International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

*Original Research Article*

# Impact of Perceived Stress on White Blood Cell Count, Erythrocyte Sedimentation Rate and Lipid Profile among First MBBS Students in a Medical College of West Bengal

**Dr. Arunima Chaudhuri[1], Dr. Debdut Banerjee[2]**

[1]Associate Professor, Department of Physiology, Rampurhat Government Medical College and Hospital (Affiliated to West Bengal University of Health Sciences), Rampurhat, West Bengal, India.
[2]Assistant Professor, Gynaecology and Obstetrics, Burdwan Medical College and Hospital, West Bengal, India.

Corresponding Author: Dr. Debdut Banerjee

## ABSTRACT

**Background:** Psychoneuroimmunology is a scientific field dealing with the relationships between the mind, the brain and the immune system and focuses on how these relationships affect health and susceptibility to disease.
**Aims:** To study impact of perceived stress on white blood cell count, erythrocyte sedimentation rate and lipid profile among first MBBS students in a medical college of West Bengal.
**Materials and methods:** This cross-sectional study was conducted in a medical college of eastern India. Approval from the institutional ethics committee and informed consent of the subjects was taken before conduction of this pilot project. On the first appointment, histories of the subjects were carefully recorded and general physical examination was done. BMI, Pulse, Blood Pressure were recorded. One hundred and twenty-one subjects were finally selected. The stress level in the subjects was assessed according to the presumptive life event stress scale (PSLES). Accordingly, they were categorized into two groups: 41–200 less/moderate stress; more than 200 severe stress. The perceived stress scale (PSS) of Cohen et al. was used for assessing perceived stress levels. Fasting blood sample were drawn for analysis of lipid profile, ESR and total count of white blood cells (WBC), Hb% were estimated.
**Statistical analysis:** Data were analyzed using software SPSS version16; Unpaired t test was used.
**Results:** One hundred and twenty-one subjects participated in the present study. Seventy- five subjects were male and forty-six were female. All subjects were on non-vegetarian diet. Sixty-six subjects had PSLES scores above 200 and fifty-five subjects had scores less than 200. There was no significant difference in age between the two groups: 18.4±1.02 vs. 18.8±1.2; P value 0.2. Results showed significant difference in WBC count, ESR, Hb%, Total Cholesterol, Triglyceride, LDL, HDL level, PSLES and PSS scores, but no significant difference in VDL level between the two groups. There was significant difference in BMI, Pulse and blood pressure between the two groups.
**Conclusions:** The prevalence of stress was found to be high during the initial years of study among MBBS students. Physical problems were associated with high stress levels. Results of the present study showed significantly higher WBC count, ESR, Hb%, Total Cholesterol, Triglyceride, LDL, PSLES and PSS scores, BMI, Pulse and blood pressure values in subjects with higher stress scores and decrease in values of HDL. All these factors may increase the risk of cardiovascular diseases. Preventive mental health services, therefore, should be made an integral part of routine clinical services for medical students, especially in the initial academic years, to prevent such occurrence.

***Keywords:*** Perceived stress, WBC count, ESR and lipid profile.

## INTRODUCTION

Medical education is perceived as being stressful, and a high level of stress may have a negative effect on cognitive functioning and health of students in a medical school. The prevalence of stress has been found to be higher during the initial three years of study. [1-6] The seven leading causes of death in the general population are: diseases of the heart, cancer, intracranial lesions of vascular origin (cerebrovascular), accidents, nephritis, pneumonia and influenza, and tuberculosis. These are not the same as the seven leading causes of death among physicians. [1] For example, arteriosclerosis, diabetes and cirrhosis of the liver each caused more deaths among physicians. Globally, about 17 million people die of cardiovascular diseases (CVDs) every year and a substantial number of these deaths are attributed to major risk factors namely unhealthy diet, physical inactivity, tobacco consumption, alcohol consumption and stress. Doctors and nurses often have a sedentary lifestyle. [6-7]

A study BY Hedge SKB et al [7] was aimed at assessing the lifestyle-associated risk for CVDs among doctors and nurses in a medical college hospital. A cross-sectional study was conducted among 250 doctors and nurses, selected using a stratified random sampling, working at a medical college hospital in Tamil Nadu. It was found that 31.2% of all study subjects and 49.2% of doctors were at high general risk for CVDs; 30.4% of all study subjects and 42.1% of doctors were at high physical activity-related risk for CVDs; 14.4% of all study subjects and 19.8% of all doctors were at high dietary pattern-related risk for CVDs. Doctors were found to be at a higher risk for CVDs as compared to nurses as well as the general population. [7]

