



Original Article

Acute noise exposure effect on certain hematological parameters in tailors: a pilot study

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ABSTRACT

Noise exposure has long been used as a stressor to investigate its effect on biological and biochemical responses. Primary examination of hematological parameters reveals the physiological status of an individual. Aim: To evaluate the effect of acute noise stress on certain hematological parameters in tailors. Methods: Newly trained tailors were exposed to acute noise stress for 7hrs/day and their blood cell parameters were determined on 8th and 24th day using automated blood cell counter. Results: A significantly increased total leukocyte count (TLC) and platelet count were observed on 24th day ($p < 0.001$) while red blood cell count (RBC) and hemoglobin concentration (Hb) did not show any significant increase. Blood indices like mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC) and mean corpuscular hemoglobin concentration (MCH) remained within the physiological range, unaltered. Conclusion: Acute noise stress increases the peripheral TLC counts in tailors, may modulate their immune function and facilitates acclimatization to their new occupational environment.

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1. Introduction

Noise, has long been realized as an occupational, environmental stressor causing physiological, psychological and behavioral changes in humans. Rapid urbanization, increased pollution and noise exposure results in certain health risks involving hearing loss, sleep disturbances, hypertension and ischemic heart disease. Considerable lung function impairment following long-term occupational exposure to dust particles in the stone quarry workers and millers has been reported in the literature [1]. Exposure to large pressure amplitude and low frequency noise in aircraft workers resulted in oro-pharyngeal microbial infections. Long-term exposure to noise stress resulted in the suppression of the cellular and humoral immune responses [2]. The mechanisms underlying noise induced reduction of the immune function may be related not only to neuro-endocrine change, but also to the imbalance of oxidative stress. White blood cell count is a routine haematological parameter for the assessment

of tissue damage, infection and many inflammatory conditions. A number of studies have shown the immunosuppressive effect of noise stress in animal models [3]; however human studies are scanty. The present study screened certain hematological parameters in a group of tailors exposed to fabric dust and acute noise stress.

2. Materials and Methods

Forty (40) men tailors aged between 25 – 40 years (mean age of 32 ± 3.5) with body mass index (BMI) of 21 – 25 kg/mt² (mean BMI 23.2 ± 0.5) at various parts of Rajahmundry city, working for 7 hrs a day gave their informed consent and participated in this study. Detail history was taken followed by clinical examination. Those with history of asthma, malignancy, infection, neurological disease, diabetes, under prolonged medication for any disorder/disease participants were excluded from the study protocol. The study is approved by Institutional Ethics Committee of GSL Medical College, Rajahmundry, India.

2.1 Study protocol

Tailors who started their new profession, already working for the past five days were considered. They were exposed to 7hrs sewing machine noise stress (3hrs between 10 hrs to 13hrs and 4hrs between 17hrs to 21 hrs with a break of 4hrs in the afternoon) associated fabric dust in their working environment. Blood samples were collected on 8th day and on 24th day from the same

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tailors and blood parameters were determined. 2ml fasting blood samples were collected in a sterile vacutainer between 7:30 to 8:30 A.M and transported to the hematology laboratory under sterile pack.

2.2 Hematological parameters

Hematological parameters of blood samples were determined with automated cell counter (Sysmex, model KX 21). The system is fully automated, quantitative hematology analyzer for *in vitro* diagnostic use in clinical laboratories. It provides accurate, quick screening for blood parameters.

2.3 Statistical analyses

Data analyses was obtained by paired Student't' test using SPSS trial version 16, $p < 0.05$ was considered as statistically significant.

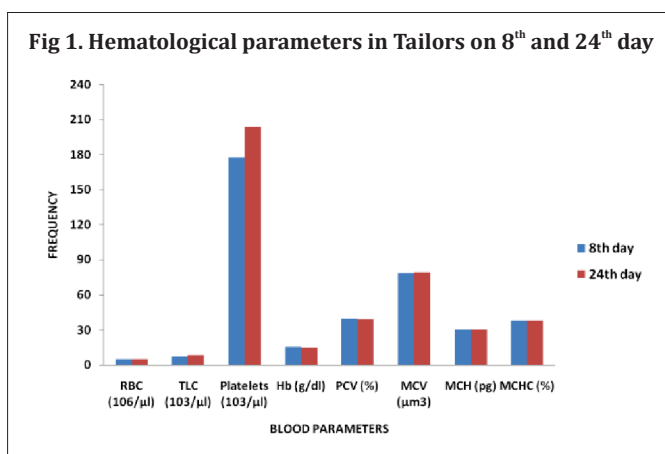
3.Results

Hematological parameters of the tailors were shown in Table. 1. Out of all the blood parameters, the WBC count and platelet count was significant between the 8th day and 24th day. Though the numerical values of hemoglobin (Hb %) and packed cell volume (PCV %) on 24th day was higher compared to 8th day, the values are not statistically significant. Red blood cell count (RBC) was decreased on 24th day; however it was not statistically significant. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) remain unchanged between the 3 week intervals. Figure. 1 shows the histograms of blood parameters of tailors on 8th and 24th day.

Table. 1 shows the mean \pm SD values of estimated hematological parameters on 8th and 24th day.

