



ORIGINAL ARTICLE

Variation in hematological parameters due to tobacco cigarette smoking in healthy male individuals.

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ABSTRACT... Objective: To evaluate the changes in hematological parameters in healthy male smokers. **Study Design:** Descriptive Cross - Sectional study. **Setting:** HITEC – IMS Taxila. **Period:** December 2021 to May 2022. **Material & Methods:** Hematological Parameters including complete blood counts (WBC, RBC, Hb, MCV, MCH, MCHC, HCT, RDW, PLT), Differential Leukocyte Count, ESR and PT, APTT were done in each case. The data were entered and analyzed on SPSS version 22. **Results:** Mean age of smokers was 28.72 ± 6.79 years while mean age of non-smokers was 30.63 ± 6.73 years. Duration of smoking was between 4 to 28 years and number of cigarettes was between 5 to 50 / day. Among hematological parameters; WBC count, Lymphocyte count, RBC count, hemoglobin, MCV, MCH and ESR were significantly raised; while neutrophil count was significantly low in smokers as compared to non-smokers. It was also observed that values of WBC count and prothrombin time were significantly higher in individuals with a smoking history of more than 10 years. **Conclusion:** In conclusion, smoking has adverse effects on the various hematological parameters that have been reported to be associated with a greater risk for developing hazardous effects on health. So, we suggest that physicians should evaluate their patients at every visit and strictly recommend them early cessation of smoking so that we could prevent our young generation from future ailments.

Key words: Complete Blood Count, Hematological Parameters, Tobacco Cigarette Smoking.

INTRODUCTION

Tobacco smoking is an independent leading cause of death worldwide and it has created major health challenges in population.¹ Tobacco smoking has been one of the most common addictions of all ages. It has been reported that tobacco smoking is an important etiological factor for various chronic illnesses, including infections, cancers, heart diseases, and respiratory diseases.² According to World Health Organization there are about 2.4 billion people addicted to tobacco in different forms like chewing, snuffing and dipping.³ WHO has estimated that in 2030 deaths due to tobacco will reach to 8.3 million while till the end of 21st century it will cause one billion deaths worldwide.⁴ In Pakistan overall 19.1% (23.9 million) of adult population are current users of different tobacco products among them, 10.5% are cigarette smokers.⁵ Tobacco smokers

are exposed to numerous injurious chemicals including nicotine, carbon monoxide and other gaseous elements out of which Nicotine is the main addictive and stimulant agent. These chemical substances have negative effects on almost every organ system of the human body specifically respiratory, cardiovascular system and gastrointestinal system.⁶ It has been reported that smoking produces negative effects on different hematological parameters such as hemoglobin (Hb) concentration, red blood cell count (RBC), MCV, MCH, WBC count, platelet counts, clotting profile and ESR⁵ resulting in systemic inflammation. Smoking is also responsible for platelet aggregation and alteration in clotting profile due to which viscosity of blood increases that results in atherosclerosis and myocardial infarction.^{6,7} Studies have shown that some of these changes are transitory, and reversible on

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cessation of smoking. 17-30% of cardiovascular diseases are caused by cigarette smoking which is considered to be a preventable cause.⁵ So, the aim of our study is to evaluate the changes in hematological parameters due to tobacco cigarette smoking in healthy male individuals at HITEC – IMS Taxila.

MATERIAL & METHODS

It was a Descriptive Cross - Sectional Study with comparison groups, conducted in Department of Pathology, HITEC – IMS Taxila. Duration of study was 06 months after approval of synopsis from Institutional Review Board (HITEC-IRB-11-2021). Total 114 healthy young adult male subjects, aged 20-40 years, were included in this study out of which 60 were healthy young adult male smokers (n=60) and rest were nonsmokers as control (n=54). Assuming the expected population standard deviation to be 2.03, and a population size of 1000, the study would require a sample size of 60 to estimate a mean with 95% confidence and precision of 0.5.⁸ Hematological Parameters including complete blood counts (WBC count with Differential Leukocyte Count, RBC, Hb, MCV, MCH, MCHC, HCT, RDW, PLT on fully automated hematology analyzer, ESR and PT, APTT were done in each case.

