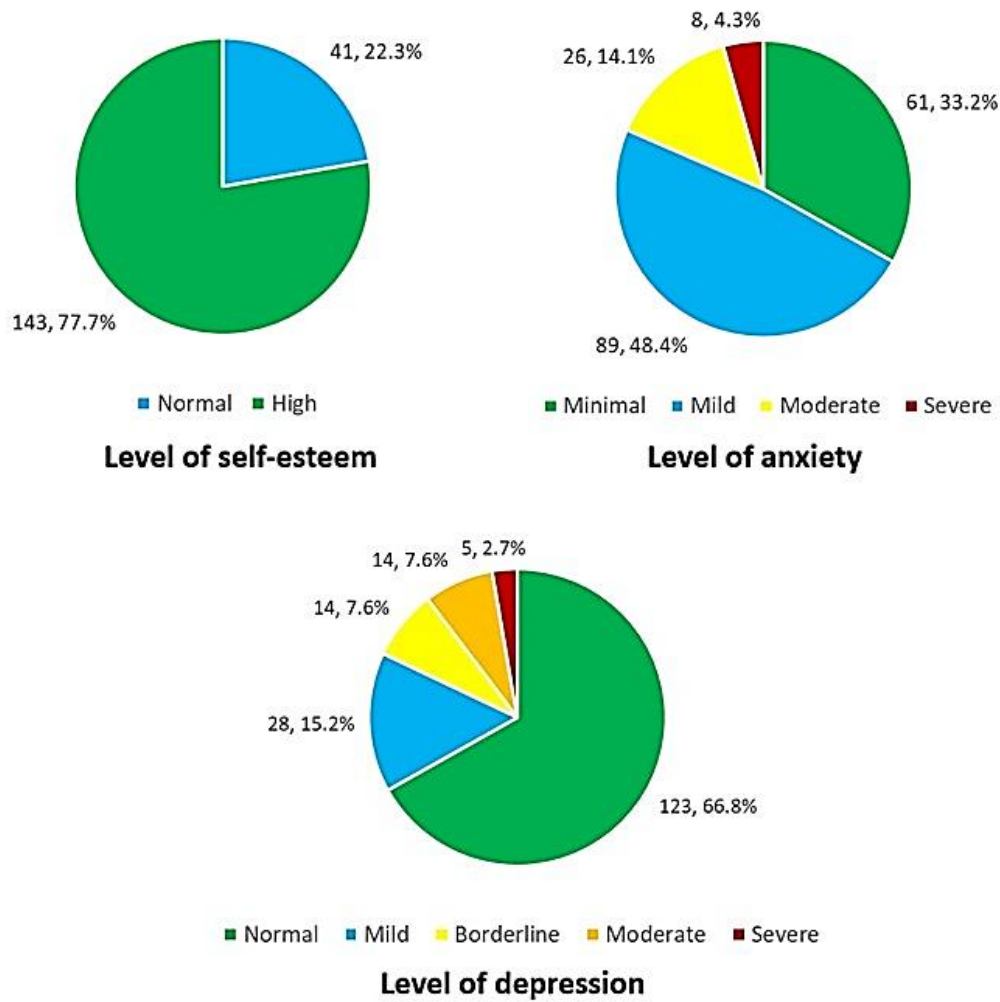


Figure 2: Distribution of the levels of self-esteem, anxiety and depression among study participants

