Assessing Physiological Responses: Exam Stress and Leukocyte Count in Medical Students at PUMHSW, Nawabshah

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ABSTRACT

Background: Medical students are confronted with substantial academic and psychological stressors during their education. Studies report that examination stress can have a noteworthy effect on the leukocyte count of students. This study aimed to evaluate the physiological effects of examination stress on the total and differential leucocyte cell count in medical students at Peoples University of Medical and Health Sciences for Women, Nawabshah.

Methods: A cross-sectional comparative study was conducted from April to October 2019, with 110 MBBS students, divided into two groups of 55 students using a non-probability randomized sampling technique with first-year and second-year female students, whereas hypertensive, diabetic, and with any psychiatric disease were excluded. Blood samples were taken before and during the examination. Data were analyzed by SPSS version 23. All the continuous variables were analyzed by the t-test for Mean±S.D while all the numerical variables were analyzed by Student's t-test.

Results: Pre-exam complete blood count (CBC) test reports of first-year students showed Neutrophils, Lymphocytes, Eosinophil, and Monocytes cell counts of 69.2182, 28.5455, 1.61, 1.2545 cell /microliter whereas complete blood count during exams showed 69.909, 27.9636, 1.41and 1.2000 cells/ microliter. In the second-year student, complete blood count before and during the exam showed Neutrophils 66.5273 to 64.0182, Lymphocytes 31.236 to 30.036, Eosinophil 1.92 to 1.76, and Monocytes 1.473 to 1.364 cells/microliter, the decreased values showing that there is an influence of exam stress on white blood cells.

Conclusion: Exams in medical schools can be stressful enough to induce a substantial decrease in blood cell parameters among medical students.

Keywords: Exam stress, Leukocytes, Physiological effects.

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INTRODUCTION

Education is widely regarded as one of the most important phases of human life because it is education that opens the door to success and creates the characteristics of a successful citizen. Stress has become a hot topic in the academic community and our culture. Academic institutions have different work settings compared to non-academic and therefore one would expect the difference in symptoms, causes, and consequences of stress in the two sets[1]. Stress in academic institutions can have both positive and negative consequences if not well managed[2,3]. The complex learning atmosphere can also cause serious medical complications in students' lives, which can contradict the benefits that one can expect after graduating from university[4]. Academic stress among students has long been studied, and stressors such as too many tasks, rivalry with other students, failures, a lack of pocket money, poor relationships with other students or lecturers, family or home issues, and exams, are considered some of the most significant stressors[5]. Owing to the competitive climate, the young student population is exposed to the stress of higher professional education[6,7].

Throughout their academic, psychological, and existential preparation, medical students face considerable academic, psychological, and existential stress[7-10]. Exam tension has been shown to have an important influence on blood cell parameters in seven studies. The regular levels of various blood cells, including white blood cells, can be altered by continuous stress on blood parameters[11,12]. Academic tests in secondary school are challenging enough to trigger changes in blood cell parameters. There was a substantial decrease in the number of eosinophils, basophils, lymphocytes, and monocytes in this sample, as well as a rise in neutrophils count seen in a study[11,13]. Relationships between work-related psychological and physical stress responses and counts of white blood cells (WBCs), neutrophils, and lymphocytes in 101 daytime workers[14]. This trend of stress and anxiety is also seen in a study in Karachi[15]. This study was conducted to document the effects of examination stress on white blood cells and differential cell count in medical students of Peoples University of Medical and Health Sciences for Women SBA.

METHODS

Data was collected after approval by the Research Ethics Committee (REC) as per office reference No 446-51 dated 06th April 2019. Peoples University of Medical & Health Sciences for Women, Shaheed Benazir Abad (PUMHSW). After obtaining written consent from participants, 2 ml of the venous blood sample was taken in an Ethylene diamine tetra acetic acid (EDTA) contained tube for complete blood count (CBC) and given to diagnostic and research laboratory PUMHSW.

Samples were taken twice, one before the examination (4 weeks) and the second during the examination. With the help of the Slovene, formula sample size was calculated. A total of 110 students were recruited from both years through the non-probability randomized sampling technique. Only healthy first-year and second-year female MBBS students and hypertensive, diabetic, and with any psychiatric disease were excluded.

Students were divided into two groups to determine the comparative effect of examination stress on blood parameters. The first group comprised the students who were studying in the first year (55 students). The second group comprised the students who were studying in the second year (55 students). After the collection of data from respondents first professional MBBS students of Peoples University of Medical & Health Sciences for Women, Shaheed Benazir Abad, the data were analyzed by SPSS version 23. All the continuous variables were analyzed by the t-test for mean standard deviation. All the numerical variables were analyzed by Student's t-test. Final results were presented by using tables, graphs, and charts.

