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Effects of Cigarette Smoking on Hematological Parameters Among Male Smokers in Tarhuna, Libya

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Abstract
Background: Cigarettes and tobacco affect the circulatory and cardiovascular systems, increasing the risk of developing blood disorders such as anemia and high blood pressure. Additionally, smoking can lead to narrowed arteries and the formation of blood clots, further increasing the risk of heart and vascular diseases.
Aims: This study assesses the impact of tobacco cigarette smoking (CS) on the hematologic characteristics of blood.
Subject and methods: One hundred fifty-nine participants were involved in the study and were divided into three groups based on their smoking status. The first group consisted of 53 male cigarette smokers, the second group included 53 male cigarette smokers with diabetes, and the third group comprised 53 male non-smokers. Data for the study were collected in Tarhuna City from November 2022 to March 2023. Clinical data, medical history, and other relevant information were obtained from the subjects through questionnaires, and blood samples were taken to estimate complete blood counts (CBC) (WBC, RBC, Hb, MCV, MCH, and PLT). Mean and standard deviation (SD) were calculated for all the hematologic parameters.
The results showed an increase in some hematologic parameters for the group of smokers compared to non-smokers, including these hematologic parameters WBC, HCT and PLT.
The study concluded that CS is linked to changes in inflammatory biomarker levels, such as WBC count, which may be attributed to the presence of many toxic and carcinogenic compounds in CS that are harmful to health.

Keywords: Cigarette Smoking; Hematological Parameters; Diabetes.

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تأثير تدخين السجائر على مؤشرات الدم لدى المدخنين الذكور في مدينة ترهونة، ليبيا

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الملخص

تقيم هذه الدراسة تأثير تدخين سيجارة التبغ على الخصائص الدموية للدم. وكان عدد المشاركين في هذه الدراسة مائة وتسعة وخمسين مشاركًا؛ بحسب حالة المدخن، تم تقسيمهم إلى ثلاث مجموعات. وتضم المجموعة الأولى 53 مدخناً ذكراً، والمجموعة الثانية تضم 53 مدخناً ذكراً مصاباً بالسكري، والمجموعة الثالثة تضم 53 ذكراً غير مدخن. تم جمع بيانات هذه الدراسة في مدينة ترهونة خلال الفترة (نوفمبر 2022 – مارس 2023). تم جمع البيانات السريرية والتاريخ الطبي والمعلومات الأخرى ذات الصلة من الأشخاص بواسطة استبيان، وتم أخذ عينات الدم لتقدير تعداد الدم الكامل (CBC) WBC, RBC, HGB, HCT, MCV, MCH, MCHC, PLT) المتوسط والانحراف المعياري تم حسابها لجميع المؤشرات الدموية. أظهرت نتيجة هذه الدراسة ارتفاع بعض متغيرات الدم لمجموعة المدخنين مقارنة بغير المدخنين ومن هذه المتغيراتWBC, PLT و HCT . وخلصت هذه الدراسة إلى أن تدخين سيجارة التبغ يرتبط بالتغيرات في مستويات المؤشرات الحيوية للالتهابات، مثل عدد خلايا الدم البيضاء، وقد يكون ذلك بسبب احتواء تدخين سيجارة التبغ على العديد من المركبات السامة والمسرطنة الضارة بالصحة.

الكلمات المفتاحية: تدخين السجائر، المؤشرات الدموية، السكري.

Introduction

Cigarette smoking is the leading cause of morbidity and mortality worldwide, responsible for 11.5% (equivalent to 6.4 million) of global deaths annually (**GBD 2017; Barua et al.,2018**). It is believed that there are 4.5 billion smokers in the world and this will increase to about 7.1 billion by 2025(Malenica **et al ., 2017**).

Despite its harmful effects on human health, tobacco is still widely consumed worldwide. One of the most prevalent addictions in modern society is smoking. It is an etiological agent for several chronic diseases, such as different infections, malignancies, heart conditions, and respiratory ailments (**Farhang et al ., 2013**).