There is an enormous amount of literature on psychological stress and cardiovascular disease. Studies of chronic stressors are discussed in terms of job stress, marital unhappiness, and burden of caregiving. Although stressors trigger events, it is less clear that stress "causes" the events. [6-7]

Cardiovascular diseases claim more lives worldwide than any other. Etiologically, the dominant trajectory involves atherosclerosis, a chronic inflammatory process of lipid-rich lesion growth in the vascular wall that can cause life-threatening myocardial infarction (MI). Leukocytes - white blood cells - are important participants at the various stages of cardiovascular disease progression and complication. Atherosclerosis is the pathology that leads to myocardial infarction and stroke. Atherosclerosis is a chronic inflammatory disease driven by lipids, specifically low density lipoproteins (LDL) and leukocytes. Lifestyle, age, hereditary factors, and co-morbidities disturb immune, digestive, endocrine, circulatory, and nervous systems, thereby altering immune function, metabolism, and many other processes, while eliciting inflammation, hypercholesterolemia, and hypertension. Atherosclerosis develops and causes myocardial infarction or stroke when many things go wrong in many different ways. [8]

The natural progression of atherosclerosis in the human involves the acquisition of specific features in the growing lesion. A key initiating process of atherosclerosis is the intimal retention of apolipoprotein (apo) B-containing lipoproteins in regions of disturbed blood flow and low shear stress. The existence of small pools of extracellular lipids in the intima is a feature of a preatheroma, whereas an easily discernible core of extracellular lipid marks an atheroma. Increasingly complicated lesions are defined by fibrous thickening; the appearance of fissures, hematoma, and thrombi; and calcification. Problems occur if a lesion interferes with tissue oxygenation when either the lesion's size reduces blood flow

or the lesion ruptures and occludes the vessel altogether. Of the two, lesion rupture is far more dangerous. Myocardial infarction and stroke are sudden events that result from occlusion of vessels that oxygenate the heart and brain, respectively. [8]

Macrophages are most numerous among leukocytes in any type of lesion and, with the possible exception of smooth muscle cells, the most prominent cellular contributors to the lesion's physical bulk. In response to intimal lipid accumulation, disturbed blood flow, low shear stress, and other stimuli, endothelial cells permit monocytes - major precursors of macrophages - passage across the endothelium. Newly-infiltrated monocyte-derived macrophages recognize and ingest lipids that have accrued in the intima as a consequence of hypercholesterolemia. Macrophages are specialized phagocytes that rely on different strategies to sense, internalize, and process the diverse lipid moieties they encounter. Lipoprotein recognition and consequent ingestion morphs macrophages into foam cells, many of which eventually die and contribute to a large lipid core, a characteristic of lesions most vulnerable to rupture. Leukocytes may fuel an inflammatory cycle, but they also, in some incarnations, quench it. In response to hypercholesterolemia, the bone marrow and spleen overproduce Ly-6Chigh monocytes that enter the circulation, contribute to excessive monocytosis, preferentially accumulate in lesions, and differentiate to macrophages. [8]

A report by Segerstrom SC et al [9] meta-analyzed more than 300 empirical articles describing a relationship between psychological stress and parameters of the immune system in human participants. Acute stressors were found to be associated with potentially adaptive upregulation of some parameters of natural immunity and downregulation of some functions of specific immunity. Brief naturalistic stressors tended to suppress cellular immunity while preserving humoral immunity. Chronic stressors were associated with suppression of both cellular and humoral measures.

Sympathetic fibers descend from the brain into both primary (bone marrow and thymus) and secondary (spleen and lymph nodes) lymphoid tissues. These fibers can release a wide variety of substances that influence immune responses by binding to receptors on white blood cells. Though all lymphocytes have adrenergic receptors, differential density and sensitivity of adrenergic receptors on lymphocytes may affect responsiveness to stress among cell subsets. The hypothalamic–pituitary–adrenal axis, the sympathetic–adrenal–medullary axis, and the hypothalamic–pituitary–ovarian axis secrete the adrenal hormones epinephrine, norepinephrine, and cortisol; the pituitary hormones prolactin and growth hormone; and the brain peptides melatonin, β-endorphin, and enkephalin. These substances bind to specific receptors on white blood cells and have diverse regulatory effects on their distribution and function. People's efforts to manage the demands of stressful experience sometimes lead them to engage in behaviors-such as alcohol use or changes in sleeping patterns-that also could modify immune system processes. Thus, behavior represents a potentially important pathway linking stress with the immune system. [9]