Parameter	8 th day (Mean \pm SD)	24 th day (Mean \pm SD)
RBC ($\times 10^6/\mu\text{l}$)	5 \pm 0.13	4.9 \pm 0.15
WBC ($\times 10^3/\mu\text{l}$)	7.20 \pm 0.21*	8.03 \pm 0.25
Platelets ($\times 10^3/\mu\text{l}$)	177.30 \pm 5.5*	203.8 \pm 7.80
Hb (g/dl)	15.11 \pm 0.23	14.83 \pm 0.21
PCV %	39.35 \pm 0.41	38.72 \pm 0.45
MCV (μm^3)	78.60 \pm 1.30	78.9 \pm 0.87
MCH (pg)	30.22 \pm 0.50	30.32 \pm 0.65
MCHC (%)	38.0 \pm 0.51	38.0 \pm 0.34

* $p < 0.001$ considered significant



4. Discussion

Stressors affect various aspects of the immune function. It has been indicated that the innate non-specific immune response, as well as the specific immune response may be altered by stress [4]. Noise exposure has long been used as a stressor to investigate its effect on biological and biochemical responses. Newly trained tailors were exposed to 7hrs of sewing machine noise stress with an interval of 4hrs between the 3rd hour and the 4th hour of noise exposure. As it is their new occupation their fabric dust exposure is not merely recorded. As a pilot study we have concentrated only on primary hematological parameters, which are mandatory for any routine clinical investigations. The results of the present study shows that most of the hematological parameters remained unchanged following acute noise stress. RBC number and hemoglobin concentration varied non-significantly between 8th day and 24th day after exposing to acute noise stress and fabric dust; however chronic noise stress results in oxidative stress by generation of reactive oxygen species via altered red cell membrane [5]. Blood indices also remained within the physiological range following acute noise stress. Platelets are no true cells; they are the cytoplasmic fragments of megakaryocytes in bone marrow, released from the bone marrow into the blood stream. An elevated platelet count in tailors is in agreement with previous investigations of other stress models. Qureshi et.al., (2002) [6] and Laderbogen et.al., (2009) [7] reported that stress produces changes in blood cell parameters and reported increased platelet count in stress group.

In our study the estimated total WBC count was significant by 13% increase between 8th day and 24th day; however the differential leukocyte count could further demonstrate the rapid change in the specific lineage of WBC's. Hioshi and Kanehisa (1996) [8] reported that during arithmetic mental stress the absolute number of leukocytes, lymphocytes, CD8+ cells, and CD16+ cells increased significantly, and the rate of CD8+ cell increase was higher than CD4+ cell increase. Therefore the CD4+/CD8+ ratio decreased significantly during acute mental stress. Stimulated leucocytes release eosinoids, platelet-activating factor and oxygen derived free radicals, which may initiate platelet aggregation and release of potent vasoconstrictors serotonin and thromboxane A₂; this may produce microvascular obstruction by thrombus formation [9]. Rodents when exposed to 80dB of rock music for 24hrs, macrophage secretion on IL-1 and neutrophil release of O₂-anion were reduced [10]. C 57/BL6 mice showed that exposure to unpredictable 100dB noise stress for 1 week resulted in the reduction of both splenic Thy+ lymphocytes (indicator of T-lymphocytes) and Lyt-1.2 lymphocytes (functionally similar to human T-helper cells) [11]. These two experiments showed a suppressive effect on cell-mediated immune function caused by acute noise stress. WBC-derived macrophages and other phagocytes may also contribute to endothelial dysfunction, development of atherosclerotic plaque rupture and thrombosis [12,13]. Inflammation may contribute to increasing micro vascular capillary resistance, initiation of platelet aggregation, and increased catecholamine levels [14, 15, 16]. Brain derived neurotrophic factor (BDNF) is stored in human platelets and circulates in plasma. BDNF levels in serum, platelets, and plasma were significantly increased in participants with

asthma, as compared with 26 age- and sex-matched control subjects. Enhanced platelet BDNF is associated with airflow limitation and airway hyperresponsiveness in asthma. In addition, corticosteroids suppress BDNF production by activated immune cells [17]; plasma BDNF is significantly correlated with age, sex and risk factors of cardiovascular disease [18]. Enhanced platelet count in the present study may also contribute to marginal increase in serum BDNF levels that may play a trophic role for acclimatization of higher centers of brain.

The absence of significant increases in erythrocyte counts, hemoglobin concentrations, and packed cell volumes in stress group indicates that changes in WBC concentration cannot be explained by the hemoconcentration. We cannot exclude the possibility that the higher WBC count may be due to an unaccounted source of infection (could be due to fabric dust). As our study population consisted of healthy middle-aged men, we did not have information on alcohol use, as alcohol use may suppress WBC count [19]; however all participants in our study were instructed not to consume alcohol 48 h before blood sample collection.

5. Conclusion

The present study indicates that enhanced peripheral blood cell counts following exposure to acute noise stress in tailors may modulate their immune function and facilitates acclimatization to their new occupational environment. Further studies are warranted with large number of participants and differential evaluation of leukocyte subsets and stress hormone levels.

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