International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 12, Issue. 2, October 2025, pp. 2662-2664 **DOI: https://doi.org/10.26540/ijgsr.v12.i2.2025.307**
***Available Online* at www.ijgsr.com**

Research Paper

Tobacco smoke affect on Haematological parameters and the protective role of vitamin E in albino rats

Rafat Khan
Department of Zoology, Mahatma Gandhi Bakika Vidyalaya Post Graduate College, Firozabad, Uttar Pradesh, India
Email: rafatkhanagra@gmail.com

Received: 24/06/2025
Revised: 30/06/2025
Accepted: 10/07/2025

Abstract: Tobacco smoke is a well-known environmental toxin with adverse systemic effects, including hematological disturbances. This study investigates the impact of tobacco smoke exposure and the role of vitamin E on key hematological parameters viz. Erythrocyte Sedimentation rate (ESR), Packed cell volume (PCV), Hemoglobin concentration (Hb conc.) and Red blood cell (RBC) counts in albino rats. The albino rats were divided into three sets (A, B and C) having ten (10) rats in each. Additionally, the study evaluates the potential ameliorative role of Vitamin E, a powerful antioxidant, in mitigating the hematological alterations induced by tobacco smoke. The outcome of present investigation shows that tobacco smoke significantly impairs hematological parameters, while Vitamin E supplementation exhibits protective impacts due to its anti-oxidative properties.

Keywords: Cigarette smoke, Vitamin E, Hematological parameters and albino rat.

Abbreviations: Erythrocyte Sedimentation rate (ESR), Packed cell volume (PCV), Hemoglobin concentration (Hb conc.) and Red blood cell (RBC)

Introduction:

smoke of tobacco consist of various toxic compounds, including free radicals, carbon monoxide, and carcinogens, which have systemic effects on various organ systems, particularly the hematopoietic system **(**World Health Organization, 2021). Exposure to tobacco smoke has been associated with oxidative stress and inflammation, leading to hematological abnormalities such as anemia and altered erythropoiesis. Hematological parameters like ESR, PCV, Hemoglobin concentration, and RBC count are vital indicators of

International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 12, Issue. 2, October 2025, pp. 2662-2664 **DOI: https://doi.org/10.26540/ijgsr.v12.i2.2025.307**
***Available Online* at www.ijgsr.com**

systemic health and are often disrupted by environmental toxins.

Kharb *et. al.* (2000) observed that the Vitamin E (α-tocopherol), a fat-soluble antioxidant, is known to protect cellular membranes from oxidative damage. Previous studies suggest that Vitamin E may help ameliorate oxidative stress-induced hematological changes. This study explores the effect of tobacco smoke on the hematological profile of albino rats and evaluates the modulatory role of Vitamin E supplementation.

Materials and Methods:

Experimental Animals

Thirty adult albino rats (150–180 g) were randomly selected for the present study. Rats were housed under Standard laboratory conditions (12-hour light/dark cycle, 22 ± 2°C).The rats were fed on Gold mohar rat and mice feed manufactured by Hindustan Unilever ltd., India. Water was given *ad libitum.* The rats were kept in acclimatized conditions prior to the experiment.

Experimental Protocol

The rats were divided into three sets randomly (10 per set).

- **Set A (Control):** Exposed to ambient air and given standard diet.
- **Set B (Experimental Set I):** Exposed to tobacco smoke only for 6 weeks (3 cigarette /day).
- **Set C (Experimental Set II):** Exposed to tobacco smoke and supplemented with oral Vitamin E (100 mg/kg/day).

Tobacco Smoke Exposure

Experimental rats were placed in a custom-built exposure chamber. Mainstream cigarette smoke was introduced using a controlled smoking device for 1 hour daily. The cigarettes used contained standard tar and nicotine concentrations.

Blood Collection and Analysis

At the end of the experimental period, blood samples were collected via cardiac puncture under anesthesia. The following hematological parameters were assessed:

- **Erythrocyte Sedimentation Rate (ESR)** was done by using Westergren method.
- **Packed Cell Volume (PCV)** was determined by Wintrobe's method.
- **Hemoglobin Concentration (Hb)** was measured using by standard Sahli's method (Wintrobe *et.al.*,1981)
- **Red Blood Cell (RBC) Count** was performed by using improved standard Neubauer haematocytometer counting chamber (Dacie and Lewis 1969).