Chronic stress might shift the balance of the immune response. Chronic stress elicits simultaneous enhancement and suppression of the immune response by altering patterns of cytokine secretion. Th1 cytokines, which activate cellular immunity to provide defense against many kinds of infection and some kinds of neoplastic disease, are suppressed. This suppression has permissive effects on production of Th2 cytokines, which activate humoral immunity and exacerbate allergy and many kinds of autoimmune disease. This shift can occur via the effects of stress hormones such as cortisol. Th1-to-Th2 shift changes the balance of the immune response without necessarily changing the overall level of

activation or function within the system. Because a diminished Th1-mediated cellular immune response could increase vulnerability to infectious and neoplastic disease, and an enhanced Th-2 mediated humoral immune response could increase vulnerability to autoimmune and allergic diseases, this cytokine shift model also is able to reconcile patterns of stress-related immune change with patterns of stress-related disease outcomes. [9]

Relationships between work-related psychological and physical stress responses and counts of white blood cells (WBCs), neutrophils, and lymphocytes were investigated in 101 daytime workers by Nishitani N et al. [10] Counts of WBCs and neutrophils were positively associated with smoking and inversely correlated with high density lipoprotein (HDL)-cholesterol levels. General fatigue score as measured by the profile of mood state was positively correlated with WBC and neutrophil counts whereas lymphocyte counts was not significantly associated with fatigue score. Multiple regression analysis showed that WBC count was significantly related to general fatigue, age, and HDL-cholesterol levels. Neutrophil count was significantly related to HDL-cholesterol levels and fatigue score. Among various psychological stress response variables, general fatigue may be a key determinant of low-grade inflammation as represented by increases of WBC and neutrophil counts. Job stress was found to be related to a dampened innate immune defense that may change the pattern of cytokine production, leading to an increase of inflammatory response which could influence WBC count as well. Similarly, IL-6 levels, an important marker of chronic low-grade inflammation, have been reported to increase by sleep disorders and fatigue. Fatigue may promote inflammatory response on one hand and suppression of cellular immune response on the other. [10]

Matthews KA et al [11] in their study evaluated whether the effects of acute stress on immune parameters were apparent in only women who showed concomitant and substantial sympathetic nervous system activation and after statistical adjustment for changes in plasma volume. Nineteen women in the follicular stage of their menstrual cycles were assessed for immunological responsiveness to a series of three 3-minute psychological tasks, which reliably elicit cardiovascular and neuroendocrine stress responses. Women were classified as high or low sympathetic reactors based on their cardiovascular and neuroendocrine responses to one of the three tasks, a public speaking task. The stress-induced decreases in CD4+ percentage and increases in natural killer cell number and cytolytic activity were only apparent among the high reactors. Further analysis adjusting for alterations in plasma volume changes showed that the increase in NK cell number remained. Stress-induced proliferative responses to pokeweed mitogen and phytohemagglutinin were not more apparent among high reactors. These results are consistent with the hypothesis that the sympathetic nervous system plays a direct role in modulating the short term response to stress of some indices of the immune system in women.

Psychological stress suppresses various parameters of immune functions and consequently can cause diseases. Various studies suggested that the nature of stressor (acute or chronic) may have differential impact upon the immune functioning, with brief acute stress enhancing some parameters of immunity whereas chronic stress adversely affecting almost all parameters of immune functions. Stress and immune functions are mediated by the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic (sympathetic and parasympathetic) nervous system. In addition, there is a possibility of behavioral pathways (such as alcohol intake, sleep disturbances) through which stress affects immune functions. [12]

In response to a stressor, physiological changes are set into motion to help an individual cope with the stressor.

However, chronic activation of these stress responses, which include the hypothalamic-pituitary-adrenal axis and the sympathetic-adrenal-medullary axis, results in chronic production of glucocorticoid hormones and catecholamines. Glucocorticoid receptors expressed on a variety of immune cells bind cortisol and interfere with the function of NF-kB, which regulates the activity of cytokine-producing immune cells. Adrenergic receptors bind epinephrine and norepinephrine and activate the cAMP response element binding protein, inducing the transcription of genes encoding for a variety of cytokines. The changes in gene expression mediated by glucocorticoid hormones and catecholamines can dysregulate immune function. The magnitude of stress-associated immune dysregulation is large enough to have health implications. [13]