Over 4000 chemicals are found in cigarette smoke (CS), including 80 recognized or probable carcinogens and at least 200 toxicants. Additionally, smoking cigarettes releases several toxic and cancer-causing substances that are bad for your health, like nicotine, nitrogen oxides, carbon monoxide, hydrogen cyanide, and free radicals (**Khaled and Rahab, 2014**). According to **(Gitte, 2011**), smoking affects hematological parameters both acutely and chronically. He discovered that smokers' mean plasma platelet counts dramatically increased as compared to non-smokers. In the past ten years, it has been hypothesized that smoking has an impact on blood parameters that contribute to death (**Soldin et al., 2011; Asif et al., 2013; Aula and Qadir, 2013**). Additionally, smoking has numerous, intricate interactions with blood pressure (BP). Smoking's immediate effects can momentarily elevate blood pressure. (**Yarlioglues,2010**). The main metabolite of nicotine, cotinine, is regarded as an accurate biomarker for determining exposure to cigarette smoking. Through a variety of physiologic processes, including its sympathomimetic effects, renin-angiotensin system modulation, and overexpression of arginine vasopressin and endothelin-1 nicotine can increase blood pressure (**yu G et al., 2008**).

In several studies, it has been found a relationship between smoking and white and red blood cell counts (**Tiel et al., 2002; Wannamethee et al., 2005; Mukherjee and Chatterjee, 2013**). Although some studies suggested that, an increase in hemoglobin levels in the blood of smokers could be a compensatory mechanism (**Asif et al., 2013; Dass et al., 2013**). However, some were of the view that smoking does not increase in hemoglobin level in all smokers and this relates to the tolerance potential of an individual to different kinds of diseases (**Tarazi et al., 2008**). Therefore, this study was conducted to determine the effects of (CS) on several hematological parameters in the male population of Tarhuna City in Libya.

Material and Methods

Study Design

This is a cross-sectional study designed to identify the impact of tobacco cigarette smoking on the hematologic characteristics of blood. One hundred fifty-nine participants were used in this study; depending on the smoker's case, they were divided into three groups. The first group includes 53 male cigarette smokers, the second group includes 53 male cigarette smokers with diabetes, and the third group 53 male non-smokers (control group).

Data collection and duration of the study

Data for this study were collected in Tarhuna City during the period time from (November 2022-March 2023). The clinical data, medical history, and other relevant information were collected from subjects by questionnaires.

Blood sampling

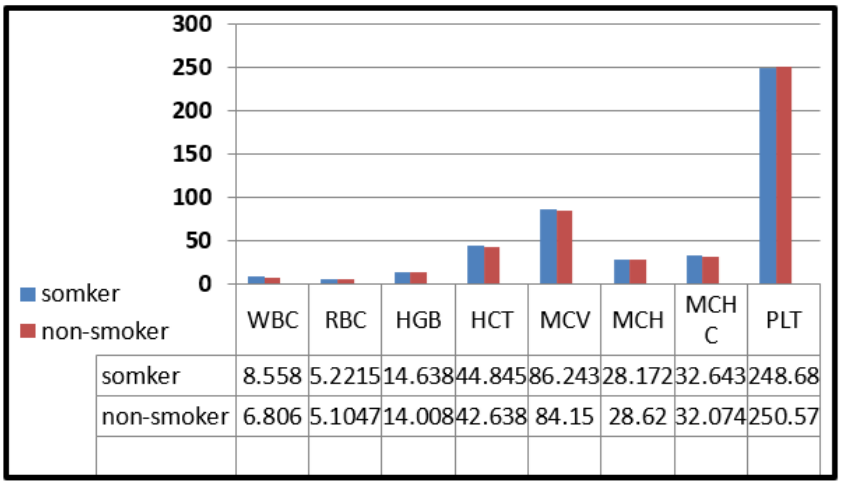
5 ml of whole blood samples were drawn by venipuncture from each member placed in a EDTA tube, then complete blood counts (CBC) were estimated within 1-2 hours of blood sampling on an automatic hematological analyzer (Sysmex xp-300 Japan) was calibrated by a standardized commercially available calibrated kit. CBC counts (WBC, RBC, Hb, MCV, MCH, and PLT) were measured in this study.

Statistical analysis

Data were analyzed using (Minitab program version 20**),** Mean and standard deviation (SD) were calculated for all the hematologic parameters.