RESULTS

The participants of the study were female medical students of MBBS and almost all residents of Sindh Province and Asian race. All the results of parameters like examination stress, sleep duration, breakfast habit, and socioeconomic status were statistically non-significant. Table 01.

Table 1: Showing the demographic characteristics of participants

Variables	First-year (n=55)	Second-year (n=55)	p-value
Age			
19-20 years	50	10	0.68
20-21 years	05	45	
Examination Stress			
Low	10	15	0.52
Moderate	15	13	
High	30	27	
Sleep Duration			
< 6 hours	35	36	0.97
6-8 hours	12	11	
> 8 hours	08	08	
Breakfast Habit			
Regular	40	45	0.25
Irregular	15	10	
Socioeconomic Status			
Low	10	12	0.77
Middle	38	38	
High	07	05	
Residence Area			
Urban	35	38	0.68
Rural	20	17	

p-value <0.05 is considered significant.

In this study, the mean Total Leukocyte Count ± SD during the examination of students in the first year was 7698.90±1492.67 cells/microliter which was insignificantly lower as compared to the before examination mean Total Leukocyte Count ±SD was 7947.27±1620.56 cell/microliter. There was no significant decrease in Total Count during the examination as compared to before the examination among the students of the first year (p-value = 0.131). (Figure 1)
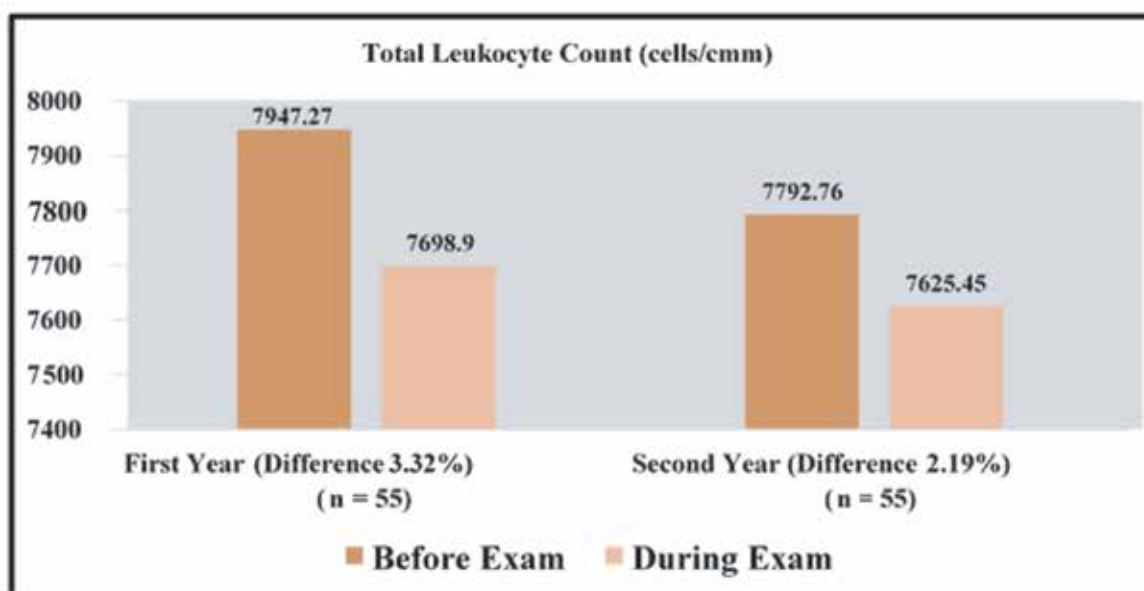
Results are presented as Mean ± Standard Deviation.

Figure 1: Comparison of Mean value of Total Leukocyte Count (cells/cm) of MBBS students before and during examination.

In this study, the mean Neutrophil Count ± SD during the examination of students in the first year was 69.909±6.222 which was insignificantly higher as compared to before examination mean Neutrophil Count ±SD was 69.218±7.353. There was no significant increase in Neutrophil Count during the examination as compared to before the examination among the students of the first year (p-value = 0.410).

The mean lymphocyte count ± SD during the examination of students in the first year was 27.9636±7.08928 % which was lower as compared to before examination mean Lymphocytes Count ±SD was 28.545 ±5.897. There was a highly significant decrease in lymphocyte count during the examination as compared to before the examination among the students of the first-year p-value = 0.001.