Inflammation is central to the aging process, and stress may play a key role in moderating inflammation factors, such as IL-6 or CRP. While erythrocyte sedimentation rate (ESR) is widely used as a clinical marker of inflammatory processes, only a few cross-sectional studies have examined its relationship with psychosocial stress in humans, and these have shown mixed results. Aldwin CM et al [14] used longitudinal data from the VA Normative Aging Study (NAS), selecting 1,234 men (Mage in 1989 = 67.7, SD = 6.8, range = 53 - 82) who completed 1 to 5 biomedical examinations and the Health and Social Behavior (HSB) surveys every three years between 1989 and 2002 (total observations = 3,134, Mean individual observations = 3.1, SD = 1.1). Multilevel modeling analysis was used to examine within-and between-person differences in ESR, stressful life events (SLEs), and hassles, controlling for self-rated health, smoking, and alcohol consumption. Between-person analyses showed that ESR increased with age and smoking status. The within-person analyses revealed that SLEs and self-rated health negatively covaried with ESR, while smoking still increased ESR. Results were interpreted using Franceschi and Campisi's (2014) biphasic model showing that acute stress can decrease inflammation, although chronic stress can increase. [14]

The effect of a 75-hour vigil on the erythrocyte sedimentation rate (ESR) was studied in two experiments with 63 healthy male volunteers in a study. The ESR was increased at the end of the vigil compared with pre-exposure values. The increases did not correlate significantly with concomitant changes in serum triglycerides, free fatty acids, cholesterol or gamma globulins, except for a significant, negative correlation with cholesterol changes in one of the two studies. Although the mechanism for the increases in ESR in response to stressor exposure remains unclear, it is concluded that when using the ESR in clinical practice, allowance should be made for situational factors such as the patient having experienced some stressful days and sleepless nights. [15]

Thus the present study was conducted to assess impact of perceived stress on white blood cell count, erythrocyte sedimentation rate and lipid profile among first MBBS students in a medical college of West Bengal so that early measures may be taken in medical schools for improvement of the quality of life of medical professionals.

## MATERIALS AND METHODS

This cross-sectional study was conducted in a medical college of eastern India. Approval from the institutional ethics committee and informed consent of the subjects was taken before conduction of this pilot project.

**Inclusion criteria:** Medical students in the age group of 17-21 years of first MBBS batch were selected.

**Exclusion criteria:** Subjects suffering from chronic debilitating diseases such as cardiac arrhythmias, hypertension, diabetes, ischemic heart disease, retinopathy, nephropathy, or respiratory diseases, smokers, persons receiving any drug that may affect the autonomic reflexes were excluded. Subjects on treatment from

psychiatry problem, pregnant women, puerperal mothers, subjects on regular meditation and exercise regime were excluded. Women on oral contraceptives were not included.

On the first appointment, histories of the subjects were carefully recorded and general physical examination was done. BMI, Pulse, Blood Pressure were recorded. One hundred and twenty-one subjects were finally selected. Pre-test instructions were given to avoid consumption of any drugs that may alter the Cardio respiratory parameters 48 hours prior to the test. The subjects were advised for a good restful sleep and to fast at least for 12 hours after a light dinner at the night before the test day. On the day of the test, no cigarette, nicotine, coffee, or drugs were permitted.

Subjects were asked to tally a list of 43 life events based on a relative score. The stress level in the subjects was assessed according to the presumptive life event stress scale (PSLES). [16-18] Accordingly, they were categorized into two groups: 41–200 less/moderate stress; more than 200 severe stress.

The perceived stress scale (PSS) of Cohen et al. the most widely used psychological instrument for measuring the perception of stress, was used for assessing stress levels. It is a measure of the degree to which situations in one's life are appraised to be stressful. Items were designed to find how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress. The questions in the PSS ask about feelings and thoughts during the last month. It comprises of 10 items, four of which are reverse-scored, measured on a 5-point scale from 0 to 4. PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 = 0) to the four positively stated items (items 4, 5, 7, and 8) and then summing across all scale items. Total score ranges from 0 to 40. [16-18] Fasting blood sample were drawn for analysis of lipid profile, ESR and total count of white blood cells (WBC), Hb% were estimated.

Increased sympathetic activity has been observed during the premenstrual phase and this was positively correlated with the stress levels in previous studies. [16-18] To avoid stress effects of the premenstrual phase, we examined our subjects during the postmenstrual phase.

**Statistical analysis:** Data were analyzed using software SPSS version16; probability values (P Value) <0.05 were considered as statistically significant and P Values <0.01 were considered as statistically highly significant. Unpaired t test was used.

## RESULTS

One hundred and twenty-one subjects participated in the present study. Seventy- five subjects were male and forty-six were female. All subjects were on non-vegetarian diet. Sixty-six subjects had PSLES scores above 200 and fifty-five subjects had scores less than 200. There was no significant difference in age between the two groups: 18.4±1.02 vs. 18.8±1.2; P value 0.2. Results showed significant difference in WBC count, ESR, Hb%, Total Cholesterol, Triglyceride, LDL, HDL level, PSLES and PSS scores, but no significant difference in VDL level between the two groups (Table1, Figure 1-3). There was significant difference in BMI, Pulse and blood pressure between the two groups (Table 2).

