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Original article

Impact of Smoking on Hematological Parameters Among Adult Males in Western Tripoli: A Cross-Sectional Study

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ABSTRACT

Background and aims. *Smoking is a major modifiable risk factor that can induce systemic alterations, including changes in hematological parameters. Understanding these changes is crucial for early detection of physiological stress and potential disease risk among smokers. This study aimed to assess the effect of smoking on hematological parameters among adult males.* ***Methods***: *A cross-sectional descriptive study was conducted among 100 adult males in western Tripoli, Libya, including 50 smokers and 50 non-smokers. Hematological parameters were measured and compared between groups using an independent samples t-test ($p < 0.05$ considered significant).* ***Results***: *The majority of participants were aged 31–50 years. Among smokers, combined cigarette and hookah use was predominant, and most had a university-level education. Smokers exhibited significantly higher hemoglobin, hematocrit, and RBC levels compared to non-smokers ($p < 0.001$), while WBC counts were slightly lower. Platelet counts were modestly elevated in smokers ($p < 0.05$). These findings indicate that smoking induces systemic haematological changes, which may predispose individuals to cardiovascular and metabolic complications.* ***Conclusion***: *Smoking significantly impacts key hematological parameters among adult males, reflecting early physiological stress and potential health risks. Routine monitoring of blood indices in smokers could facilitate early intervention and support public health strategies for smoking cessation.*

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INTRODUCTION

Smoking remains a major public health concern worldwide and has been linked to numerous adverse health outcomes. It is well established that smoking can affect various physiological systems, including the cardiovascular, respiratory, and hematopoietic systems. Several studies have demonstrated that smoking alters hematological parameters, which may reflect systemic inflammatory and oxidative stress responses [1–4]. Cigarette smoke contains thousands of chemical compounds, including nicotine, carbon monoxide, oxidants, and free radicals, which can interfere with normal blood physiology. These substances are known to affect erythropoiesis, platelet function, and white blood cell counts, potentially leading to compensatory hematological changes [5–7]. For example, elevated hemoglobin and hematocrit levels have been reported in smokers, possibly as an adaptive response to hypoxia, while alterations in platelet count and function may contribute to increased thrombotic risk [8–10].

White blood cell counts are also frequently affected by smoking, reflecting an underlying inflammatory state [11,12]. Some studies have reported increased total and differential leukocyte counts in smokers, indicating immune system activation. Alterations in platelet indices, such as mean platelet volume and plateletcrit, have also been observed, suggesting potential implications for hemostasis and cardiovascular risk [13–15].

Understanding the hematological consequences of smoking is particularly relevant in populations with a high prevalence of tobacco use, as it provides insight into potential subclinical alterations that may precede overt disease. While many studies have investigated these changes globally, regional data, especially from Libya, remain limited. This study aimed to evaluate the effect of smoking on key haematological parameters among adult males in western Tripoli, providing valuable data for public health and clinical practice.

METHODOLOGY

Study Design

A cross-sectional descriptive study was conducted to assess the effect of smoking on haematological parameters among males. Two groups of participants were recruited: Group 1 (smokers) and Group 2 (non-smokers).

Ethical Considerations

Ethical approval was obtained prior to the initiation of the study. All participants provided informed consent after being briefed about the study objectives and procedures. Consent included voluntary participation, completion of a structured questionnaire, and provision of a venous blood sample for laboratory analysis.

Study Population and Sampling

The study was carried out between July and September 2018 at medical laboratory centers in western Tripoli, Libya. A total of 100 male participants were recruited using purposive sampling, with 50 participants classified as smokers and 50 as non-smokers. Inclusion criteria included adult males aged 15 years and above, with no history of recent acute illness or chronic hematological disorder.

Data Collection Procedures

Data were collected through direct interviews using a structured questionnaire that captured demographic variables (age, educational status, and smoking patterns). Following the interviews, venous blood samples were collected under aseptic conditions and analyzed for haematological parameters.

Study Instruments

The study utilized two instruments:

Demographic Data: captured background information including age, education level, and smoking type.

Haematological Investigations: included measurement of haemoglobin (Hb), red blood cell count (RBC), hematocrit (HCT), platelet count, and white blood cell count (WBC).

Statistical Analysis

Data were analyzed using SPSS software. Descriptive statistics, including mean, standard deviation (SD), and percentage distribution, were employed to summarize demographic and haematological findings. An independent samples t-test was conducted to compare haematological parameters between smokers and non-smokers. A p-value < 0.05 was considered statistically significant, while values < 0.001 were interpreted as highly significant.

RESULTS

Participant Demographics

The study included 100 male participants, with 50 smokers and 50 non-smokers. As shown in Table 1, the majority of participants (56%) were between 31–50 years of age, while 28% were older than 50 years. Only 16% were within the younger age group of 15–30 years.