We also divided smokers into two groups for the comparison of hematological parameters on the basis of duration of smoking. These two groups were comprised of smokers with smoking history less than and more than ten years. Informed consent was taken from all the participants. Subjects not giving consents, having chronic illness, COVID positive in last 3 months, on anticoagulant therapy, taking hematinics or on any other prolonged medication and individuals consuming tobacco in any other form were excluded from the study. Medical history and other relevant information were collected from subjects by personal interview. Data was analyzed by using Statistical Package of Social Sciences (SPSS) version 22. Descriptive statistics was calculated for demographic data. Mean and standard deviation were calculated for numerical parameters. Independent sample t-test was applied for comparing hematological values

between smokers and nonsmokers and P value ≤ 0.05 was considered significant.

RESULTS

The mean age of smokers was 28.72 years \pm 6.79 ranging from 21 to 40 years while mean age of non-smokers was 30.63 years \pm 6.73 ranging from 20 to 40 years. Duration of smoking was between 4 to 28 years and number of cigarettes was between 5 to 50 / day.

Table-I shows comparison of hematological parameters between smokers and nonsmokers. Among these WBC count, Lymphocyte count, RBC count, hemoglobin, MCV, MCH and ESR were significantly raised; while neutrophil count was significantly low in smokers as compared to non-smokers. Rest of the parameters did not show any significant difference.

Table-II shows comparison of hematological parameters between two group of smokers with smoking history less than and more than ten years. There was significant difference between number of cigarettes smoked among both groups ($p \leq .001$). Mean value of number of cigarettes smoked in more than ten years group was 18.2 \pm 10.35 while in less than ten years was 12.5 \pm 5.23. WBC count and prothrombin time were significantly raised in individuals with smoking history of more than 10 years.

DISCUSSION

This study was conducted because trend of cigarette smoking in young healthy adults, is rising progressively. Smoking is a well-known high-risk factor for many diseases including cardiovascular diseases, inflammation, stroke, coagulopathies, and respiratory diseases. Smoking also promotes carcinogenesis in several organs.^{9,10} Adverse effects of smoking on hemopoietic system have been evaluated in various studies previously. In our study, we also explored the effects of smoking on several hematological indices. We think that impact of smoking on individuals without any history of chronic disease can be seen at an earlier stage which could help to lessen forthcoming ailments by providing awareness to such personages.

Hematological Parameters	Smokers (n= 60) Mean ± SD	Non-Smokers (n= 54) Mean ± SD	P-Value
WBC (x10 ⁹ /L)	8.13 ± 1.53	7.44 ± 1.58	.02*
Neutrophils (%)	54.32 ± 11.57	59.52 ± 7.55	.001*
Lymphocyte (%)	37.08 ± 10.32	31.35 ± 6.98	.001*
Monocyte (%)	5.70 ± 2.27	6.19 ± 2.27	.26
Eosinophils (%)	3.25 ± 1.28	3.09 ± 1.23	.51
RBC (x10 ¹² /L)	5.18 ± 0.41	4.99 ± 0.43	.02*
Hb (g/dL)	15.55 ± 0.87	14.98 ± 0.78	.001*
HCT (%)	44.05 ± 4.13	43.37 ± 2.64	.30
MCV (fL)	91.22 ± 8.98	83.92 ± 8.05	.001*
MCH (pg)	32.17 ± 2.86	29.12 ± 1.96	.001*
MCHC (g/dL)	34.30 ± 2.97	33.50 ± 1.15	.07
Platelet count (x10 ⁹ /L)	236.97 ± 49.13	234.52 ± 65.17	.82
PT (sec)	14.30 ± 0.79	14.22 ± 0.42	.52
APTT (sec)	32.18 ± 0.75	32.05 ± 0.23	.23
ESR mm/at 1st Hr	11.50 ± 8.38	6.61 ± 1.79	.001*

