https://doi.org/10.29309/TPMJ/2024.31.08.8106

The Professional Medical Journal
www.theprofesional.com
2024, Volume, 31 Issue, 08

ORIGINAL ARTICLE

Evaluation of physiological effects of examination stress on Quantitative red blood cells count and hemoglobin in female medical students at Peoples University of medical and health sciences for women, Nawabshah.

Reh Naz Sheikh[1], Seema Qazi[2], Hanna Khair Tunio[3], Sidra Jabeen[4], Nida[5], Iftkhar Ali Rathor[6], Masood Ahmed Unar[7]

Article Citation: Sheikh RN, Qazi S, Tunio HK, Jabeen S, Nida, Rathor IA, Unar MA. Evaluation of physiological effects of examination stress on Quantitative red blood cells count and hemoglobin in female medical students at Peoples University of medical and health sciences for women, Nawabshah. Professional Med J 2024; 31(08):1218-1223. https://doi.org/10.29309/TPMJ/2024.31.08.8106

ABSTRACT… Objective: To assess the physiological effects of examination stress on red blood cells in female medical students at Peoples university of medical and health sciences for women, Nawabshah. **Study Design:** Comparative Cross Sectional study. **Setting:** Department of Physiology, Peoples University of Medical & Health Sciences for Women, Shaheed Benazir Abad. **Period:** 7th April 2019 to 6th October 2019. **Methods:** A total 110 healthy students of first & Second year MBBS were included for this, by the non-probability randomized sampling technique, divided into two equal (55-students in each) groups A and B first & second year MBBS. Blood samples were collected prior to and during the exam, and the findings were evaluated using statistical software. **Results:** The mean RBC count ± SD thru the examination of students including the first year was 4.98±0.26 c/cm^3, which was considerably higher than the pre-exam mean RBC count ±SD of 4.65±0.27 c/cm^3. There was a small rise in RBC count throughout the examination compared to before (n = 55, p-value = 0.031) among the first-year students. During the second year examination, students had a mean RBC count ± SD of 4.67±0.28 c/cm^3, which was not substantially higher than the pre-exam mean of 4.66±0.33 c/cm^3. There was no significant increase in RBC count throughout the examination compared to before it among 2nd year students (n = 55, p-value = 0.932). **Conclusion:** Findings of study concluded that examination stress significantly affects first-year medical students' red blood cell (RBC) count, increasing it during exams, but not second-year students. This suggests varying physiological responses to stress, possibly due to academic adaptation or stress levels.

Key words: Examination Stress, Physiological Effects, Red Blood Cells.

INTRODUCTION

Stress is a universal human experience that includes a variety of physical, emotional, and psychological reactions to life's demands and constraints. It can be induced by a variety of causes, such as job, relationships, financial problems, big life changes, and, especially for students, scholastic duties such as exams. Stress is frequently characterized by feelings of pressure, tension, and overwhelm.[1]

Stress hormones, primarily cortisol and adrenaline, are produced during a stress response and prime the body for action. An innate survival process known as "fight or flight" primes the body to either confront or escape perceived threats. During this response, the heart rate increases, breathing increases and muscles contract up in anticipation of movement. This reaction is helpful when quick decisions and action are required, but it becomes problematic when everyday challenges consistently cause it.[2]

One common way that stress manifests itself in an educational context is during exams. It can be identified by elevated stress and anxiety before and during tests. Academic pressure to perform well, performance anxiety, and fear of failure are common experiences for students. These pressures can result in a range of emotional and physical symptoms, including irritability, anxiety, trouble focusing, and trouble falling asleep.

1. MBBS, M.Phil (Physiology), Assistant Professor Physiology, Peoples University of Medical and Health Sciences for Women, Nawabshah.
2. MBBS, MPH, Senior Lecturer, Prime University of Medical and Allied Health Sciences, Islamabad.
3. MBBS, MPH, Assistant Professor, Community and Health Sciences, PUMHSW-SBA.
4. MBBS, Senior Demonstrator Physiology, Suleman Roshan Medical College, Tando Adam.
5. MBBS, Lecturer Physiology, PUMHSW-SBA.
6. MBBS, Lecturer Physiology, PUMHSW-SBA.
7. MBBS, M.Phil (Pharmacology), Assistant Professor Pharmacology, SMBBMU, Larkana.