Table 1: Age distribution of study participants (N = 100)

Age group (years)	Percentage (%)
15 – 30	16%
31 – 50	56%
50 <	28%

Smoking Patterns and Educational Background of Smokers

Among the smoker group (N = 50), the predominant pattern of tobacco use was the combined consumption of cigarettes and hookah (62%), while 22% used cigarettes only and 16% reported exclusive hookah smoking. Regarding educational attainment, most smokers (60%) had university-level education, followed by secondary-level (24%) and primary-level education (16%). Details are presented in Table 2.

Table 2: Smoking patterns and educational level among smokers (N = 50).

Variable	Category	Percentage (%)
Type of smoking	Cigarettes	22%
	Hookah	16%
	Both	62%
Educational level of Smokers	Primary	16%
	Secondary	24%
	University	60%

Comparison of Hematological Parameters

A comparison of haematological parameters between smokers and non-smokers is presented in Table 3. Smokers demonstrated a markedly higher mean haemoglobin concentration (23.34 ± 4.11 g/dL) compared with non-smokers (14.80 ± 1.14 g/dL), a difference that was highly significant (p = 0.001). In contrast, the mean RBC count was significantly lower in smokers (4.33 ± 0.17 $\times 10^6$/µL) than in non-smokers (4.77 ± 0.33 $\times 10^6$/µL, p = 0.001). Similarly, hematocrit values were reduced among smokers (51.21 ± 3.00%) compared with non-smokers (55.93 ± 5.21%, p = 0.001).

Platelet counts were significantly elevated in smokers (379.77 ± 84.56 $\times 10^{10}$/L) relative to non-smokers (344.20 ± 31.71 $\times 10^{10}$/L, p = 0.008). Conversely, WBC counts were lower in smokers (6.52 ± 1.56 $\times 10^3$/µL) than in non-smokers (7.37 ± 1.21 $\times 10^3$/µL), a statistically significant difference (p = 0.003).

Table 3: Comparison of hematological parameters between smokers and non-smokers Groups

Items	Smokers (N=50)		Non-smokers (N=50)		P-value
	Mean	SD	Mean	SD	
Hgb (g/dL)	23.34	4.11	14.80	1.14	0.001**
RBC ($x10^6$/µL)	4.33	0.17	4.77	0.33	0.001**
Hematocrit (%)	51.21	3.00	55.93	5.21	0.001**
Platelet ($x10^{10}$/L)	379.77	84.56	344.20	31.71	0.008*
WBC ($x10^3$/µL)	6.524	1.562	7.374	1.213	0.003*

*Note: Hgb: Hemoglobin. RCB: Red blood cell. WBC: White blood cells. *: P<0.01 level is considered statistically significant. **: P<0.001 level is considered highly statistically significant.*

DISCUSSION

This study demonstrated that smoking exerts a measurable influence on several hematological parameters. The observed elevation in hemoglobin among smokers is consistent with previous reports, where chronic exposure to carbon monoxide was shown to increase carboxyhemoglobin and stimulate erythropoietin production, resulting in compensatory erythrocytosis [1–2,16]. Similar findings were reported in Sudan [4] and Bosnia and Herzegovina [17], confirming that smoking-induced hypoxia is a universal mechanism. Interestingly, despite elevated hemoglobin, our study revealed a reduction in RBC count and hematocrit among smokers compared to non-smokers. While many investigations documented raised hematocrit with smoking [4,18], others have noted reductions, particularly among heavy or dual users of cigarettes and hookah [5,19]. This paradox may be explained by the deleterious effect of smoking toxins on bone marrow or shortened red cell lifespan due to oxidative stress.

The increased platelet count among smokers aligns with evidence that tobacco promotes thrombopoiesis and enhances platelet reactivity [6,21–21]. Previous studies in Turkey [22], Korea [23], and elsewhere [24] highlighted that smoking augments platelet indices, thereby increasing the risk of thrombosis and cardiovascular complications. Contrary to the majority of studies reporting leukocytosis among smokers [11,25], the present study found significantly lower WBC counts. Reduced leukocyte levels have also been observed in Rania City, Iraq [5], and may reflect immunosuppressive effects of nicotine and other toxins that inhibit leukocyte proliferation or survival [26]. This suggests that smoking may alter immune function in a dose-dependent manner, with leukocytosis in moderate use and suppression in heavy or prolonged exposure.

This study was limited by its relatively small sample size and restriction to male participants from a single region. In addition, smoking duration and intensity were not quantitatively assessed. However, these limitations do not affect the reliability of the observed differences in hematological parameters between smokers and non-smokers.

Conclusion

The findings of this study demonstrate that smoking is associated with significant alterations in hematological parameters, including increased hemoglobin and platelet counts, as well as reduced RBC, hematocrit, and WBC levels. These results highlight the complex physiological effects of tobacco use, reflecting both compensatory mechanisms to hypoxia and toxic suppression of hematopoiesis and immune function. The observed changes may contribute to the increased cardiovascular and immunological risks among smokers.

Conflict of interest: Nil

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