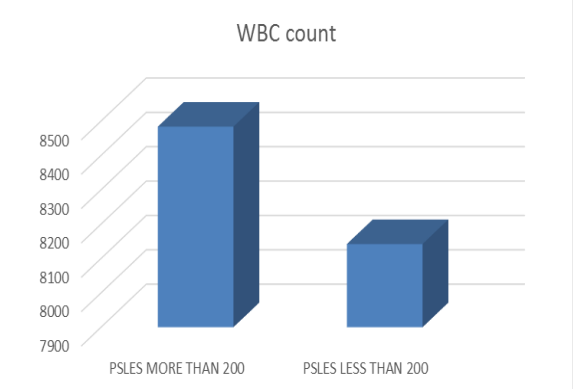


**Figure 1: Comparison of WBC count**

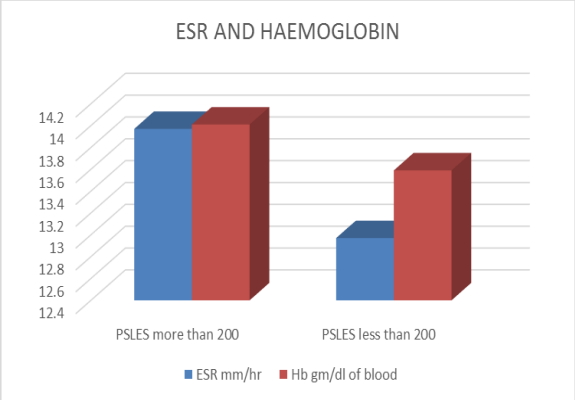


**Figure 2: Comparison of ESR and Hemoglobin**

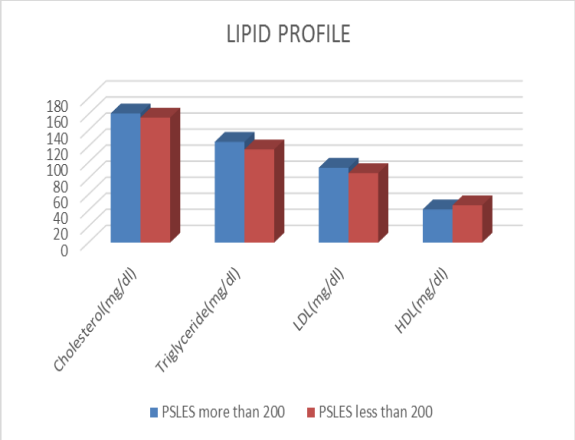


**Figure 3: Comparison of Lipid profile**

**Table 1: Shows comparison of different parameters of subjects with PSLES scores more than 200 and less than 200.**

| Parameters | Mean ± SD | | P value |
|---|---|---|---|
| | Subjects with PSLES scores more than 200 | Subjects with PSLES scores less than 200 | |
| WBC count/mm$^3$ | 8483.6± 1241.26 | 8142± 1146.94 | 0.046* |
| ESR mm/hr | 13.97± 2.34 | 12.97± 2.99 | 0.009** |
| Hb gm/dl of blood | 14.01±1.46 | 13.59±1.36 | 0.041* |
| Cholesterol(mg/dl) | 161.06± 20.6 | 155.85± 14.35 | 0.041* |
| Triglyceride(mg/dl) | 125.57± 25.2 | 116.17± 25.28 | 0.0098** |
| LDL(mg/dl) | 93.3± 15.83 | 86.62 ± 12.5 | 0.0012** |
| HDL(mg/dl) | 41.4± 5.35 | 46.54±2.3 | <0.001** |
| VLDL(mg/dl) | 24.44±4.73 | 23.91±5.7 | 0.47 |
| Perceived stress score | 28.2±3.1 | 19.4±2.6 | <0.001** |
| PSLES score | 311.9±26.2 | 162.8±25.5 | <0.001** |

Results show significant difference in WBC count, ESR, Hb%, Total Cholesterol, Triglyceride, LDL, HDL level, PSLES and PSS scores, but no significant difference in VDL level.
P-value <0.05* (significant)
P-value <0.01** (highly significant)

**Table- 2: The average values of BMI, Pulse, SBP, DBP ratio of the two groups are shown in the following table.**

| PARAMETERS | Mean ± SD | | P-VALUE |
|---|---|---|---|
| | SUBJECTS WITH PSLES SCORES MORE THAN 200 | SUBJECTS WITH PSLES SCORES LESS THAN 200 | |
| BMI(kg/m2) | 25.1±2.8 | 22.9±1.4 | <0.001** |
| PULSE (beats per minute) | 74.7 ± 4.5 | 72.7 ± 3.02 | <0.001** |
| SBP(mm Hg) | 117.7 ± 7.9 | 113.9 ± 5.9 | <0.001** |
| DBP(mm Hg) | 80.04 ± 6.5 | 75.4 ± 5.4 | <0.001** |