Results:

Parameter	Set A (Control)	Set B (Smoke)	Set C (Smoke + Vit. E)
ESR (mm/hr.)	2.8 ± 0.5	**6.5 ± 1.2** ↑	3.9 ± 0.7 ↓
PCV (%)	45.3 ± 2.1	**38.2 ± 2.4** ↓	42.0 ± 2.0 ↑
Hb (g/dL)	15.2 ± 0.8	**11.0 ± 1.1** ↓	13.8 ± 0.9 ↑
RBC ($\times 10^6$ /µL)	7.8 ± 0.6	**5.4 ± 0.5** ↓	7.0 ± 0.4 ↑

*Values are mean ± SD; **significant difference from control ($p < 0.05$)*
Arrows indicate direction of change relative to control.

ISSN: 2348-8344 (Online)
DOI: https://doi.org/10.26540/ijgsr.v12.i2.2025.307

Discussion:

The results align with previous studies reporting tobacco-induced anemia and hematotoxicity in albino rats. These changes could result from oxidative stress and the toxic effects of carbon monoxide and other smoke constituents, which can interfere with red blood cell production

A significant increase in ESR and a reduction in PCV, Hemoglobin concentration, and RBC count, indicating anemia and systemic inflammation tobacco smoke exposed rats. Flora *et al*., (2008) stated that the elevated ESR reflects an inflammatory response, likely due to smoke-induced tissue damage and oxidative stress.

Uboh, *et al*., (2007) observed that the reduction in RBC count and hemoglobin concentration impaired erythropoiesis and possible hemolysis. Gellatly *et al*. (2009). In tobacco smoke the presence ofCarbon monoxide forms carboxyhemoglobin, which is responsible for reducing oxygen-carrying capacity in terms of contributing to hypoxia

Vitamin E supplementation in Group C partially restored hematological parameters towards normal values. As an antioxidant, Vitamin E neutralizes free radicals, stabilizes RBC membranes, and supports erythropoiesis (Halliwell, 2007). The improvement in hematological indices in the Vitamin E-treated group supports its protective role against oxidative damage induced by tobacco smoke.

Conclusion:

Tobacco smoke exposure significantly alters hematological parameters in albino rats, indicative of systemic inflammation and anemia. Vitamin E shows promise in mitigating these adverse effects, likely through its antioxidative and membrane-stabilizing properties. These findings suggest potential therapeutic benefits of antioxidant supplementation in individuals exposed to tobacco smoke.

References:

World Health Organization. (2021). Tobacco. https://www.who.int/news-room/fact-sheets/detail/tobacco

Kharb, S., Singh, V., Ghalaut, V. S., Sharma, P. C., and Singh, S. (2000) "Vitamin E and lipid peroxidation in smokers and non-smokers." Indian J Clin Biochem, 15(2), 145–148.

Wintrobe, M. M., Lee, G. R. Boggs, D. R. Bithell, T. C. Forester, J. Anthens, J. W. and Leukens, J. N. (1981) Clinical haematology(8 th ed.). Lea and Febiger, Philaelphia 188.

Dacie, J. V. and S. M. Lewis (1969) Practical haematology (5 th ed.) J. and A. Charch Hill, Livingstone, Edinburgh.

Flora, S. J. S., (2008) "Toxicity of tobacco smoke: Oxidative stress and its implications." J. Environ. Biol., 29(4), 577–581.

Uboh, F. E., Akpamabiatu, M. I., Eyong, E. U. Ebong, P. E. and Eka, O. O. (2007) "Tobacco smoke alters hematological parameters in rats." Journal of Biochemistry, 19(2), 45–50.

Gellatly, N. (2009) Effect of cigarette smoke on red blood cell mass and erythropoietin levels. Journal of Clinical Investigation, 119(10), 2867–2875.

Halliwell, B. and Gutteridge, J. M. C. (2007) Free Radicals in Biology and Medicine. Oxford University Press.