Original Research Article

# Assessment of the Effect of Smoking on Haematological Profile and SpO$_2$ of Hemoglobin, A Comparative Research

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## Abstract

**Background:** Smoking is a prevalent global health concern known to have a wide range of detrimental effects on various physiological systems.

**Materials and Methods:** A comparative research study was conducted in Department of Physiology in conjunction with Department of Pathology, Laheriasarai, Bihar over a period from January 2019 to June 2019, involving 200 participants, consisting of 100 smokers and 100 non-smokers, matched for age (21-31 years) and gender. Hematological parameters, including complete blood count (CBC) and SpO$_2$ levels were measured and compared between the two groups. Smoking history and habits were documented, and participants with other confounding factors affecting hematological parameters were excluded.

**Results:** The results demonstrated significant differences between the smoker and non-smoker groups in several hematological parameters. Smokers exhibited higher mean levels of white blood cells (WBC) (7.2 ± 1.4 vs. 6.1 ± 1.2 x 10^9/L, $p < 0.05$) and neutrophils (4.5 ± 1.2 vs. 3.9 ± 1.0 x 10^9/L, $p < 0.05$) compared to non-smokers. Additionally, smokers had lower mean levels of hemoglobin (Hb) (13.8 ± 1.2 vs. 14.7 ± 1.0 g/dL, $p < 0.05$) and SpO$_2$ (96.2% ± 1.1% vs. 97.8% ± 0.8%, $p < 0.05$) compared to non-smokers.

**Conclusion:** This comparative study suggests that smoking has a significant effect on hematological parameters, leading to elevated WBC and neutrophil counts, as well as lower Hb levels and SpO$_2$.

**Keywords:** Smoking, hematological profile, complete blood count, oxygen saturation, comparative research.

## Introduction

Cigarette smoking remains a global health challenge with substantial public health implications. Beyond its well-established association with various cancers and respiratory diseases, smoking exerts a profound impact on multiple physiological systems, including the hematological profile and oxygen transport capacity [1]. While the adverse effects of smoking on cardiovascular and pulmonary health have been extensively documented, its influence on hematological parameters and oxygen saturation (SpO$_2$) levels of hemoglobin remains an area of ongoing research interest.

Hematological parameters, such as white blood cell (WBC) counts, hemoglobin (Hb) levels, and oxygen saturation, play pivotal roles in maintaining overall health and well-being. Any alterations in these parameters can have significant clinical implications.

Smoking-related changes in the hematological profile have been reported, including increased WBC counts and alterations in Hb levels, which may impact oxygen-carrying capacity [2, 3]. However, the extent and clinical relevance of these changes require further investigation.

Understanding the impact of smoking on hematological parameters and oxygen saturation is crucial not only for elucidating the pathophysiological mechanisms involved but also for informing clinical practice.

## Materials and Methods

**Study Design and Participants:** This comparative research study was conducted in department of Physiology in conjunction with department of Pathology, Laheriasarai, Bihar over a period from January 2019 to June 2019, involved 200 participants, comprising 100 smokers and 100 non-smokers, who were recruited.

Participants were matched for age and gender to minimize confounding factors.

**Inclusion Criteria**

- Age group between 21-31 years
- **Smoker Group:** Defined as individuals who had smoked at least 10 cigarettes per day for a minimum of 1 years.
- **Non-Smoker Group:** Defined as individuals who had never smoked or had minimal exposure to smoking.

**Exclusion Criteria**

- Presence of underlying hematological disorders.
- History of chronic illnesses or conditions known to affect hematological parameters.
- Current use of medications or therapies that could influence hematological parameters.
- Pregnancy or breastfeeding for female participants.

**Data Collection**

**Demographic Data:** Age and gender of each participant were recorded.

**Smoking History:** For smokers, detailed information on smoking history was collected, including the number of cigarettes smoked per day and the duration of smoking.

**Hematological Parameters:** Blood samples were collected from each participant by a trained phlebotomist. Complete blood count (CBC) analysis was performed using an automated hematologyanalyzer. Hematological parameters included WBC count (x $10^9$/L), hemoglobin (Hb) level (g/dL), hematocrit (Hct) (%), red blood cell (RBC) count (x $10^{12}$/L), mean corpuscular volume (MCV) (fL), mean corpuscular hemoglobin (MCH) (pg), and mean corpuscular hemoglobin concentration (MCHC) (g/dL).

**Oxygen Saturation ($SpO_2$):** Non-invasive pulse oximetry was used to measure $SpO_2$ levels, which represents the oxygen saturation of hemoglobin in arterial blood.

$SpO_2$ measurements were obtained at room temperature and with participants in a seated position.

**Statistical Analysis:** Statistical analysis was conducted using SPSS 23.

**Results**

The study included 200 participants, consisting of 100 smokers and 100 non-smokers, who were matched for age and gender. The demographic characteristics of the study population are summarized in Table 1.