Results

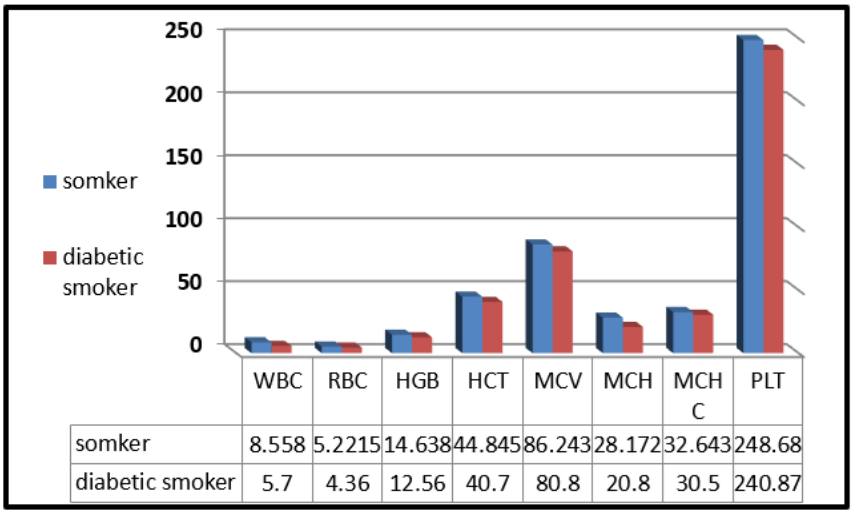
One hundred fifty-nine Libyan males participated in this study 53 smokers, 53 male cigarette smokers with diabetes and 53 male non-smokers (control group). The age of participants ranged between 17-73 years old. The result of this study revealed that WBC, RBC, HGB, HCT, MCV, MCH, MCHC, PLT (8.558,5.2215,14.638,44.845 ,86.243,28.172,32.643 , 248.68) figure (4-1) while in non-smokers group were (6.8065.1047 ,14.008,42.638 ,84.15 ,28.62 ,32.074,250.57). respectively form (1). The result shows that there is a significant increase in WBC in smokers while RBC and other parameters didn't show a significant difference between smokers and non-smokers.



	WBC	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
somker	8.558	5.2215	14.638	44.845	86.243	28.172	32.643	248.68
non-smoker	6.806	5.1047	14.008	42.638	84.15	28.62	32.074	250.57

Figure 1 The effect of smoking on the hematological parameters of smokers and non-smokers.

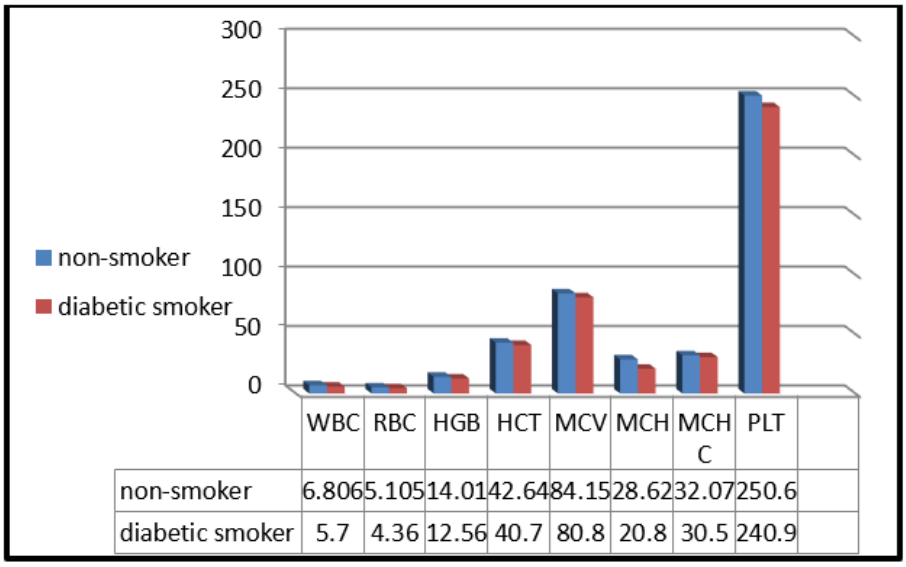
The diabetes affected some of those parameters, figure (2). The result shows that there is increase in (WBC, PLT MCV, MCH) in smokers while RBC, HGB and other parameters didn't show a significant difference between smokers and non-smokers.



	WBC	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
somker	8.558	5.2215	14.638	44.845	86.243	28.172	32.643	248.68
diabetic smoker	5.7	4.36	12.56	40.7	80.8	20.8	30.5	240.87

Figure 2 The effect of smoking on hematological parameters of smokers with diabetes and smoker groups.