Correspondence Address:
Dr. Masood Ahmed Unar
Department of Pharmacology
SMBBMU, Larkana.
fastmasood7@gmail.com

Article received on: 16/01/2024
Accepted for publication: 27/05/2024

These stress responses can become more intense when there is a fear of academic failure and the implications for future goals.[3]

Long-term exposure to stress can be detrimental to one's physical and emotional well-being. It's been connected to conditions like heart disease, depression, anxiety, and weakened immune systems. Therefore, managing stress is essential for overall health and quality of life.[4]

The impacts of stress on health and wellbeing have led to study into the development of medicines and stress-reduction strategies. These include, among other things, psychotherapy, stress management courses, mindfulness exercises, and lifestyle modifications.[5] Encouraging people to better understand and manage the complexities of stress and develop resilience to better manage life's challenges is the aim. To help students and staff deal with the demands of their jobs, educational institutions regularly implement stress reduction programs and provide support services. Understanding that stress affects everyone and taking proactive measures to treat it can help individuals and organizations create environments that are healthier, more productive, and generally improve quality of life.

Stress can affects the hematological parameters due to various changes in hormonal imbalances.

It can affects the physiological parameters includes increase in RBC, Platelets and neutrophils increase in number, while eosinophil, lymphocytes, and monocytes decrease. Physiological investigations have shown that stress of any kind can affect the immunological, hemopoietic, and endocrine systems.[6]

A study was conducted to assess the levels of red blood cells under two conditions: absence of examination stress and presence of examination stress. Both male and female participants were compared based on their pre-examination results and results obtained during exams. The study revealed that there were only minimal changes in the count of red blood cells due to psychological stress.[7,8] In relation to the stage of study, first-year students pursuing professional degree courses such as MBBS experience higher levels of exam stress compared to second-year students. This difference in stress levels leads to variations in physiological and psychological parameters, which become evident in tests.[8] An other study by Christina jern et al suggested that any type of stress where the subjects may be normal in health can influence the hematological parameters.[9] Study by Dyrbye et al also showed that exam stress in medical students exists and physiological have some negative impacts on overall health of students.[10]

Further research is required to explore the impact of psychological stress on the production of RBCs and hemoglobin levels in males and females.

METHODS

Rationale

The purpose of this comparative study was to investigate the changes in complete blood count (CBC) parameters in female junior students of MBBS (First & second year) before and after their exams. Medical education is a demanding and stressful field, with examinations causing significant physiological consequences, especially for female students. Understanding the impact of exam stress on red blood cells is crucial for overall health.

The study was conducted at the PUMHSW-SBA, Physiology department. PUMHSW-SBA Ethical Review Committee provided ethical approval (PUMHSW/SBA/REGISTRAR/446-51) (06-04-2019) prior to the study's execution. 110 junior female students in regular standing participated in the study; 55 students each from groups A (first year) and B (second year). Prior to gathering any data, the researcher—who was also the data collector—got signed consent from each participant. Every student had two milliliters of blood drawn from their cuboidal veins before and after the exam. After that, these samples were delivered to the diagnostic lab of PUHMSW-SBA for a full blood count. For this objective, the Nihon Kohden Cell machine—a dependable and popular instrument for CBC analysis—was

employed. The CBC test yielded insightful data. These parameters were compared between the two groups (A and B) before and after the exams to determine if there were any significant changes. The data collected from the CBC tests were analyzed using appropriate statistical methods to identify any significant differences between the pre-exam and post-exam values. The findings of this study will add to our understanding of how exams affect medical students' blood parameters, particularly those of junior female students. It is crucial to remember that the results of this study may not apply to other demographics or genders because it was restricted to a particular group of female junior MBBS students. To guarantee the accuracy and dependability of the findings, the methodology and study design were, nonetheless, properly thought out and carried out.

Data Analysis

Following data collection, SPSS version 23 was utilized to analyze the data. While numerical variables were studied using the Student's t-test, continuous variables were subjected to t-tests to establish mean standard deviation. The results were then presented using charts, graphs, and tables.

RESULTS

Stress from exams and its impact on red blood cell count

The mean red blood cell count (∂SD) throughout the examination of students, including those in their first year, was 4.98±0.26 c/cm3 in this study. This was significantly higher than the mean red blood cell count (±SD) before to examination, which was 4.65±0.27 c/cm3. When compared to the pre-examination period, there was a notable rise in the red blood cell count among the first-year students. (n = 55, p-value = 0.031). See Table-I.