Table-I. Hematological parameters in smokers and non smokers

*Significant p value (≤ 0.05)

Hematological Parameters	Smoking history ≤10 years (n= 36) Mean ± SD	Smoking history >10 years (n= 24) Mean ± SD	P-Value
WBC (x10 ⁹ /L)	7.81 ± 1.42	8.60 ± 1.59	.04*
Neutrophils (%)	52.42 ± 10.68	57.17 ± 12.49	.12
Lymphocyte (%)	38.86 ± 10.36	34.42 ± 9.86	.10
Monocyte (%)	5.56 ± 2.08	5.92 ± 2.55	.55
Eosinophils (%)	3.19 ± 1.26	3.33 ± 1.34	.68
RBC (x10 ¹² /L)	5.15 ± 0.39	5.22 ± 0.45	.53
Hb (g/dL)	15.57 ± 0.85	15.54 ± 0.91	.90
HCT (%)	44.75 ± 4.53	43.00 ± 3.27	.10
MCV (fL)	90.69 ± 8.73	91.99 ± 9.48	.58
MCH (pg)	32.52 ± 2.85	31.65 ± 2.86	.25
MCHC (g/dL)	34.11 ± 2.86	34.58 ± 3.18	.55
Platelet count (x10 ⁹ /L)	244.50 ± 40.77	225.67 ± 58.65	.14
PT (sec)	14.14 ± 0.59	14.54 ± 0.98	.05*
APTT (sec)	32.08 ± 0.65	32.33 ± 0.87	.20
ESR mm/at 1st Hr	11.86 ± 8.40	10.95 ± 8.49	.68

Table-II. Comparison of hematological parameters between 2 groups of smokers

(more than 10 years and less than 10 years)

*Significant p value (≤ 0.05)

Our study confirmed that there is increased leukocytosis in smokers as compared to control groups (p-value 0.02). However, neutrophil count in smokers was lower (p value 0.001) and Lymphocyte count was higher (p-value 0.001) as compared to control group, while a similar study of Lymperaki et.al¹¹ illustrates a drift for granulocyte rise against lymphocytes in active smokers. Reports on different hematological investigations

associated to smoking are not constant. Aula and Qadir established significant rise in leukocytes, neutrophils, eosinophils, basophils, lymphocytes and monocytes in smokers relative to the control group of non-smokers.^{12,13} On the other hand, Kastelein et. al¹⁴ demonstrated no noteworthy difference in values of neutrophils in middle-aged smokers and non-smokers. Overall, all studies illustrates that there is a headstrong effect of

smoking on TLC. Chronic tissue damage may be a possible mechanism for the increased total leucocyte count in smokers.

We also considered Differential leucocyte counts important in smokers because the link of cigarette smoking with TLC has been established in various studies but its influence on the DLC is a matter of debate. Conferring to some investigators, effect of smoking on differential count is not constant and current smoking behavior has an influence on it. Some studies illustrate that neutrophil count increases and lymphocyte decreases, while few studies have shown that both these counts increase.^{13,15} Our findings discovered that the lymphocyte count increased from a mean value of 31.5% in non-smokers to 37.08% in smokers, which was found to be statistically highly significant (P-value 0.001) (Table-I). Amongst other parameters, neutrophil count was decreased in smokers than non-smokers and this difference was also highly significant (p-value 0.001). No significant change was observed in eosinophils, basophils and monocytes count.