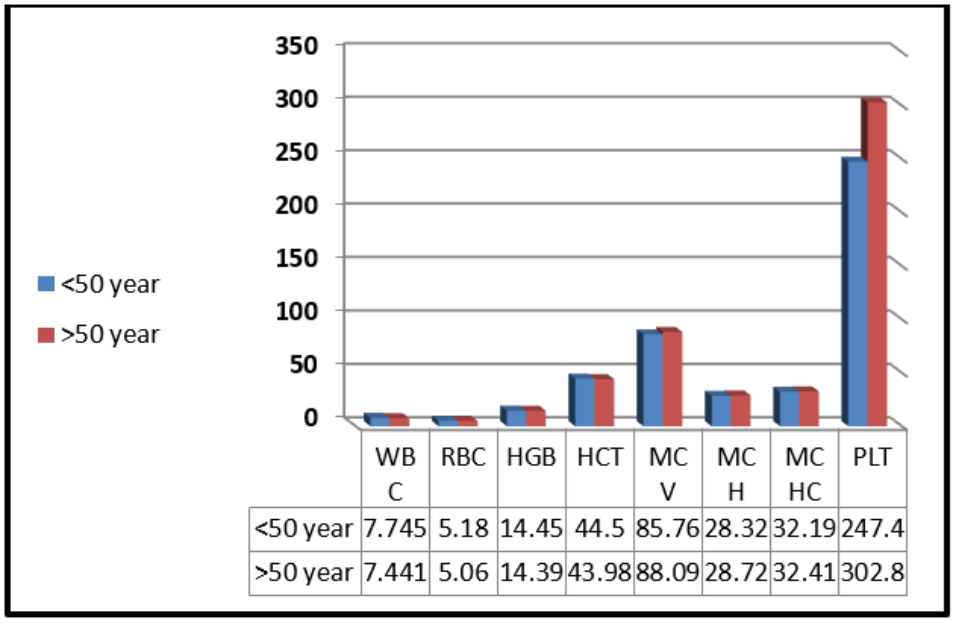
According to the result of this study figure (3), The effect of diabetes on smokers was clear when compared with non-smokers. The results of the investigation into blood values reveal a marginally significant difference in HCT, MCV, MCH, and PLT parameters between the two groups.



	WBC	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
non-smoker	6.806	5.105	14.01	42.64	84.15	28.62	32.07	250.6
diabetic smoker	5.7	4.36	12.56	40.7	80.8	20.8	30.5	240.9

Figure 3 The effect of smoking on hematological parameters of the non- smoker with a diabetic smoker.

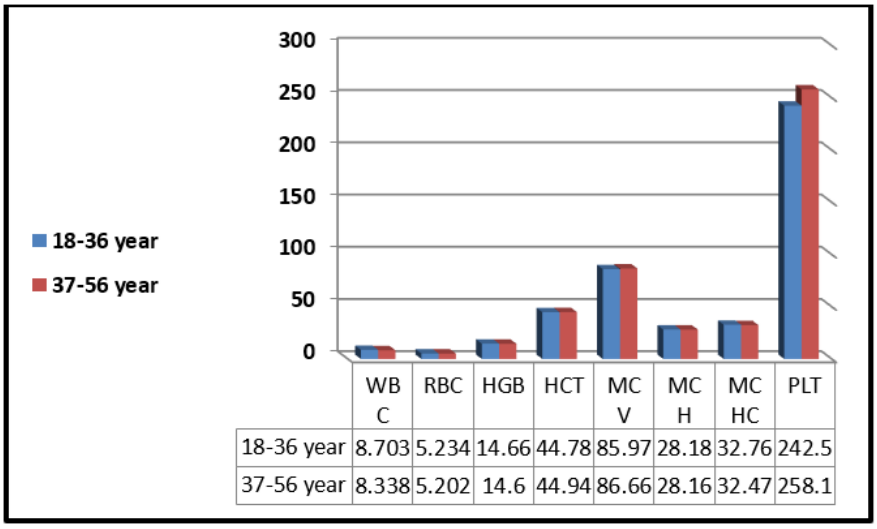
The study's findings demonstrated the impact of age on hematological parameters. Figure 4, compares PLT count and MCV level between two groups (less than 50 years and more than 50 years) and shows that the group with more years had higher PLT count than the group with fewer years.