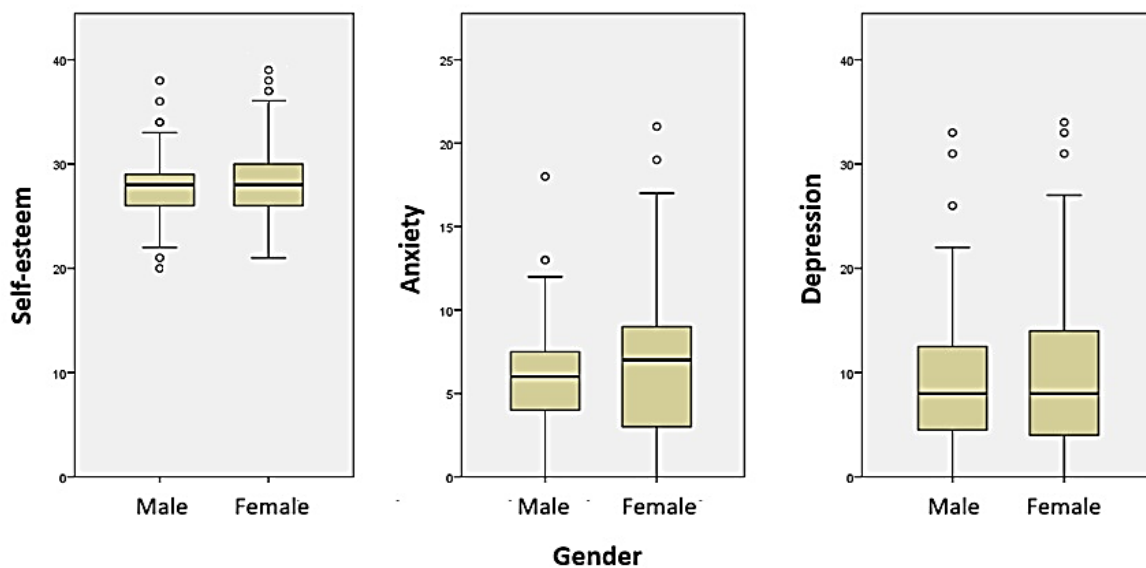


Figure 3: Distribution of the scores in self-esteem, anxiety and depression among male and female students

A Statistically significant negative correlation was observed between self-esteem and anxiety ($r = -.336$, $p < 0.001$), and between self-esteem and depression ($r = -.355$, $p < 0.001$). There was a statistically significant, positive correlation between anxiety and depression ($r = .570$, $p < 0.001$) (Figure 4).

Effect of self-esteem, anxiety and depression on academic performance in Anatomy

There was a statistically significant, positive correlation between self-esteem and final score in Anatomy ($r = .245$, $p = 0.001$) (Figure 5). The students with higher levels of self-esteem were observed to have better performance in Anatomy. There was no statically significant correlation between the final score in Anatomy and the levels of anxiety or level of depression.

