WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 5, Issue 02, 146-154. Research Article ISSN 2277– 7105

# A COMPARATIVE STUDY ON SOME HEMATOLOGICAL PARAMETERS OF SOME SMOKERS AND NON SMOKERS BLOOD SAMPLES

**Fayruz E. K. Fadiel* and H. M. I. Hasan***

*Chemistry Department, Faculty of Science, Omar El –Mukhtar University, Libya.

Article Received on
28 Nov 2015,

Revised on 20 Dec 2015,
Accepted on 13 Jan 2016

***Correspondence for Author**
**Fayruz. E. k. Fadiel**
Chemistry Department, Faculty of Science, Omar El –Mukhtar University, Libya.

## ABSTRACT

This study was carried out on some smokers and non smokers blood samples. The samples were collected from Shahat city hospital (LIBYA) during November 2015. The effects of smoking on some hematological parameters (Hemoglobin, WBC, RBC, HCT, MCT, and MCV) were studied by using complete blood count ( CBC ) by using digital instrument. The results showed high levels of hemoglobin (Hb), HCT and WBC in blood smokers samples comparing with non smokers samples ones.

**KEYWORDS:** Hemoglobin, WBC, RBC, HCT, MCT, and MCV.

## INTRODUTION

The effects of cigarette smoking on human health are serious and in many cases, deadly. Cigarette smoking carries higher risks for most of the chronic diseases. It also has chronic and acute effects on the hematologic system. Smoking is the most important public health problem. Many studies performed have proved its deleterious effects on many organ systems mainly respiratory, and cardiovascular systems. With 6000 chemical substance it contains, it exerts pharmacological, mutagenic, carcinogenic, toxic, and inflammatory effects (Öztuna, 2004).

Evidence collected during the past four decades have unanimously demonstrated that both active and passive tobacco cigarette smoking increase morbidity and the risk for premature death and generate adverse acute and long-term health effects in nearly all systems of the human organism (Flouris *et al*., 2010b). Despite the global initiatives and theimplementation

of smoke-free measures, smoking still kills nearly 6 million people every year (Flouris, 2009).

There are more than 4000 chemicals found in cigarette smoke (Green and Rodgman, 1996), and a cigarette smoker is exposed to a number of harmful substances including nicotine, free radicals, carbon monoxide and other gaseous products (Gitte, 2011). It is widely known that smokers have higher risk for cardiovascular diseases, hypertension, inflammation, stroke, clotting disorder, and respiratory disease (Abel *et al.*, 2005). Moreover, cigarette smoking accelerates pathogenesis in different type of cancers such as lung, pancreas, breast, liver and kidney (Islam *et al*., 2007). Similarly, it also enhances pH in stomach that resulted in peptic ulcers and gastric diseases (Kume *et al*., 2009).

Nowadays, it is responsible for every six cases of death (Kumar, 2000). Cigarette contains carcinogens (polycyclic aromatic hydrocarbons etc.), irritant substances, nicotine, carbon monoxide, and other gases. Cigarette smoke contains many oxidants, and free radicals which can harm lipids, proteins, DNA, carbohydrates, and other bio molecules (Al-Azzawy and Al-Qaicy, 2011). The effects of smoking on various metabolic, and biological processes, hormone secretion, and hematopoietic system have been demonstrated. In many studies, among acute effects of smoking on hematological system, increases in WBC, eosinophil, and platelet (PLT) counts have been shown (Öztuna, 2004). A correlation was established between smoking, and WBC counts. Relatively higher WBC counts were detected in smokers (De Heens *et al*., 2009). Smoking has been suggested to increase the levels of hematological parameters as hemoglobin (Hb) concentration, red blood cell (RBC), neutrophil, eosinophil, monocyte, and platelet counts. Smoking cessation studies have demonstrated that some of these changes are reversible, and transitory in case of cessation of smoking (McKarns, 1992).

During past years, it was suggested that cigarette smoking affect the blood characteristics as well that leads to death. For example, relation between smoking and white blood cell count has been well established (Torres de Heens *et al*., 2009). In a number of studies, it has been found that smokers have higher white blood cell counts than nonsmokers (Wannamethee *et al*., 2005).

However, there is little information on more routinely-performed hematology laboratory tests such as the complete blood count (CBC) which is one of the most commonly ordered blood tests in medicine providing an overview of an individual's general health status as well as

information for infection, inflammation and inflammatory disease, deficiencies in the immune system, bone marrow disease and other health-related conditions. Acute and chronic active tobacco cigarette smoking has been known to increase white blood cell count . Moreover, previous epidemiological studies reported that chronic passive tobacco cigarette smoking can increase white blood cell count.