In our study we observed that subjects having more than ten years of smoking history showed significantly raised TLC (P-value 0.02) (Table-II). This clearly shows that with subsequent increase in number and duration of smoking, the inflammatory impacts of smoking affect the human body and possibly may lead to irreparable alterations. Smoking has an irritant effect on the respiratory tract consequential of chronic inflammation.¹⁵ Increased WBC counts and altered WBC functions can result in direct damage to epithelial and endothelial surfaces and/or impact on increase in cytokine levels (especially IL-6) caused by products of cigarette smoke.¹³

Apart from TLC and DLC, Erythrocyte sedimentation rate is also a marker of inflammation. We also studied ESR in smokers and compared our data with control group. ESR remained highly significant in our study among smokers with P value 0.001 (Table-I). Our study also showed linear correlation of ESR with number of cigarettes per day, however we observed no

significant correlation of ESR with number of pack years (Table-II). These findings are similar as Islam et al. and Rashmi et al. which says ESR values show a highly significant rise ($P < 0.01$) in smokers as compared to non-smokers.¹⁶

In our study groups, we also observed a higher hemoglobin concentration and higher RBC counts in smokers than the control subjects. This observation is in consonance with previous studies.^{17,18} In our study we also detected that among smokers, the hemoglobin concentration and RBC count gets significantly high as the intensity of smoking increases. Whitehead et. al and ANANDHA et.¹⁹ Al, observed similar effects in their study that hemoglobin concentration and hematocrit were significantly increased in those smoking more than 10 cigarettes per day. Similarly, when we compared smokers and nonsmokers, MCV and MCH were raised significantly in smokers which is again in compliance with the literature.¹⁸ In contrary Asif et al.⁷ found rise in MCV and fall in MCH and MCHC levels in smokers as compared to controls in his research. Elevated levels of MCV in our study depicts that subject might suffer from megaloblastic, hemolytic, pernicious or macrocytic anemia which is typically caused by B12 or folic acid deficiency.⁷

Our study showed no substantial influence on platelets count which is also in compliance to the literature.²⁰ The present results were not in agreement with the findings identified by Ghahremanfard et al.,²⁰ who determined that, the mean platelet count was significantly raised in adult smokers than in adult non-smokers. A study done by Mustafa in 2018 and a study by Metta in 2015 revealed that smoking considerably reduced platelet count in chronic smokers.^{21,22} Concerning Prothrombin (PT) and Activated Partial Thromboplastin Time (APTT), our study revealed that, when compared to the non-smokers the mean PT was significantly lower in smokers having more than 10 years of smoking duration and with increasing the quantity of cigarettes per day (Table-II). The significant decrease in PT value was in conformity with the results acquired by Akpotuzor et al.²⁰, who stated that, smokers have considerably lower mean prothrombin time

(PT) values when compared to the control group. On the other hand, our study results regarding PT value were not in the agreement with the results of Al-Dahr study²⁰, and Metta S et.al²², which reported that no significant change in PT is found between two groups. Regarding the results of the APTT no statistically significant difference was found between smokers and non-smokers in our study which is consistent with previous literature.²⁰ In concordance to our study, literature shows that cigarette smokers have lower platelet counts and shorter PT values, as compared to non-smokers which possibly can lead to hypercoagulable state. This hypercoagulable state could possibly result in thrombosis later on. Cigarette smoke seems to play a momentous role in coagulation factors malfunction and literature shows that hemostasis can lead to reduced tissue factor pathway inhibitor expression and raised plasma fibrinogen levels compared to non-smokers.²³

CONCLUSION

It is concluded that smoking has adverse effects on the various hematological parameters like hemoglobin concentration, red blood cells count, hematocrit, WBC counts, neutrophil counts, mean corpuscular volume, ESR and prothrombin time. These changes have a greater risk for developing atherosclerosis, chronic obstructive pulmonary disease and/or cardiovascular diseases.

So, keeping all this in mind we suggest that physicians should evaluate their patients at each and every visit and strictly recommend them cessation of smoking by making them aware about hazardous effects of smoking on their health. Even though public awareness about harmful effects of smoking has been raised up substantially, still more struggle is needed on community level so that we could prevent our young generation from future ailments.

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