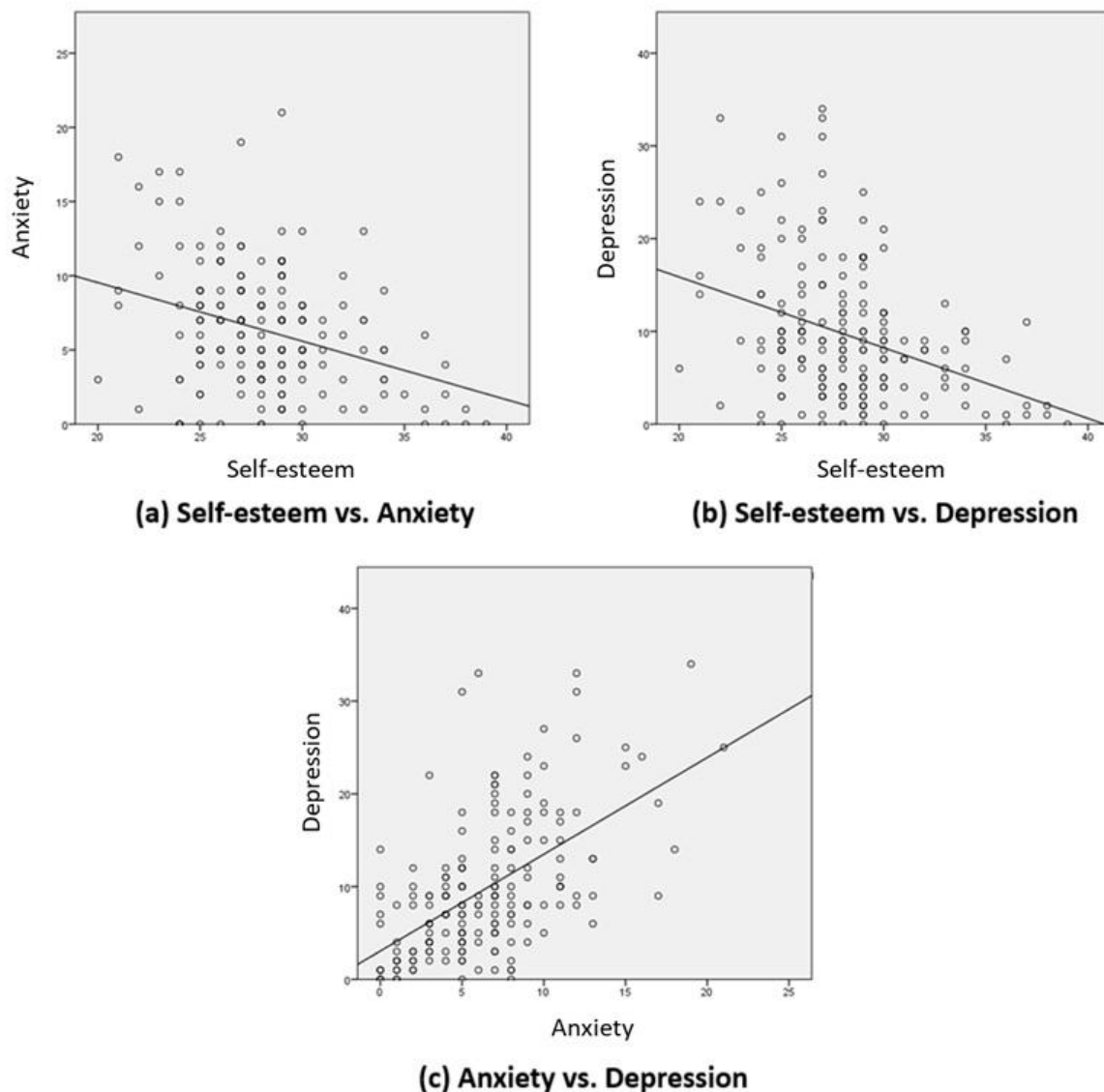


Figure 4: *Correlation between self-esteem and anxiety, self-esteem and depression, and anxiety and depression*

Other factors affecting students' level of self-esteem, anxiety and depression

A significant association was observed between the economic status and level of depression, where the post hoc test showed significant difference between the students that belong to 'high-income' (monthly family income >350,000 SLR) and 'middle-income' (monthly family income 50,000 – 350,000) groups, where the mean scores on BDI were 17.33 (SD 11.43) and 9.21 (SD 7.15) respectively. The distance to home from the university was not observed to have a significant effect on students' levels of self-esteem, anxiety or depression.

There were no significant associations between the z-score obtained at the GCE A/L examination and the psychological parameters of the students evaluated in this study. The students who had failed the GCE A/L English examination reported a significantly higher level of depression ($P=0.039$) (Figure 6), however there was no such effect on the level of self-esteem and level of anxiety among students.

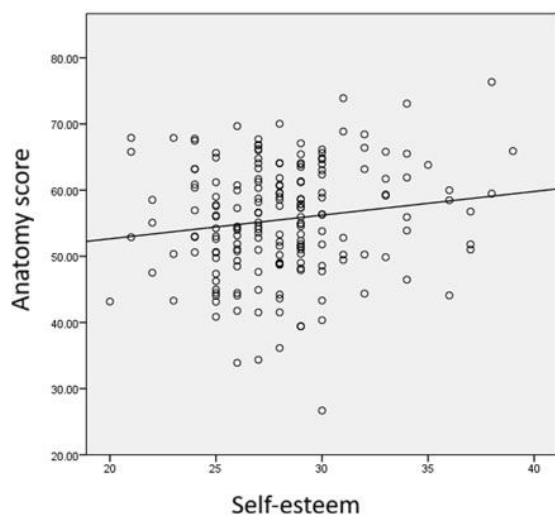


Figure 5: Correlation between self-esteem and final score in Anatomy

Students' perceptions regarding factors affecting their mental health and supportive factors

On qualitative inquiry, majority of the participants (71.7%) expressed that the module-based exam system with frequent multiple exams affect their mental health. Other factors reported by students as

factors affecting mental health were conflicts with friends ($n=9$), family-related problems ($n=8$), water quality ($n=8$), homesickness ($n=7$), and economic problems ($n=7$). The majority of the students have a positive perception of support from peers (83.7%), faculty and staff (95.1%), and the availability of facilities in faculty (84.2%). The majority of the students (75%) perceived that they have effective methods of managing stress.

