Evaluation of Some Haematological Metrics among Smokers in Port Harcourt, Rivers State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Introduction: Smoking is extremely toxic and has had a significant negative impact on society. One of the leading contributors to preventable illness and mortality has been found to be cigarette smoking.
Aim: The goal of this study is to evaluate a few haematological metrics among smokers in Port Harcourt, Rivers State, and to verify the idea that smoking cigarettes either has a negative or favorable impact on these variables.
Methodology: In this cross-sectional study, 100 participants between the ages of 20 and 45 were included, 50 of whom were smokers and 50 non-smokers. Venipuncture was used to obtain blood samples from the patients, which was then put into an EDTA vial for a full blood count (FBC) and other haematological analysis. The full blood count and erythrocyte sedimentation rate (ESR) were done using Haemo Auto Analyzer, Model XP-300 KOBE Japan by SYSMEX and the Westergreen

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method respectively. In order to analyze the data, Graph Prism Pad 6.2 and Microsoft Office Excel 2016 were both used. Using the student's independent t-test, a comparative study of mean and standard deviation values for the various parameters for test and reference ranges was conducted.

Results: According to the findings, the average age of 50 smokers was 43.6200± 9.7250 years and that for the 50 non-smokers was 42.7800± 6.5440 years, which was statistically insignificant with p valve of 0.6130. Smokers' haemoglobin level was 14.5080 ± 1.5590 (g/dL) and non-smokers was 12.1340 ± 0.70410 (g/dL). According to statistics, the level of Hb was significantly higher in smokers compared to non-smokers (P<0.0001). In comparison to non-smokers, the RBC count dramatically increased in smokers (P<0.0001) greater than in non-smokers at 5.2550 ± 0.6629 $(x10^{12}/L)$ and 4.6340 ± 0.5530 $(x10^{12}/L)$ respectively. While the total leucocyte count (TLC) in smokers is 8.0500 ± 1.8796 $(x10^9/L)$, compared to 6.8580 ± 1.2454 $(x10^9/L)$ in non-smokers. Statistics show that smokers have a higher total leucocyte count than non-smokers (P<0.0002). Smokers' platelet count is 255.7600±61.8351 $(x10^9/L)$ while non-smokers' is 216.5800±35.5752 $(x10^9/L)$. The study has statistically shown that smokers' platelet counts rose considerably in comparison to non-smokers (P<0.012).

Conclusion: It may be concluded that uninterrupted smoking has an undue negative impact on haematological parameters such that increase occur in values of Hb, RBC, TLC and platelets. Significantly, these changes may increase the risk of serious health issues such as heart related defects, hardening of the arteries, Vaquez-Osler disease. It is recommended that smokers have these metrics regularly monitored.

1. INTRODUCTION

The most significant single preventable cause of morbidity and premature death has been identified as cigarette smoking. Smoking is popular among people for a variety of reasons, including amusement, socialization, and stress relief [1]. The psychological factors that lead to many young people starting to smoke, such as parental smoking, curiosity, rebelliousness, and the need to prove their independence, often play a role in this. Nicotine's pharmacological characteristics have a key role in the durability of the habit once it develops into a regular behavior [2]. One-third of smokers worldwide, or 1.1 billion people, are between the ages of 15 and 20, according to the World Health Organization (WHO). The majority of these smokers, 800 million of whom are men, live in developing nations. It's socially acceptable to use tobacco in many parts of the Nigerian society [3].

According to estimates, each cigarette smoked during the smoking phase results in a loss of life of 7 minutes on average. Smoking reduces lifespan by an average of 8 years for those who start at age 15, and by an average of 4 years for those who start after age 25 [4]. Most extra deaths linked to smoking are caused by coronary heart disease, cancer, and various respiratory illnesses.

Compared to non-smokers, smokers have an average 16 times higher chance of developing lung cancer, a 12 times higher risk of developing chronic obstructive pulmonary disease (COPD), and a 2 times higher risk of suffering a myocardial infarction [2]. The effects of smoking on the human body are more detrimental than beneficial. Chronic smoking can lead to ailments like coronary heart disease, cancer, and numerous respiratory illnesses, among others.