The mean red blood cell (RBC) count ± standard deviation (SD) observed during the assessment of second-year students was 4.67 ± 0.28 c/cm^3, which showed a slight increase compared to the mean RBC count ± SD before the examination, which was 4.66 ± 0.33 c/cm^3. However, this difference was found to be statistically insignificant. Among the second-year students (n = 55), there was no significant rise in RBC count during the examination compared to before the examination (p-value = 0.932).

The impact of exam-induced stress on hemoglobin levels (Hb %).

The results concluded that mean Hemoglobin (Hb%) ± SD of the first year students, at the time of examination period was 10.0204±1.67277% It was substantially lower than the mean from the prior exam hemoglobin (Hb%) ±SD was 12.3484±1.66828%. There was significant decrease of Hemoglobin (Hb%) during examination as compared to before examination among the students of first year (n = 55) p value = 0.001. Table-II

Red Blood Cell Count (c/cm3)	(Before Exam)	(During Exam)	P-Value
First year (n = 55)	4.65±0.27	4.98±0.26	0.031*
Second year (n = 55)	4.66±0.33	4.67±0.28	0.932

Table-I. Comparison of the MBBS students' mean red blood cell count (c/cm^3) before and during the exam (n = 110)
Results are presented as Mean ± Standard Deviation
*** p value is statistically significant(studnt t test)**

Hemoglobin (Hb%) gm/dl	(Before Exam)	(After Exam)	P-Value
First year (n = 55)	12.3484±1.66828	10.0204 1.67277	0.001**
Second year (n = 55)	12.3927±1.54415	12.2600±1.47580	0.145

Table-II. Comparison of Mean value of Hemoglobin (Hb%) (gm/dL) of MBBS students before and during examination (n=110)
Results are presented as Mean ± Standard Deviation *P value is statistically highly significant (calculated by Student's t test)

Mean Hemoglobin (Hb%) ± SD during examination of students of 2nd year was 12.2600±1.47580 mg/dL which was lower as compared to before exam mean Hemoglobin (Hb%) ±SD was 12.3927±1.54415 mg/dL. There was no significant decrease of Hemoglobin (Hb%) during examination as compared to before examination among the students of second year (n = 55) p value = 0.145. See Graph -02.

DISCUSSION

Examination stress is a form of worry felt by many medical students in the days leading up to and during academic exams. It usually occurs during the revision period prior to tests, as well as just before and during the exams. Though a moderate level of stress is necessary for motivation and exam preparation, excessive stress can be hazardous.

Academic examination stress causes considerable fluctuation in hematological characteristics. Platelets, neutrophil count, and red blood cells increase, whereas eosinophil, lymphocytes, and monocytes decrease in quantity.[11] the number of red blood cells increases when hemoglobin levels rise. However, stress-induced pro-inflammatory cytokine production has been linked to hemopoietic cell growth.[12]

Hemoglobin, red blood cells, and other metrics were not substantially impacted. Our results are inconsistent with the earlier Qureshi et al.[13] report which shows an increase in neutrophils, platelet counts and lymphocyte decreases but no significant changes in RBCs count. The impact of study stress on hematological measurements was studied by Maes et al.[7] and they founded that the stress of examination increased considerably hematocrit, HB, MCV, MCH, and MCHC. Stress-inducing production of cytokine inflammatory has been suggested to stimulate hematopoietic cell proliferations this may be the possible cause of increase or decrease in some hematological parameters.[14] The hemo concentration, caused by fluid shifts from intravascular to extra vascular spaces, concentrated in non-diffusible blood components, may explain an increase in neutrophils, platelets, PCVs and MCV following stressor.[15]

In our study the reason behind the no significant changes in hemoglobin of both groups of female students may the natural mensuration which could affected the results and may showed not actual results, same as the results of study by Qureshi et al.[13] our findings are inconsistent with an Indian study by Jehad F. Alhmoud et al according to this study they included the both sexes female and males but significant changes were observed in the readings of Hemoglobin, Red Blood Cell count (RBC). hematocrit and mean corpuscular hemoglobin concentration (p >0.2).[15] same finding observed in study by Fawzia Shawesh et al in Libiya, that hemoglobin level was remained same in medical students.[16] Study by Kondo H et al showed Hemoglobin levels packed cell volumes, and erythrocyte counts were not affected during or after mental stress.[17]

CONCLUSION

The hemoglobin percentage in first year students was significantly decreased (p value = < 0.05) whereas in second year student, there was no significant decrease (p value = > 0.05) during examination. There was no significant change (p value = > 0.05) of total red blood cell among the first year and second year students during examination.