Discussion

The present study investigated the psychological landscape of second-year medical students of FMAS, RUSL to determine how mental well-being influences academic achievement in anatomy. Our findings highlight the importance of self-esteem as a significant predictor of success in Anatomy examinations, which also serves as a protective factor against anxiety and depression, potentially caused by the rigors of the preclinical curriculum. The results of the study provide a foundational context for understanding the complex interplay between a student's internal psychological state and their academic performance, highlighting the need for targeted support systems within medical education. The academic performance in Anatomy among second-year medical students in this study showed a wide distribution, with a significant gender disparity, where female students performed significantly better than male students. Interestingly, this difference exists despite having no statistically significant difference between genders in their levels of self-esteem, anxiety, or depression. This suggests that the higher academic achievement in females is likely driven by factors other than the psychological parameters measured in this study. The results of the previous studies provide contrasting evidence regarding the gender differences in academic performance in preclinical sciences among undergraduate medical and health sciences students. In contrast to the findings of the present study, some studies showed either better performance among male students (14) or no gender difference in academic performance (15,16). Still, few studies have shown better performance in Anatomy and/or physiology among female medical/health science students. Higher academic performance among female students was

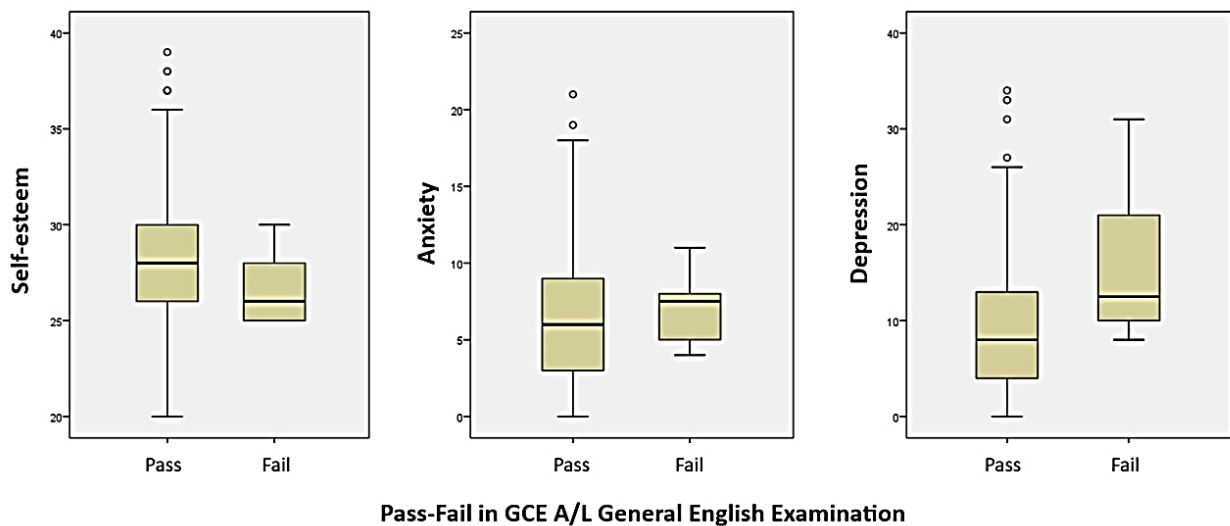


Figure 6: Distribution of the scores in self-esteem, anxiety and depression score among students who have passed and failed GCE A/L General English examination

attributed to the facts that that female medical students often exhibit higher levels of conscientiousness and more consistent study patterns, better reading comprehension and memory skills. These studies also indicated that female students use more diverse learning strategies, have better attendance to study sessions and maintain better study notes (17, 18), which are particularly beneficial for the subjects like Anatomy with high content load. These finding highlights the need for further exploration of learning styles and preferences of Sri Lankan male and female medical undergraduates. Further research is recommended to explore the underlying pedagogical and behavioral factors influencing the observed difference in academic performance. Future studies should incorporate validated tools to assess gender-specific learning styles, and objective measures of academic engagement, such as lecture attendance, engagement in learning management system and other online platforms and library usage. Additionally, qualitative inquiries into the sociocultural factors affecting study habits among Sri Lankan medical undergraduates could provide deeper insights into these performance gaps, ultimately informing more tailored educational support strategies for both male and female students.