When compared to non-smokers, smokers have a 2-fold increased risk of myocardial infarction, a 12-fold increased risk of chronic obstructive pulmonary disease (COPD), and a 16-fold increased risk of lung cancer [2]. This study aims to determine how smoking affects several haematological parameters and offers potential remedies for its negative consequences.

2. MATERIALS AND METHODS

2.1 Study Design

This cross-sectional study was conducted in Port Harcourt, Rivers State, among smokers and non-smokers.

2.2 Study Area

The study was conducted in the Port Harcourt metropolis region of Nigeria's Rivers state. Oil and gas industry activity, in particular, is visible in the chosen study area. It had a population of 541, 115 and by 2015, it had grown to 2 million, with an urban density of 14,800/km2 (38,000/sq

mi). It has a humid tropical climate with long rainy seasons that last for a long time and brief dry seasons. The city experiences relatively consistent year-round temperatures with little seasonal variance. In the city, the usual range of temperatures is 250°C to 280°C. One of the major industrial hubs in Nigeria is Port Harcourt.

2.3 Study Population

In this cross-sectional study, 100 people between the ages of 20 and 45 years were included, 50 of whom were smokers and 50 non-smokers.

2.4 Collection of Blood Samples, Storage and Transportation

Venipuncture was used to obtain 5 milliliters of blood samples from the study population, which were then placed in an EDTA vial and properly mixed to prevent clotting. The samples were transported to the point of testing in a sample carrier at the appropriate temperature of $4^{o}C$ to $8^{o}C$ and analyses were done the same day of sample collection. The samples were used for full blood count (FBC) and other haematological analysis.

2.5 Methodology

2.5.1 Determination of full blood count by haematology auto-analyzer

Among the haematological parameters (Full Blood Count) examined are haematocrit, haemoglobin, red blood cells count, platelets count, total white blood cells count, neutrophils, lymphocytes and MXD (The MXD comprise of Basophils, Eosinophils and Monocytes generated by a three- part automated haematology analyzer). Model number: XP-300 KOBE Japan Sysmex Xp-300 Haematology Auto-Analyzer.

Procedure:

In the mixer, samples were allowed to blend for 10 minutes. It was turned on at the power switch. Self-check, auto-rinse, and background checks were all carried out automatically. The probe was used to inject control samples into the apparatus. By lightly tapping the start button, the sample was introduced through the probe for sample aspiration. Two buzzer beeps were heard, followed by an analysis display, and the sample tube was then taken out. On the LCD panel, the test's results were shown.

2.5.2 Estimation of erythrocyte sedimentation rate

The other haematological parameter that was analyzed was the Erythrocyte Sedimentation Rate and it was done using the Westergren method.

Procedure:

1.6 ml of venous blood was placed with 0.4 ml of 3.2% sodium citrate in the Westergren bucket and mixed by inverting the bucket 2 to 3 times for the blood to mix properly with the anticoagulant. Then the Westergren tube was filled up to the 0 mark and placed in the rack at room temperature away from sunlight and undisturbed for one hour. Exactly after 1 hour the result was read and recorded in millimeters from top surface of column to top of RBC sediments.

2.5.3 Statistical analysis

Microsoft Office Excel 2016 and Graph Prism Pad version 6.2 were used to examine the results. The student's independent t-test was used to compare the mean and standard deviation values for the various parameters for the test and reference ranges.

3. RESULTS

Table 1 shows the mean age of 50 smoking subjects and 50 non-smokers mean age as According to Table 1, the mean age of 50 smoking subjects was 43.6200 ± 9.7250 years while the mean age of 50 non-smokers was 42.7800 ± 6.5440 years.