Table 2: Comparison of Mean value of Neutrophils, Lymphocytes, Eosinophil, and Monocyte Count in MBBS students before and during examination (n = 110)

Variables	Before Examination (Mean ±SD)	During Examination (Mean ±SD)	p-value
Neutrophil Count			
First-year (n = 55)	69.2182±7.35273	69.9091±6.22204	0.410
Second-year (n = 55)	66.5273±6.39402	64.0182±8.73158	0.081
Lymphocytes Count			
First-year	28.5455±5.89670	27.9636±7.08928	0.001
Second year	31.2364±7.19044	30.0364±5.51081	0.024
Eosinophil Count			
First-year	1.61±1.02724	1.41±.49781	0.017
Second year	1.92±1.34515	1.76±.99933	0.034
Monocytes Count			
First-year	1.2545±0.479	1.2000±0.403	0.0001
Second year	1.4727±0.539	1.3636±0.580	0.0006

Results are presented as Mean ± Standard Deviation. p-value <0.05 is significant (student's t-test)

The mean Eosinophil Count ± SD during the examination of students in the first year was 1.41±.497 which was lower as compared to before examination mean Eosinophil Count ±SD was 1.61±1.027. There was a significant decrease in Eosinophil Count during the examination as compared to before the examination among the students of the first year (p-value 0.017).

In this study, the mean monocyte count ± SD during the examination of students in the first year was 1.2000±0.403 which was lower as compared to before examination mean monocyte count ±SD was 1.2545±0.479. There was a highly significant decrease in monocyte count during the examination as compared to before the examination among the students of the first year (p-value=0.0001). Table 2

DISCUSSION

Examination stress is a sensation of pressure anxiety experienced by many medical students in the days leading up to and during academic examinations. It normally happens during the revision time before exams, as well as right before and during the exams. Though a moderate amount of stress is important for retaining motivation and preparing for exams, excessive stress can be harmful. Stress generated by academic examination shows significant variation in hematological variables[9]. These variations comprise an increase in platelets, neutrophil count, and red blood cells while eosinophils, lymphocytes, and monocytes are reduced in number. With elevated hemoglobin, the number of large red blood cells increases. However, it has been suggested that stress-induced pro-inflammatory cytokine development can trigger hemopoietic cell proliferation[9].

Shahida et al, found in their study that first-year and final-year students were more in trouble 75 and 71% respectively as compared to the students of second and third-year batches due to the vast academic curriculum followed by frequency of examinations[16]. Qahtani et al noted in their study that the major factor associated with perceived stress was long hours of study, examination, very tight time schedules, language problem, and place adjustment[17].

The results of this study showed a significant effect on the blood cell variables. Stress can affect the hemopoietic and immune systems by releasing cytokines and cortisol, resulting in an increase in

white blood cells[18-19]. Certain hematologic parameters such as neutrophils, platelet counts, and mean volume of the cell (MCV) were found to be increased during the students' examination stresses, and lymphocyte counts were found to be reduced. Hemoglobin, red blood cells, and other parameters were not significantly affected. Our results are inconsistent with the earlier Qureshi et al[10]. report which shows an increase in neutrophils, platelet counts and lymphocyte decreases. The impact of study stress on hematological measurements was studied by Maes et al and they found that the stress of examination increased considerably hematocrit, HB, MCV, MCH, and MCHC[20]. Stress-inducing production of cytokine inflammation has been suggested to stimulate hematopoietic cell proliferation[21]. The hemo concentration, caused by fluid shifts from intravascular to extravascular spaces, concentrated in non-diffusible blood components, may explain an increase in neutrophils, platelets, PCVs, and MCV following a stressor. In comparison with pre-intervention examination stress levels, the level of neutrophils and platelets has been significantly reduced. Following 6 weeks of practice, the level was further reduced[22,23]. The stress of examination is also associated with decreased numbers of monocytes and lymphocytes. And some studies show high levels[24,25].

It is recommended that further studies be carried out on a larger number of subjects and male students. This would help to determine if there are gender differences in response to stress. It is also recommended to construct a stress questionnaire that may be more appropriate for the local population.

CONCLUSION
Examination stress is associated with a significantly decreased eosinophil, monocyte, and lymphocyte count among first-year and second students during the examination. So, it has been observed in this study that exam stress can affect the important hematological parameters that can influence the overall performance of students.

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None.

CONFLICT OF INTEREST
The authors declare that they have no competing interests.

ETHICAL APPROVAL
The proposal was approved by the Ethical Review Committee of Peoples University of Medical and Health Sciences for Women, Shaheed Benazir Abad. Pakistan (Registrar 446-51 dated 06/04/2019). The anonymity and confidentiality of the data were respected throughout the study.

PATIENT CONSENT
Written informed consent was obtained from all the participants.

AUTHORS CONTRIBUTIONS
RS was the main researcher; she gathered the data. UR, SL did the proofreading. MNN, and JAL were involved in the literature search and data analysis. MAU finalized the data and structured the article and corresponding author.

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