A key finding of this study is the significant positive correlation between self-esteem and the final score in Anatomy. A similar correlation between self-esteem and academic performance was observed in a number of previous studies conducted among undergraduate students in medical and non-medical courses in various settings (19-22). The students with higher self-esteem are likely to perform better, when faced with the challenges of high volume of content, new teaching-learning methods and new learning environment. In the transition to self-directed learning in university education, students with high self-esteem tends to experiment with new learning strategies without the fear of failure. When faced with high volume of contents, the students with high level of self-esteem can dedicate their full cognitive resources to study, while those with low self-esteem are at risk of developing intrusive thoughts of failure, obstructing their mental space that is required for memory consolidation (23, 24). Moreover, students with higher self-esteem tend to be more confident in adopting deep learning and metacognitive strategies, such as active recall and repetition, self-questioning and seeking feedback, that contribute to better learning and higher academic success (25). Our results also showed a significant negative correlation between self-esteem and both anxiety and depression; a finding

that was similar to previous studies conducted among medical students (26-29). These findings suggest that high self-esteem facilitates more adaptive coping mechanisms among medical students in their stressful learning environment. However, it is also worth considering that the academic success itself is likely to improve student's self-esteem creating a positive feedback loop. Given that 77.7% of the students reported high levels of self-esteem in this study, it appears that the majority of the second-year medical students at Rajarata University maintain a resilient self-image, which acts as a protective factor against the stressors of the pre-clinical years. Meta-analyses on the prevalence of depression and anxiety among medical students showed that nearly one-third of the medical students are having depression and anxiety with a global prevalence of 28.0% (30) and 33.8% (5) respectively, which are substantially higher than the general population. Notably, the prevalence of depression was higher among first year medical students (30). Anxiety was most prevalent among medical students in the Middle East and Asia (6). A study conducted in year 2000, among 1097 Sri Lankan medical undergraduates reported that 8.7% of the students were diagnosed with a psychological illness after entry to the medical schools (31). Our study also revealed a significant burden of mental health challenges, even if most students fell within the "normal" to "mild" ranges in the anxiety and depression scales. However, the presence of a few numbers of students with severe anxiety and severe depression represents a vulnerable subgroup that requires targeted attention. A notable finding in this study was the lack of a statistically significant correlation between Anatomy examination scores and the levels of anxiety or depression. This contradicts with the findings of recent reviews in scientific literature, which suggest that high levels of depression and anxiety impair cognitive function and academic performance among medical students (32, 33). It is likely that the Sri Lankan medical undergraduates who are selected based on a rigorous examination process in schools have developed a high level of resilience that allows them to maintain academic performance even while experiencing significant internal

distress. However, this is a major concern because academic success is likely to mask an underlying need for psychological intervention among Sri Lankan medical students. Additionally, it has been shown that certain level of anxiety can improve performance on complex tasks up to an optimal point (34). It is likely that the level anxiety in many students in this study remained within a facilitative range helping them to navigate the demanding academic program. The study also demonstrated a strong, statistically significant positive correlation between anxiety and depression highlighting the comorbid nature of these conditions. Depression and anxiety appeared to co-exist among medical students, with number of shared risk factors, particularly the economic stressors and positive family history of psychological problems (7, 35). Furthermore, the significant negative correlations between self-esteem and both anxiety and depression suggest that psychological distress is closely tied to the students' sense of self-worth. Self-esteem serves as a buffer against extreme stress, preventing the academic pressure forcing the students into clinical distress (27, 28).