Table 1. Age distribution in smokers and non-smokers

	Number	Mean±SD (Years)
Smokers	50	43.6200±9.7250
Non-smokers	50	42.7800±6.5440
P-value		0.6130
Remark		NS

Key: SD = Standard deviation; NS = Not significant; S = Significant

Table 2 shows the Haemoglobin (Hb) value of 14.5080 ± 1.5592 (g/dL) in smokers and 12.1340 ± 0.7041 (g/dL) in nonsmokers. There was a statistically significant increase in the level of Hb in smokers compared to non-smokers ($P < 0.005$).

Table 2. Haemoglobin concentration in smokers and non-smokers

	Number	Mean±SD (g/dL)
Smokers	50	14.5080±1.5592
Non-smokers	50	12.1340±0.7041
P-value		0.0020
Remark		S

Key: SD = Standard deviation; NS = Not significant; S = Significant

According to Table 3, the RBC count in smokers is 5.2550 ± 0.6629 $(\times 10^{12}/L)$ and in non-smokers it is 4.6340 ± 0.5530 $(\times 10^{12}/L)$. When compared to non-smokers, smokers had a statistically significant rise in RBC count ($P < 0.0001$).

Table 3. Red blood cell count in smokers and non-smokers

	Number	Mean±SD ($\times 10^{12}/L$)
Smokers	50	5.2550±0.6829
Non-smokers	50	4.6340±0.5330
P-value		<0.0001
Remark		S

Key: SD = Standard deviation; NS = Not significant; S = Significant

Table 4: Total Leucocyte Count is 8.0500 ± 1.8796 $(\times 10^9/L)$ in Smokers and 6.8580 ± 1.2454 $(\times 10^9/L)$ in Non-smokers. There was a statistically significant increase in the Total Leucocyte Count in smokers compared to non smokers ($P < 0.002$).

Table 4. Total leucocyte count in smokers and non-smokers

	Number	Mean±SD ($\times 10^9/L$)
Smokers	50	8.0500±1.8796
Non-smokers	50	6.8580±1.2454
P-value		0.0020
Remark		S

Key: SD = Standard deviation; NS = Not significant; S = Significant

Table 5: Platelet Count in Smokers is 255.7600 ± 61.8351 $(\times 10^9/L)$ and Non-smokers, 216.5800 ± 35.5752 $(\times 10^9/L)$. There was a statistically significant increase in the platelet count in smokers compared to non-smokers ($P < 0.012$).

Table 5. Platelet count in smokers and non-smokers

	Number	Mean±SD ($\times 10^9/L$)
Smokers	50	255.7600±61.8351
Non-smokers	50	216.5800±35.5752
P-value		0.0120
Remark		S

Key: SD = Standard deviation; NS = Not significant; S = Significant

Table 6: The mean value of Erythrocyte Sedimentation Rate (ESR) in Smokers was 11.7400 ± 10.7780 (mm/hr) and Non-smokers, 7.3800 ± 1.6020 (mm/hr).There was a statistically significant increase in the ESR in smokers compared to non-smokers ($P = 0.0060$).

Table 6. Erythrocyte sedimentation rate values in smokers and non-smokers

	Number	Mean±SD (mm/hr)
Smokers	50	11.7400±10.7780
Non-smokers	50	7.3800±1.6020
P-value		0.0060
Remark		S

Key: SD = Standard deviation; NS = Not significant; S = Significant; ESR = Erythrocyte Sedimentation rate

4. DISCUSSION

Revelations made from this study, show smokers had statistically significant increases in their haemoglobin concentration and RBC count ($P < 0.0001$). This could be due to carbon monoxide, which is present in cigarette smoke. Smokers' carboxy-haemoglobin (CoHb) prevents oxygen from being transported and used properly. Smoking decreases tissue oxygen delivery, which causes hypoxia. Interstitial cells in the peritubular capillary bed of the kidney (85%) and perivenous hepatocytes in the liver (15%) release erythropoietin in response to this hypoxia. The amount of committed stem cells in the bone marrow that are erythropoietin-sensitive and capable of developing into erythrocyte precursors and ultimately mature erythrocytes is increased by erythropoietin. By boosting globin synthesis and potentiating -amino Levulinic acid synthetase, it also encourages haemoglobin synthesis. Hb concentration and RBC count would consequently rise.