ACKNOWLEDGEMENTS

We want to convey our sincere gratitude to each and every member of the Department of Physiology department at PUMHSW-SBA, including Professors Hajira and Zardari, the department head, and other faculty members who helped finish this study in a constructive way.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Anisman H, Merali Z. **Understanding stress: Characteristics and caveats.** Alcohol Res Health. 1999; 23(4):241-249.

2. Chu B, Marwaha K, Sanvictores T, et al. **Physiology, stress reaction.** [Updated 2022 Sep 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK541120

3. Barbayannis G, Bandari M, Zheng X, Baquerizo H, Pecor KW, Ming X. **Academic stress and mental well-being in college students: correlations, affected groups, and COVID-19.** Frontiers in Psychology. 2022 May 23; 13:886344.

4. Yaribeygi H, Panahi Y, Sahraei H, Johnston TP, Sahebkar A. **The impact of stress on body function: A review.** EXCLI J. 2017; 16:1057-1072. Published 2017 Jul 21. doi:10.17179/excli2017-480

5. Kriakous SA, Elliott KA, Lamers C, Owen R. **The effectiveness of mindfulness-based stress reduction on the psychological functioning of healthcare professionals: A systematic review.** Mindfulness (N Y). 2021; 12(1):1-28. doi:10.1007/s12671-020-01500-9

6. Dorshkind K, Horseman NS. **Anterior pituitary hormones, stress, and immune system homeostasis.** Bioassays. 2001; 23:288-94.

7. Maes M, Van Der Planken M, Van Gastel A, et al. **Influence of academic examination stress on hematological measurements in subjectively healthy volunteers.** Psychiatry Res. 1998; 80(3):201-12. doi:10.1016/s0165-1781(98)00059-6

8. Swaminathan A, Viswanathan S, Gnanadurai T, Ayyavoo S, Manickam T. **Perceived stress and sources of stress among first-year medical undergraduate students in a private medical college – Tamil Nadu.** National Journal of Physiology, Pharmacy and Pharmacology. 2016; 6(1):9-14.

9. Jern C, Wadenvik H, Mark H, Hallgren J, Jern S. **Haematological changes during acute mental stress.** British Journal of Haematology. 1989 Jan; 71(1):153-6.

10. Dyrbye LN, Thomas MR, Shanafelt TD. **Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian Medical Students.** Academic Medicine. 2006; 81(4):354-73.

11. Fawzia Shawesh, Arwa Khdeir, Rowida Alzaruge, Maram Abu-Alqasim, Abobaker Kharbash and Altayeb Elazomi. **Effect of examination stress on blood cells parameters among medical technology students In The University of Zawia, Libya.** Ejpmr. 2020; 7(1):171-76.

12. Sharma N, Gupta V. **Effect of examination stress on haematological and haemodynamic parameters in students.** JMS SKIMS. 2012 Dec 27; 15(2):153-6.

13. Qureshi F, Alam J, Khan MA, Sheraz G. **Effect of examination stress on blood cell parameters of students in a Pakistani Medical College.** Journal of Ayub Medical College, Abbottabad: JAMC. 2002; 14:20-22.

14. Pietras EM. **Inflammation: A key regulator of hematopoietic stem cell fate in health and disease.** Blood. 2017; 130(15):1693-98.

15. Alhmoud JF, Farah HS, Al-Qaisi T. **The changes in some hematological parameters among university students due to stressful conditions during and after examinations period.** Indian Journal of Forensic Medicine & Toxicology. 2021; 15(1):1181-6.

16. Shawesh F, Khdeir A, Alzaruge R, Abu-Alqasim M, Kharbash A, Elazomi A. **European journal of pharmaceutical and medical research.** 2020; 7(1):171-76. Available from: https://www.ejpmr.com.

17. Kondo H, Morimoto K. **Effects of mental arithmetic stress on blood cell counts and the immune system. Environmental health and preventive medicine.** 1996 Jul; 1:76-9.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Reh Naz Sheikh	Main researcher.	
2	Seema Qazi	Data collection.	
3	Hanna Khair Tunio	Proof reader.	
4	Sidra Jabeen	Data analysis.	
5	Nida	Data interpreter.	
6	Iftkhar Ali Rathor	Proof reader.	
7	Masood Ahmed Unar	Data and description writer.	