The aim of the present study was to assess the extent of adverse effects of cigarette smoking on homological characteristics of blood in male smokers of shahat city in Libya comparing with of non smokers blood samples.

## MATERIALS AND METHODS

### Sampling

Our cross-sectional study was performed on healthy 26 male patients aged 25-80 years who consulted to shahat Hospital between October 2015, and November 2015 for any indication. The first group consisted of smokers, and the second group of nonsmokers.

### Laboratory test

The blood samples were collected in the morning time 8.00 to 9.00 am after an overnight fasting for at least 10 hours. Venous blood samples were drawn in EDTA (15%) Becton Dickinson Vacuum tubes and mixed gently.

Complete Blood Count (CBC) was measured within 1-2 hours of blood sampling by using Nihon fully automatic Hematological analyzer (Daigon, Korea). The Hematological analyzer was calibrated by standardized commercially available calibrators' kit. CBC count (WBC, RBC, Hb, MCV, MCH and HCT) were measured in this study.

## RESULTS

The obtained results are given in table(1), the results showed that the contents of hemoglobin in the smokers blood samples were ranged between (4.2- 18.30) , WBC ( 8.0 - 15.10) , RBC (4.28 - 5.49) and HCT contents were ranged between ( 31.60 – 49.50). On the other hand the above parameters in the blood non smokers samples were ranged as following: (13.12 - 15.20), (5.75 – 8.45), (3.99 – 5.01) and (29.45 – 37.56), respectively , Table (2).

**Table (1): The homological parameters analysis of the collected blood samples of smokers.**

| parameter / Sample | WBC | RBC | Hb | HCT | MCV | MCH | Smoking Period |
|---|---|---|---|---|---|---|---|
| **1** | 12.6 | 4.70 | 16.5 | 40.5 | 84.8 | 35.1 | 25 |
| **2** | 10.5 | 4.74 | 15.3 | 45.8 | 83.0 | 38.4 | 26 |
| **3** | 5.5 | 5.20 | 16.3 | 48.9 | 92.6 | 31.3 | 40 |
| **4** | 12.9 | 4.28 | 14.2 | 42.6 | 81.5 | 36.1 | 13 |
| **5** | 8.0 | 4.55 | 15 | 45 | 85 | 38.8 | 30 |
| **6** | 15.1 | 5.10 | 16.2 | 49.5 | 84.3 | 33.5 | 50 |
| **7** | 8.7 | 4.79 | 17.2 | 31.6 | 69.9 | 25.9 | 30 |
| **8** | 12.2 | 4.50 | 14.8 | 45.8 | 88.1 | 33.1 | 35 |
| **9** | 8 | 4.63 | 15.1 | 45.3 | 73.1 | 31.2 | - |
| **10** | 9.3 | 5.49 | 18.3 | 75.9 | 92.8 | 39.3 | - |
| **11** | 12.6 | 4.44 | 17.1 | 37.2 | 70.6 | 27.9 | 5 |
| **12** | 6.5 | 4.67 | 17.3 | 36.9 | 77.3 | 26.4 | 25 |
| **13** | 10.66 | 5.1 | 16.80 | 41.89 | 89.11 | 36.45 | 32 |
| **14** | 11.89 | 4.99 | 18.11 | 44.88 | 82.74 | 34.56 | 49 |
| **15** | 9.12 | 5.09 | 17.30 | 45.71 | 87.98 | 39.46 | 32 |
| **16** | 11.02 | 5.23 | 17.75 | 39.57 | 75.87 | 39.79 | 22 |
| **Average** | 10.28 | 4.84 | 16.45 | 44.81 | 82.41 | 34.20 | - |
| **STD** | 2.58 | 0.33 | 1.25 | 9.53 | 7.25 | 4.63 | - |