Results show significant difference in BMI, Pulse, SBP and DBP between these two groups.
P-value <0.05 (*significant)
P-value <0.01 (**highly significant)

## DISCUSSION

Psychoneuroimmunology (PNI) is a scientific field dealing with the relationships between the mind (psyche), the brain (neuro) and the immune system (immunology). PNI focuses on how these relationships affect health and susceptibility to disease. Emotions affect our immune system through neurotransmitters such as serotonin, dopamine, and nor-epinephrine, which are injected into the blood and act on white blood cells. Many cytokines (the chemicals that white blood cells release to communicate with each other) also affect the nervous system. Long-term effects of glucocorticoid hormones on leukocyte populations are seen in humans with chronic medical disorders; for example, Cushing's syndrome is a disorder characterized by chronically elevated levels of plasma cortisol and medical researchers have found that patients with this disorder had chronically elevated neutrophil counts and lower lymphocyte counts compared to healthy individuals. Similarly, neutrophils are elevated and lymphocytes depressed in humans with psychological disorders such as depression and schizophrenia, which are

characterized by chronically elevated plasma cortisol level. Elevated white blood cell (WBC) count has been reported to be an independent predictor of coronary heart disease and is associated with several cardiovascular disease risk factors. Studies have reported that WBC count is a convenient and useful marker to capture inflammatory responses because it is inexpensive compared to other inflammatory markers such as interleukin-6 (IL-6) and high-sensitivity C-reactive protein (CRP). [19-21] In the present study we found higher WBC count and ESR values in subjects having higher PSS levels. Total Cholesterol, triglyceride, LDL were also significantly increased in these subjects and these factors are major contributors to development of cardiovascular diseases in future.

A dose-response association exists between exposure to work stress and the metabolic syndrome. Employees with chronic work stress have more than double the odds of the syndrome than those without work stress, after other risk factors are taken into account. Health professionals are an important population subgroup, since they are committed to health promotion and prevention, or treatment of diseases, which affect not only their own health but also communities, families and individuals with which they work. [22-23] In the present study we also observed that higher stress scores among MBBS students had a negative impact on their health profile.

Cardiovascular disease (CVD) risk has been linked to several emotional and psychological factors, including stress and depression. Mental stress can elicit acute coronary events and is considered a risk factor for CVD. Major depressive disorder (MDD) is an independent risk factor for cardiovascular disease (CVD); the presence of MDD symptoms in patients with CVD is associated with a higher incidence of cardiac complications following acute myocardial infarction (MI). Stress-hemoconcentration, a result of psychological stress that might be a risk factor for the pathogenesis of CVD. [24]

Secondary analysis of stress hemoconcentration was performed on data from controls and subjects with mild to moderate MDD participating in an ongoing pharmacogenetic study of antidepressant treatment response to desipramine or fluoxetine by Wong ML et al in 2008. [24] Hematologic and hemorheologic measures of stress-hemoconcentration included blood cell counts, hematocrit, hemoglobin, total serum protein, and albumin, and whole blood viscosity. Subjects with mild to moderate MDD had significantly increased hemorheologic measures of stress-hemoconcentration and blood viscosity when compared to controls; these measures were correlated with depression severity. Measures of stress-hemoconcentration improved significantly after 8 weeks of antidepressant treatment. Improvements in white blood cell count, red blood cell measures and plasma volume were correlated with decreased severity of depression. Secondary data analyses supported the concept that stress-hemoconcentration, possibly caused by decrements in plasma volume during psychological stress, is present in Mexican-American subjects with mild to moderate MDD at non-challenged baseline conditions. It was also found that after antidepressant treatment hemorheologic measures of stress-hemoconcentration were improved and were correlated with improvement of depressive symptoms. These findings suggest that antidepressant treatment may have a positive impact in CVD by ameliorating increased blood viscosity. Physicians should be aware of the potential impact of measures of hemoconcentration and consider the implications for cardiovascular risk in depressed patients.

In the present study we also found significantly higher Hb% in subjects with higher stress scores.

To estimate the prevalence of depression and its relationship with disease

activity parameters in Egyptian patients with RA Mostafaa H et al [25] conducted a study in 2013 on 170 patients with RA. The following values were assessed for each patient: erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), rheumatoid factor (RF), swollen and tender joint counts (SJC and TJC), disease activity score 28 (DAS28), health assessment questionnaire score (HAQ), visual analogue scale (VAS) of pain and hospital anxiety and depression scale-depression subscale (HADS-D).