	WBC	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
<50 year	7.745	5.18	14.45	44.5	85.76	28.32	32.19	247.4
>50 year	7.441	5.06	14.39	43.98	88.09	28.72	32.41	302.8

Figure 4 The effect of age on hematological parameters.

The study's findings demonstrated that smoking and age had an impact on hematological parameters. Figure 5 compares two smoking groups (18–36 and 37–56 years old) based on age and shows that the PLT level in group 37–56 years old is higher than that of group 18–36 years old.



	WBC	RBC	HGB	HCT	MCV	MCH	MCHC	PLT
18-36 year	8.703	5.234	14.66	44.78	85.97	28.18	32.76	242.5
37-56 year	8.338	5.202	14.6	44.94	86.66	28.16	32.47	258.1

Figure 5 The effect of age on hematological parameters of smokers and non-smokers.

Discussion

This study was conducted to measure the alteration in hematological parameters among smokers CS and non-smokers. The result demonstrates that there is a significant increase in WBC in smokers when compared with non-smokers. In this study, the high WBC count in smokers is consistent with other published reports (**Asif et al., 2013; Aula and Qadir, 2013**). another study indicates that CS is associated with changes in inflammatory biomarker levels, such WBC count, and these may be due to CS containing many toxic and carcinogenic compounds harmful to health (**Asif et al., 2013**) that can induce inflammatory processes. CS is associated with an elevated peripheral blood leucocyte count (**Schwartz and Weiss, 1994**). It has been suggested that inflammatory stimulation of the bronchial tract induces an increase in inflammatory markers in the blood but it has also been suggested that nicotine may induce an increase in blood lymphocyte counts (**Calapai et al., 2009; Geffken et al., 2001**).

In healthy individuals smoking causes an increase in Hb levels probably mediated by exposure to carbon monoxide (CO) which binds to Hb to form carboxyhaemoglobin (HbCO). Mean Hb levels and HbCO levels increase progressively with the number of cigarettes consumed per day. In addition to the number of cigarettes smoked per day, the duration of chronic exposure to HbCOalso correlates with the development of polycythemia (**Leifert ,2008**). The study's findings indicate that smokers with diabetes have a distinct impact on non-smokers. The blood values investigated in this study indicate a significant difference between the two groups. Structural alterations to the erythrocyte membrane, variations in the surface electric charge of the erythrocytes, and erythrocyte aggregation may all contribute to the reduced RBC indices in type 2 diabetes. As stated by **Malandrino et al**. (**2012**).

An increase in blood sugar leads to the sugaring of a protein in blood cells, called glycation, and is used as a guide to measure the period of occurrence of the disease because it is related to the age of the red blood cell, the reaction takes place in two stages, consisting in the first Aldimine is a Schiff base between the aldehyde carbonyl of glucose and the amino group. Valine in the hemoglobin protein ends up in a stable compound (Amadori product ketamine), which is a non-product (**Jansen et al., 2009**) reverse Excess sugar leads to auto-oxidation, and free radicals are formed additional. O^2 and . HO as well as a free radical generator H^2O^2 end with the osmotic fragility of the erythrocyte (**Moussa,2007**). The results of some studies were contradictory between the high and low levels of hematological parameters, and this difference may be due to the difference in sample size, social and economic status, geographical location, laboratory diagnostic method used, and the difference in the study population.

In this study, we observed an increase in some hematological parameters with age, and this result is consistent with a study by (**Eun- Hee Nah et al., 2018**), As well as this study showed that There is no statistically significant difference between the age of smokers and its effect on hematological indicators, except that platelets increase with increasing age, and this result is consistent with the study conducted by **Ercan Varol et al.,2013**, In the same context, there are medical statistics proving that the elderly are more susceptible to thrombocytosis (**Gremmel et al., 2018**).

Conclusion: in this study we found that male smokers had a higher plasma WBC concentration compared to non-smokers. We also observed a difference hematological parameter between a diabetic smoker and a non-diabetic smoker. Finally, the results of this study showed that there is a relationship between age and hematological parameters, especially platelets.

Recommendations: quit smoking, especially for people with diabetes, because of its effect on blood vital indicators, especially on the percentage of blood saturation with oxygen. This study also recommends that smokers should conduct periodic examinations and analysis of the complete blood count to identify abnormal blood indicators and work to treat them.

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