**Table (2): The homological parameters analysis of the collected blood samples of non smokers:**

| parameter / Sample | WBC | RBC | Hb | HCT | MCV | MCH | Smoking Period |
|---|---|---|---|---|---|---|---|
| **1** | 6.11 | 4.56 | 13.45 | 32.45 | 72.1 | 28.19 | - |
| **2** | 5.75 | 4.89 | 13.12 | 29.45 | 74.3 | 27.22 | - |
| **3** | 7.83 | 5.01 | 14.62 | 33.67 | 69.33 | 31.90 | - |
| **4** | 8.32 | 4.23 | 14.57 | 37.45 | 73.23 | 28.03 | - |
| **5** | 7.43 | 3.99 | 13.54 | 37.56 | 70.81 | 29.11 | - |
| **6** | 8.45 | 4.32 | 15.1 | 37.40 | 77.29 | 32.48 | - |
| **7** | 6.91 | 4.78 | 14.86 | 30.14 | 68,80 | 27.65 | - |
| **8** | 7.34 | 4.29 | 15.20 | 34.55 | 71.52 | 28.28 | - |
| **9** | 6.34 | 4.11 | 14.35 | 31.12 | 70.12 | 29.74 | - |
| **10** | 7.91 | 4.56 | 15.34 | 35.20 | 79.27 | 33.28 | - |
| **Average** | 7.23 | 4.47 | 14.41 | 33.89 | 73.10 | 29.58 | - |
| **STD** | 0.93 | 0.34 | 0.78 | 3.05 | 3.33 | 2.18 | - |

## DISCUSSION

Smoking is known as a high risk factor for cardiovascular diseases, hypertension, inflammation, stroke, coagulation, and respiratory diseases (de Heens *et al*., 2009). Besides, as shown in various studies, smoking accelerates cancer genesis in various organs as lungs,

pancreas, kidney, and liver (Islam *et al*., 2007). Effects of smoking on hemapoietic system have been also analyzed in many studies. In our study, we also investigated the impact of smoking on hematological parameters. The mechanism of action of smoking on WBC is not clear-cut yet. In smokers, lymphocytosis is thought to be mainly associated with an increase in T-cells (Silverman *et al.*, 1975). Nicotine which is a component of cigarette smoke, stimulates catecholamine release, and induces increase in cortisol levels. Increases in peripheral blood WBC counts, and alterations in WBC function can be the result of direct damage stemming from alterations in epithelial, and endothelial surfaces and/or cytokine levels (especially IL-6) caused by components of cigarette smoke (Smith *et al*., 2003). In a study on the impact of smoking on hematological parameters, WBC, red blood cells, Hb, and HTC levels were found to be markedly increased, while MCV, and MCH counts were lower. These changes have been associated with atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease, and cardiovascular diseases, and also higher risk of atherosclerosis, polycythemia, chronic obstructive pulmonary disease, and cardiovascular disease in smokers has been revealed (Asif *et al*., 2013). It have been detected that smoking significantly increased WBC, neutrophil, lymphocyte, monocyte, platelet counts, Hb, Hct, and RBC indexes in both genders . Also some studies comparing smoker, and nonsmoker groups have demonstrated increases in Hb, HCT, RBC, MCV, WBC, neutrophil, lymphocyte, eosinophil, and monocyte counts in both groups (Whitehead *et al*., 1995). Similarly when smokers, and nonsmokers were compared, rates of MCV were found to be significantly higher in smokers in compliance with the literature. Zafar et al. investigated the impact of smoking on RBC, WBC, and Hb, and indicated increases in WBC counts, and decreases in RBC,. Linear regression model demonstrated a positive correlation between number of pack-years, and total WBC count, and the authors stressed the importance of these increments. Presence of a positive correlation has been revealed between pack-years of smoking, and WBC counts. Studies displayed sustained, and important increments in WBC counts in line with pack-years of smoking. Even smoking 10 cigarettes a day led to important increase in WBC counts (Zafar *et al.*, 2003).

In our study, when we analyzed the impact of years of smoking on WBC counts, we detected significant increases in WBC counts in individuals with a smoking. However in individuals who used we note there is relative increase in WBC and Hb contents with increase the period of smoking . The harmful effects of smoking on hematological parameters improve with a little bit decrease in the daily number of cigarettes smoked. If chronic smokers quit smoking,

then, as has been demonstrated in many studies, most of the parameters related to red, and white blood cells rapidly return to their normal values (Bain *et al*., 1992).