The prevalence of depression was 15.29% (26 RA patients). In the depressed RA patients, positive significant correlations were found between HADS-D score and age, disease duration, HAQ score, VAS, DAS28 score and CRP. However, no significant correlation was found between HADS-D score and ESR, number of swollen and tender joints. A high positive significant correlation was found between depression and CRP. Compared with non-depressed individuals, depressed patients have activated inflammatory pathways, including increased expression of chemokines, adhesion molecules and cytokines. Patients with major depression have increased serum and/or plasma concentrations of CRP, IL-6 51, 52 and proinflammatory TNF-α. [25]

The present study also observed increased WBC count and Higher ESR levels in subjects with higher stress scores.

We had conducted a study to observe effect of stress on academic performance and health profile in medical students in 2016. [26] One hundred and fifty MBBS students in the age group of 18-20 years under stress were chosen for the study. Baseline anthropometric measurements were done; body mass index and waist to hip ratio (WHR) were calculated. Resting pulse rate and blood pressure were measured. The results of internal assessment examinations conducted in this time period were recorded. A total of 30 subjects had moderate PSLES scores (167.25±26.67); 120 had high scores (373.86±149.21; P <0.000). We found statistically significant higher heart rate, diastolic blood pressure, WHR, and PSS scores (22.05±5.02 vs. 19.25±4.21; P 0.003) in subjects having high PSLES scores. No significant effect of stress scores was observed on systolic blood pressure. Examination results were significantly worse in the highly stressed group (64.3±10.8 vs. 69.1±9.6; P 0.019) as compared to subjects having moderate stress. [26] In the present study impact of stress levels on WBC count ESR and Lipid profile was analyzed. In the present study only sixty- six subjects had PSLES score more than 200 and fifty- five had stress scores less than 200. Percentage of subjects having higher stress scores were significantly more in the previous study as compared to the present one. In the present study significant difference in systolic blood pressure was observed between the two groups, while in the previous study there was no significant difference in systolic blood pressure between the two groups. We did not study the effect of perceived stress on academic performance in the present study. These are the differences between the two studies.

From the above mentioned findings of the present study it may be predicted that higher perceived stress levels among medical students may increase the risk of developing cardiovascular diseases by increasing WBC count, ESR levels, Total cholesterol, Triglyceride, LDL cholesterol levels and all these factors may contribute in development of atherosclerosis.

**Limitations and future scope:** There are several limitations to the present study. First, this was a cross-sectional study. Further longitudinal investigations are needed to determine the impact of changes in WBCs and ESR as physical indicators due to a psychological stress response. In this study, WBCs and ESR were examined, but the inflammatory mechanism is complex. Further detailed investigation including cytokines and CRP levels may be necessary to investigate the impact of stress

among medical students on potential inflammatory processes.

## CONCLUSIONS

The prevalence of stress was found to be high during the initial years of study among MBBS students. Physical problems were associated with high stress levels. Results of the present study showed significantly higher WBC count, ESR, Hb%, Total Cholesterol, Triglyceride, LDL cholesterol, PSLES and PSS scores, BMI, Pulse and blood pressure values in subjects with higher stress scores and decrease in values of HDL. Preventive mental health services, therefore, should be made an integral part of routine clinical services for medical students, especially in the initial academic years, to prevent such occurrence.