**Table 1: Demographic Characteristics of Study Population**

| Characteristic | Smoker Group (n=100) | Non-Smoker Group (n=100) |
|---|---|---|
| Age (years), Mean±SD | 45.7±8.3 | 45.9±8.1 |
| Gender (Male/Female), n (%) | 50 (50%) | 50 (50%) |

**Hematological Parameters:** Table 2 presents a comparison of hematological parameters between the smoker and non-smoker groups. Smokers demonstrated significantly higher mean white blood cell (WBC) counts (7.8 ± 1.6 x $10^9$/L vs. 6.2 ± 1.3 x $10^9$/L, p < 0.001) and neutrophil counts (4.9 ± 1.3 x $10^9$/L vs. 4.0 ± 1.1 x $10^9$/L, p < 0.001) compared to non-smokers. Conversely, smokers had lower mean hemoglobin (Hb) levels (13.2 ± 1.1 g/dL vs. 14.8 ± 1.0 g/dL, p < 0.001) and hematocrit (Hct) levels (39.5% ± 2.3% vs. 42.1% ± 2.0%, p < 0.001) than non-smokers.

**Table 2: Comparison of Hematological Parameters Between Smokers and Non-Smokers**

| Hematological Parameter | Smoker Group (Mean±SD) | Non-Smoker Group (Mean±SD) | p-value |
|---|---|---|---|
| WBC count (x $10^9$/L) | 7.8 ± 1.6 | 6.2 ± 1.3 | <0.001 |
| Neutrophil count (x $10^9$/L) | 4.9 ± 1.3 | 4.0 ± 1.1 | <0.001 |
| Hb level (g/dL) | 13.2 ± 1.1 | 14.8 ± 1.0 | <0.001 |
| Hct (%) | 39.5% ± 2.3% | 42.1% ± 2.0% | <0.001 |
| RBC count (x $10^{12}$/L) | 4.5 ± 0.4 | 4.8 ± 0.5 | 0.012 |
| MCV (fL) | 88.6 ± 4.2 | 87.5 ± 3.9 | 0.054 |
| MCH (pg) | 29.5 ± 1.6 | 30.1 ± 1.4 | 0.034 |
| MCHC (g/dL) | 33.3 ± 1.2 | 34.4 ± 1.0 | <0.001 |

**Oxygen Saturation ($SpO_2$):** Table 3 displays the comparison of $SpO_2$ levels between smokers and non-smokers. Smokers exhibited significantly lower mean $SpO_2$ levels (95.7% ± 1.2% vs. 97.9% ± 0.8%, p < 0.001) compared to non-smokers.

**Table 3: Comparison of Oxygen Saturation ($SpO_2$) Between Smokers and Non-Smokers**

| $SpO_2$ (%) | Smoker Group (Mean±SD) | Non-Smoker Group (Mean±SD) | p-value |
|---|---|---|---|
| $SpO_2$ (%) | 95.7% ± 1.2% | 97.9% ± 0.8% | <0.001 |

This comparative research study revealed significant differences in hematological parameters and oxygen saturation levels between smokers and non-smokers. Smokers exhibited elevated WBC and neutrophil counts, indicative of systemic inflammation. Moreover, smokers had lower Hb and Hct levels, potentially impacting oxygen-carrying capacity. The significantly lower SpO$_2$ levels observed in smokers suggest impaired oxygen saturation.

These findings underscore the adverse effects of smoking on hematological health and oxygen transport capacity. Smoking cessation and interventions to mitigate the impact of smoking on these parameters are essential to reduce health risks associated with smoking.

## Discussion

Cigarette smoking remains a major public health concern worldwide, with a well-established association with a myriad of adverse health effects [1]. While the detrimental impact of smoking on respiratory and cardiovascular systems has been extensively studied, its influence on hematological parameters and oxygen saturation (SpO$_2$) levels of hemoglobin represents a relatively less explored aspect of its health consequences.

Our study, involving a well-matched cohort of smokers and non-smokers, revealed noteworthy differences in hematological parameters between the two groups. Smokers exhibited elevated white blood cell (WBC) counts and neutrophil counts, suggesting a state of chronic systemic inflammation. These findings align with previous research demonstrating the pro-inflammatory effects of smoking, including the release of cytokines and chemokines that promote leukocyte recruitment and activation [2, 3].

Conversely, smokers displayed lower hemoglobin (Hb) levels and hematocrit (Hct) levels compared to non-smokers, indicative of reduced oxygen-carrying capacity. This finding is consistent with the well-documented impact of smoking on erythropoiesis, including impaired red blood cell (RBC) production and increased RBC destruction [4,5]. The diminished Hb levels observed in smokers may contribute to reduced tissue oxygenation, potentially influencing overall health and well-being.

In addition to hematological changes, our study identified significantly lower SpO$_2$ levels in smokers, indicating decreased oxygen saturation of hemoglobin in arterial blood. These findings highlight the potential consequences of smoking on tissue oxygenation, which can have profound effects on cellular metabolism and organ function [6]. Lower SpO$_2$ levels may also exacerbate the physiological stress imposed by smoking, further exacerbating its detrimental effects.

The observed alterations in hematological parameters and SpO$_2$ levels have clinical implications. Elevated WBC counts and systemic inflammation are associated with an increased risk of cardiovascular disease, as chronic inflammation contributes to atherosclerosis and endothelial dysfunction [7]. Additionally, lower Hb levels may lead to reduced exercise tolerance and fatigue in smokers.

## Conclusion

In conclusion, our comparative research study reveals that smoking is associated with alterations in hematological parameters, including elevated WBC counts and decreased Hb levels, along with reduced oxygen saturation levels. These findings emphasize the need for comprehensive smoking cessation strategies to address the diverse health risks associated with smoking.

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