WBC count is perhaps the most useful, inexpensive and simple biomarker for endothelial damage. The high WBC count in male smokers in this study is consistent with other published reports (Kawada, 2004). Freedman et al. observed that median total leukocyte count was 36% higher in current smokers as compared to non-smokers (Wannamethee *et al*., 2005). 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). While leukocytosis may simply be a marker of smoking-induced tissue damage, the high count can promote cardiovascular diseases through multiple pathologic mechanisms that mediate inflammation, plug the microvasculature, induce hyper coagulability and promote infarct expansion (Islam *et al*., 2007). The high WBC count in our male smoking subjects may also suggest that they might be at greater risk for developing atherosclerosis and cardiovascular diseases than non-smokers. We observed that hemoglobin values were significantly high in smokers . Elevated levels of hemoglobin are correlated with increased numbers or sizes of RBCs. RBC values were high in smokers than those of non-smokers and are consistent with other investigations (Kume *et al*., 2009). It is reported that high level RBC, WBC and Hematocrit are associated with blood viscosity and clotting in smokers (Ho, 2004).

High level of RBC is termed as polycythemia and very high RBC mass slows blood velocity and increase the risk of intravascular clotting, coronary vascular resistance, decreased coronary blood flow, and a predisposition to thrombosis (Ravala and Paula, 2010). It has been established that fibrinogen levels are higher in smokers than in non-smokers, and it has been estimated that the increasing risk of cardiac disease in smokers may be associated with high fibrinogen levels through arterial wall infiltration and effects on blood viscosity, platelet aggregation, and fibrin formation (Wannamethee *et al*., 2005).

Hematocrit values were also significantly high in smokers than those of non-smokers and consistent with previous findings (Kume *et al*., 2009). Higher levels of hematocrit may cause polycythemia vera (PV), a myeloproliferative disorder in which the RBCs are produced excessively by bone marrow, and also related to an increased risk of development of atherosclerosis and cardiovascular disease (Ferro *et al*., 2004).

In cigarette smoking, carbon monoxide (CO) is produced by the incomplete combustion of carbon-containing material. CO has a very high affinity for hemoglobin relative to that for oxygen (approximately 200-fold) (Carallo *et al*., 1998).

Higher levels of hematocrit and hemoglobin have been demonstrated in smokers, and these increases are likely to be compensatory for exposure to CO (Roethig et al., 2010). Increased hematocrit and hemoglobin concentrations observed in smokers that may contribute to a hypercoagulable state (Leroy *et al*., 2012).

## CONCLUSION

From the data which recorded in this study we can say there is different between the hematological parameters between the smokers and non smokers blood samples , where high counts of WBC, HCT and Hb were clearly recorded in the samples of smokers ones.

## REFERENCES

1. Abel, G.A., Hays, J.T, Decker PA, Croghan, G.A., and Kuter, D.J. Effects of biochemically confirmed smoking cessation on white blood cell count. Mayo Clin Proc., 2005; 80(8): 1022-1028.
2. Al-Azzawy, L.H.A and Al-Qaicy, A. G. S. A study about some physiological parameters in smokers. Ibn Al-Haitham .J. for Pure & Appl., 2011; 24.
3. Asif, M., Karim, S, Umar Z, Malik A, Ismail T., and Chaudhary A. Effect of cigarette smoking based on hematological parameters: comparison between male smokers and nonsmokers. Turkish Journal of Biochemistry-Turk .J Biochem., 2013; 38: 75-80.
4. Bain, B.J., Rothwell, M., Feher, M.D, Robinson, R., Brown J., and Sever, P.S. Acute changes in hematological parameters on cessation of smoking. J R Soc Med., 1992; 85: 80-2.
5. Calapai, G., Caputi, A.P., Mannucci, C, Russo A.G, Gregg, E., Puntoni, R, Lowe F, McEwan M, Bassi, A, Morandi, S., and Nunziata, A. Cardiovascular biomarkers in groups of established smokers after a decade of smoking. Basic & Clinical Pharmacology & Toxicology., 2009; 104: 322–328.
6. Carallo, C., Pujia, A., Irace, C., De Franceschi ,M.S, Motti ,C. and Gnasso, A. Whole blood viscosity and haematocrit are associated with internal carotid atherosclerosis in men. Coron Artery Dis., 1998; 9: 113–117.