**Conflict of interest:** Declared none.

## REFERENCES


1. Dimsdale JE. Psychological Stress and Cardiovascular Disease. J Am Coll Cardiol. 2008; 51(13): 1237–1246.
2. AlKanhal AA, Mahmoud ES, Ponnamperuma GG, Alfaris EA. Stress and Its Effects on Medical Students: A Cross-sectional Study at a College of Medicine in Saudi Arabia. J Health Popul Nutr. 2011; 29(5): 516–522.
3. Tyseen R, Vaglum P, Gronvold NT, Ekeberg O. Factors in medical school that predict postgraduate mental health problems in need of treatment. A nationwide and longitudinal study. Med Educ. 2001; 35: 110–20.
4. Dahlin M, Joneborg N, Runeson B. Stress and depression among medical students: a cross-sectional study. Med Educ. 2005; 39: 594–604.
5. El-Gilany AH, Amr M, Hammad S. Perceived stress among male medical students in Egypt and Saudi Arabia: effect of sociodemographic factors. Ann Saudi Med. 2008; 28: 442–8.
6. Amr M, El-Gilany A, El-Sayed M, El-Sheshtawy E. Study of stress among medical students at Manssoura University. Banha Med J. 2007; 37:25–31.
7. Hegde SKB, Vijayakrishnan G ,Sasankh AK, Venkateswaran S, Parasuraman G. Lifestyle-associated risk for cardiovascular diseases among doctors and nurses working in a medical college hospital in Tamil Nadu, India. J Family Med Prim Care. 2016 ; 5(2): 281–285.
8. Swirski FK, Nahrendorf M. Leukocyte behavior in atherosclerosis, myocardial infarction, and heart failure. Science. 2013; 339(6116): 161–166.
9. Segerstrom SC, Miller GE. Psychological Stress and the Human Immune System: A Meta-Analytic Study of 30 Years of Inquiry. Psychol Bull. 2004; 130(4): 601–630.
10. Nishitani N, Sakakibara H. Association of Psychological Stress Response of Fatigue with White Blood Cell Count in Male Daytime Workers. Ind Health. 2014; 52(6): 531–534.
11. Matthews KA, Caggiula AR, McAllister CG, Berga SL, Owens JF, Flory JD, Miller AL. Sympathetic reactivity to acute stress and immune response in women. Psychosom Med. 1995;57(6):564-71.
12. Hussain D. Stress, Immunity, and Health: Research Findings and Implications. International Journal of Psychosocial Rehabilitation. 2010; 15(1):94-100.
13. Padgett DA, Glaser R. How stress influences the immune response. Trends in immunology. 2004; 24(8): 444-48.
14. Aldwin CM, Choun S, Nath R, Proulx J, Spiro A. Does erythrocyte sedimentation rate covary with stress? Longitudinal findings from the va normative aging study. The Gerontologist. 2015; 55(2): 178–179.
15. Palmblad J, Karlsson CG, Levi L, Lidberg L. The erythrocyte sedimentation rate and stress. Acta Med Scand. 1979;205(6):517-20.
16. Chaudhuri A, Ray M, Saldanha D, Bandopadhyay A. Effect of progressive muscle relaxation in female health care professionals. Ann Med Health Sci Res 2014; 4:791-5.
17. Chaudhuri A, Roy M, Dasgupta S, Ghosh MK, Biswas A, Hazra S. Effect of progressive muscle relaxation on adverse cardiovascular profile in women with polycystic ovarian syndrome. J Basic Clin Reprod Sci 2014; 3:115-20.
18. Chaudhuri A, Ray M, Saldanha D, Sarkar SK. Effects of progressive muscle relaxation on postmenopausal stress. J Sci Soc 2015; 42:62-7.

19. Lee CD, Folsom AR, Nieto FJ, Chambless LE, Shahar E, Wolfe DA. White blood cell count and incidence of coronary heart disease and ischemic stroke and mortality from cardiovascular disease in African-American and White men and women: atherosclerosis risk in communities study. Am J Epidemiol. 2001; 154, 758–64.
20. Nakanishi N, Suzuki K, Tatara K. Association between lifestyle and white blood cell count: a study of Japanese male office workers. Occup Med (Lond). 2003; 53: 135–7.
21. Nishitani N, Sakakibara H. Subjective poor sleep and white blood cell count in male Japanese workers. Ind Health. 2007; 45: 296–300.
22. Chandola T, Brunner E, Marmot M. Chronic stress at work and the metabolic syndrome: prospective study. BMJ. 2006; 332(7540):521-525.
23. International Standard Classification of Occupations - Structure, group definitions and correspondence tables: ISCO-08. International Labour Office, Geneva: International Labour Organization. 2012; 1:1-433. [ISBN: 978-92-2-125953-4 (web pdf) (www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm)
24. Wong ML, Dong C, Esposito K, Thakur S, Liu W, Elashoff RM, Licinio J. Elevated Stress-Hemoconcentration in Major Depression Is Normalized by Antidepressant Treatment: Secondary Analysis from a Randomized, Double-Blind Clinical Trial and Relevance to Cardiovascular Disease Risk. PLOS ONE 2008; Published: July 16, 2008 https://doi.org/10.1371/journal.pone.0002350.
25. Mostafaa H, Radwanb A. The relationship between disease activity and depression in Egyptian patients with rheumatoid arthritis. The Egyptian Rheumatologist. 2013; 35 (4): 193-199.
26. Chaudhuri A, Goswami A, Ray M, Hazra SK. To study impact of stress on education and health profile of newly admitted medical students in a medical college of Eastern India. Saudi J Sports Med 2016; 16:41-6.

How to cite this article: Chaudhuri A, Banerjee D. Impact of perceived stress on white blood cell count, erythrocyte sedimentation rate and lipid profile among first MBBS students in a Medical College of West Bengal. International Journal of Research and Review. 2018; 5(12):220-230.

******