This study corroborates with the research on Hb concentration and RBC count by Nargish et al. [5]; Sagone et al. 2016, [6] and Whitehead et al. [7] while a research by Ilueme et al. [8] on the Evaluation of haematological parameters among cigarette smokers who drink local gin in Ogba/Egbema/ Ndoni Local Government area of Rivers State showed a statistically significant increase in Haemoglobin concentration among their subjects who only smoke without drinking compared to their control subjects who neither smoke nor. Contrarily to this study, they reported no significant difference in the RBC count between the smokers and non smokers [8].

This study found that smoking causes an increase in total leucocyte count (TLC) (P< 0.0001, extremely significant). There is no obvious explanation for how smoking cigarettes increases TLC. The possible explanations put forward to explain this finding in smokers are as follows: Nicotine, acetaldehyde, acrolein, and nicotine are just a few of the dangerous substances found in cigarette smoke. Acetaldehyde is a product of chemical processes in the cigarette smoke. Additionally, smoking causes structural modifications to the respiratory system. These alterations include disruption of the respiratory epithelium, pathogen adhesion modifications, increased mucosal permeability, mucociliary clearance impairment, and peribronchiolar inflammation and fibrosis. These alterations increase the risk of upper and lower respiratory tract infections, which may exacerbate lung inflammation brought on by cigarette smoke. The haematopoietic system, specifically the bone marrow, is stimulated by the systemic inflammatory response, releasing leucocytes into the bloodstream with the help of colony stimulating factors like granulocyte-monocyte colony stimulating factor (GM-CSF) and Smokers' total leucocyte counts can rise as a result. This study is in line with the studies by Ilueme et al. [8] and Rafiye et al. [9] which also reported statistically significant increase in leucocyte count among smokers in their study populations compared with the non-smokers [8,9].

In this study, it was discovered that smokers have higher platelet counts (p< 0.0001, extremely significant). Some research claim that smoking increases the platelet count in female smokers, whereas other studies assert that there is no connection between smoking and platelet count, meaning that the platelet count remains constant. Smokers' higher platelet counts can be explained as follows: Smoking cigarettes causes inflammation of the lungs, which stimulates the bone marrow and causes the release of platelets. Chronic smoking appears to negatively impair platelet activity and survival. Smoking inhibits Cyclo-oxygenase both acutely and chronically, which reduces prostacyclin and boosts the production of thromboxane A2 a strong vasoconstrictor and platelet agonist and Smokers' greater platelet counts may be a result of this. The findings of a studies on platelet count conducted by Ilueme et al. [8] and Tell et al. in 2014 are comparable to those of our investigation [8,10].

As shown in the study, smokers have higher ESR readings (p = 0.006) compared with non-smokers in the study population. This can be explained by the fact that the ESR is mostly dependent on the rouleaux, or the mass or size of the falling particles. Smokers have higher plasma fibrinogen concentrations, which affects how the rouleaux forms and grows in size.

Because they are negatively charged and repel one another, red cells normally want to stay apart from one another. Fibrinogen stabilizes the modifications on the red cells and makes them sticky, which promotes the production of rouleaux, which in turn boosts ESR. Our findings are supported by data from research on ESR by Famodu et al. [11] and Ilueme et al. [8,12].

5. CONCLUSION

The results obtained from the study indicate that Smokers displayed aberrant haematological parameters. RBC count, Hb concentration, total leucocyte count, platelet count, and ESR are all elevated in smokers. These changes may increase the risk of atherosclerosis, secondary polycythemia vera, chronic obstructive pulmonary disease, and/or cardiovascular disorders. It is recommended that smokers have these metrics regularly monitored.

CONSENT AND ETHICAL APPROVAL

The study was approved by the Department of Medical Laboratory Science at Rivers State University, Port Harcourt and written informed consent was obtained from participants who appeared to be in good health prior to enrollment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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