7. De Heens, G.L., Kikkert R, Aarden LA, van der Velden U. and Loos , B.G. Effects of smoking on the ex vivo cytokine production in periodontitis. J Periodontal Res., 2009; 44: 28-34.
8. Ferro, J.M, Canhao P., Stam, J., Bousser, M.G. and Barinagarrementeria, F. ISCVT Investigators: Prognosis of cerebral vein and dural sinus thrombosis: results of the international study on cerebral vein and dural sinus thrombosis (ISCVT). Stroke., 2004; 35: 664– 670.
9. Flouris, A.D., 2009. Acute health effects of passive smoking. Inflamm. Allergy Drug Targets., 2009; 8: 319–320.
10. Flouris, A.D., Vardavas, C.I., Metsios, G.S., Tsatsakis, A.M., Koutedakis, Y., 2010b. Biological evidence for the acute health effects of secondhand smoke exposure. Am. J. Physiol. Lung Cell. Mol. Physiol., 298: L3–L12.
11. Gitte, R.N. Effect of cigarette smoking on plasma fibrinogen an platelet count. Asian Journal of Medical Sciences., 2011; 2: 181- 184.
12. Green, C.R and Rodgman , A. The tobacco chemists' research conference: a half century forum for advances in analytical methodology of tobacco and its products. Recent Adv Tobacco Sci., 1996; 22: 131–304.
13. Ho, C.H. White blood cell and platelet counts could affect whole blood viscosity. J Chin Med Assoc., 2004; 67(8): 394-397.
14. Islam, M.M ., Amin, M. R., Begum, S., Akther, D. and Rahman, A. Total count of white blood cells in adult male smokers. J Bangladesh Soc Physiol., 2007; 2: 49-53.
15. Kawada, T. Smoking-induced leukocytosis can persist after cessation of smoking. Arch Med Res., 2004; 35: 246–250.
16. Kumar, C. Ro. Basic pathology. Çevikbaş U. 6. Baskı, Elma Basım., 2000.
17. Kume, A., Kume ,.T, Masuda K, Shibuya F, Yamzaki H. Dose-dependent effect of cigarette smoke on blood biomarkers in healthy volunteers: Observations from smoking and non-smoking. Journal of Health Sciences., 2009; 55(2): 259-264.
18. Leroy, M.C, Jarus-Dziedzic., K, Ancerewicz, J., Lindner, D., Kulesza ,A, and Magnette, J. Reduced exposure evaluation of an Electrically Heated Cigarette Smoking System. Part 7: A one-month, randomized, ambulatory, controlled clinical study in Poland. Regulatory Toxicology and Pharmacology., 2012; 64: 74-84.
19. McKarns ,S.C. Smoker-nonsmoker comparative study., 1992; 3070.
20. Öztuna, F. Sigaranın hücresel etkileri. Akkciğer Arşivi., 2004; 2: 111-6.

21. Ravala, M. and Paula ,A. Cerebral venous thrombosis and venous infarction: Case report of a rare initial presentation of smoker's polycythemia case rep. Neurol., 2010; 2: 150–156.
22. Roethig, H.J, Koval T, Muhammad-Kah R, Jin Y, Mendes P, and Unverdorben, M. Short term effects of reduced exposure to cigarette smoke on white blood cells, platelets and red blood cells in adult cigarette smokers. Regul Toxicol Pharmacol., 2010; 57: 333–337.
23. Silverman, N.A, Potvin C, Alexander J.C Jr,. and Chretien P.B. In vitro lymphocyte reactivity and T-cell levels in chronic cigarette smokers. Clin Exp Immunol., 1975; 22: 285-92.
24. Smith, M.R, Kinmonth A.L, Luben R.N, Bingham S, Day NE, and Wareham , N.J,. Smoking status and differential white cell count in men and women in the EPIC-Norfolk population. Atherosclerosis., 2003; 169: 331-7.
25. Torres, de., Heens ,G.L, Kikkert , R, Aarden LA, Velden Van der U, amd Loos, B.G. Effects of smoking on the ex vivo cytokine production. J Periodont Res., 2009; 44: 28-34.
26. Wannamethee, S.G, Lowe G.D, Shaper A.G, Rumley A,. and Lennon L,. Association between cigarette smoking, pipe/cigar smoking, and smoking cessation, haemostatic and inflammatory markers for cardiovascular disease. Eur Heart J., 2005; 26(17): 1765-1773.
27. Whitehead, T.P, Robinson, D, Allaway S.L., and Hale A.C. The effects of cigarette smoking and alcohol consumption on blood haemoglobin, erythrocytes and leucocytes: a dose related study on male subjects. Clin Lab Haematol., 1995; 17: 131-8.
28. Zafar, I, Mohammad K.N, Nisar M, Rashida M., and Shumaila, B.. Effect of cigarette smoking on erythrocytes, leukocytes and haemoglobin. Journal of Medical Sciences., 2003; 3: 245-50.