The findings of this study highlight that psychological well-being is not solely influenced by the academic pressure, but is significantly influenced by the students' socioeconomic background and English language proficiency. Previous studies conducted among medical undergraduates in Sri Lanka have also reported economic difficulties as a major source of stress among students (31), and the GCE A/L English exam results as a significant predictor of performance in Final MBBS examination (36). A notable finding in our study was the significant association between economic status and levels of depression. Specifically, students from the 'high-income' group reported a higher mean depression score compared to the 'middle-income' group. This contradicts the general socioeconomic trend where lower income usually correlates with higher rates of anxiety and depression among medical students (7, 34). In the context of the present study, this may be explained by difficulty in adapting to environment and peers in the rural university setting of Rajarata University of Sri Lanka, potentially leading to social withdrawal in the

‘high-income’ group. Higher academic pressure was shown to increase risk of depression among medical students (35), and the students in the ‘high-income’ group are likely to have a higher level of perceived academic pressure due to greater family pressure and expectation. Moreover, the study revealed that students who failed the GCE A/L English examination reported significantly higher levels of depression. In Sri Lanka, the medical curriculum is conducted entirely in English, making English language proficiency a prerequisite for effective learning. For these students, the language barrier likely functions as a daily stressor, particularly in the early stages of the medical course. This likely leads to gradual deterioration of student's confidence, developing in to a sense of hopelessness and helplessness that correlates with higher depression scores. Qualitative feedback identified unique local stressors such as water quality and economic problems. These findings underscore that for students at Rajarata University, the physical and economic environment also plays a role in determining their mental wellbeing, independent of the academic workload. Despite the academic and socioeconomic pressures identified, a majority of the students maintained a positive perception of their support systems including peer support, and faculty and staff assistance. This high level of perceived support, coupled with the fact that 75% of students believe they possess effective stress management methods, may explain why clinical levels of anxiety and depression remained relatively low for the majority. It suggests that while the modular system is demanding, the supportive environment created by peers and mentors serves as a protective factor against psychological distress.

Strengths and limitations

The study achieved a high response rate of 88.46% which minimizes non-response bias and ensures that the data is highly representative of the second-year batch at Rajarata University. By utilizing internationally recognized and validated scales for the measurement of self-esteem, anxiety and depression, the study ensures that the psychological parameters measured are strong and

comparable to global medical education literature. Still, due to the cross-sectional design of the study, we cannot establish a definitive causal relationship between psychological states and academic performance. The academic scores were self-reported by students, which introduces the potential for recall bias or social desirability bias, where students might over-report their grades. While many stressors are universal to medical students, the unique socioeconomic and environmental factors (such as the specific modular system and local water quality issues) in the setting of Rajarata University of Sri Lanka may limit the generalizability of the results to other medical faculties in Sri Lanka or abroad. While we measured major psychological determinants, other factors such as physical health, learning styles, quality of peer interactions, digital literacy, intrinsic motivation were not evaluated and may also influence Anatomy examination scores.

Conclusion and Recommendations

The findings of this study underscore the critical role of psychological health in the academic journey of medical undergraduates. Our research concludes that self-esteem serves as a vital psychological buffer against the high demands and complexities of the medical curriculum. While the majority of students demonstrate functional resilience, there remains a vulnerable minority experiencing severe anxiety and depression. Furthermore, the identification of language proficiency and socioeconomic status as determinants of mental distress suggests that academic performance in Anatomy is influenced by a complex web of psychological, social, and linguistic factors. Given the significant association between English proficiency and depression, the faculty should implement targeted "Medical English" workshops. Bridging the language gap early in the pre-clinical years can reduce the cognitive load and psychological distress associated with learning Anatomy in a non-native language. Institutional programs should focus on fostering self-esteem and self-efficacy. There should be routine, confidential screening process for the early identification of the students in higher levels of psychological distress, who may be

performing well academically but are at high risk of burnout or psychological collapse. Since a large majority of students identified frequent exams as a primary stressor, a review of the assessment schedule may be warranted. Exploring ways to reduce the perceived pressure of frequent testing while maintaining academic rigor could lessen unnecessary anxiety. Investing in these measures for the improvement of psychological wellbeing of the students from the earliest stage of their undergraduate medical programme will strongly contribute to the development of competent, mentally healthy physicians who are capable of navigating the complexities of their future medical careers.

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