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A Comparative Study of Hematological Parameters among Current Smokers, Ex-Smokers and Non-Smokers

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Abstract

Context: Smoking continues to be the single most preventable source of health hazards. A detailed analysis of impact of duration of smoking, intensity of smoking on the hematological parameters in current smokers, ex-smokers and non smokers is lacking.

Aims: The objectives were to study the effect of smoking and its intensity on hematological parameters in chronic smokers and to compare it with that of in ex-smokers and non smokers.

Materials and Methods: Adult male chronic smokers and ex-smokers were interviewed about their smoking pattern and the results of their hematological parameters were collected. The results of the same hematological parameters from non smokers were also collected for comparison. The collected data were entered in excel and analyzed by statistical tests.

Results: Out of 133 participants, 47 were current smokers, 45 were ex-smokers, and 41 were non smokers. Majorities (59%) of the current smokers were from the age group 31-50 and ex-smokers (53%) were from the age group 51-70. Majority (81%) of the current smokers were smoking 1-10 cigarettes per day for duration of 16-30 years (62% of the smokers). On comparing the hematological parameters among current smokers, ex-smokers and non smokers, it was found that chronic smokers had statistically significant (P value < 0.05) elevated levels of MCH, MCHC, Neutrophils and Lymphocytes compared to that of non smokers.

Conclusion: Chronic smoking causes altered hematological parameters. Abnormal parameters in current smokers return to near normal after quitting smoking.

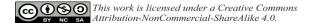**Keywords:** Smoking, Hematological Parameters; Current Smokers; Ex-Smokers; Non Smokers.

Introduction

Smoking continues to be the single most preventable cause of disease and death in both developing and developed nations [1]. Chronic smoking has been implicated as an etiological agent for various chronic diseases, including many infections, malignancies, cardiac and respiratory illnesses from various studies. Although some studies have analyzed the overall changes in hematological parameters in chronic smokers, a detailed analysis of impact of duration of smoking, intensity of smoking on the hematological parameters and the time duration by which these parameters can return to normal or near normal after cessation of smoking and the association between smoking habits and the leukocyte subpopulations is lacking. Hence this study was aimed to study the effect of chronic smoking and its intensity on haematological parameters of current smokers and to compare the variation in the hematological parameters in current smokers, ex-smokers and non-smokers.

Materials and Methods

The study design was cross sectional study. After obtaining the approval of Institutional Ethics committee, this study was done in adult male smokers visiting the Medicine, Pulmonary Medicine and Surgery departments of a tertiary care hospital. An informed consent was obtained from the participants to ensure the participation on a voluntary basis and the details of their age, number of years of smoking, type of tobacco product smoked, number of cigarettes/beedi smoked per day and duration of cessation of smoking in months and years were obtained.

The participants were categorized as:

Current smoker is someone who has smoked greater than 100 cigarettes in their lifetime and currently smokes at least monthly and has smoked in the last 28 days.

Ex-smoker is someone who has smoked greater than 100 cigarettes in their lifetime but has not smoked in the last 28 days.

Never smoker is someone who has not smoked greater than 100 cigarettes in their lifetime and does not currently smoke.

Since smoking is extremely rare in women in this region, women were excluded from the study.

The results of their hematological investigations were collected and an attempt was made to find the association of their smoking patterns with the hematological parameters like Hemoglobin, Red blood cell count, Hematocrit, Mean corpuscular volume, Mean corpuscular hemoglobin, Mean corpuscular hemoglobin concentration, Red cell distribution width, White blood cell count, Differential leukocyte percentages of neutrophils, eosinophils, basophils, lymphocytes and monocytes, Total platelet count, Mean platelet volume, Platelet distribution width, Plateletcrit.

Statistical analysis: Those continuous variables following normal distribution were summarized as Mean±SD and those following non normal distribution were summarized as median and inter quartile range. Categorical variables were summarized as percentage or ratio. Statistical test of significance of the hematological parameters between the three groups were done using ANOVA for the intergroup comparison. Statistical analysis was done using SPSS software version 24. p value of < 0.05 was considered statistically significant.

Results

A total of 133 patients, recruited for the study including 47 current smokers, 45 ex-smokers and 41 non smokers.

- On analyzing the age group wise distribution of study participants (Table 1), it was found that majority (59%) of the current smokers were from the age group 31-50. Among the ex-smokers, majority (53%) were from the age group 51-70. In case of non smokers, most of them (56%) were from the age group 18-40.

Table.1: Age group wise distribution of study participants

Age group (in years)	Current smokers Numbers (Percentage)	Ex smokers Numbers (Percentage)	Non smoker Numbers (Percentage)
18-30	3 (6.4)	2 (4.4)	10 (24.4)
31-40	10 (21.3)	11 (24.4)	13 (31.7)
41-50	18 (38.3)	5 (11.1)	5 (12.2)
51-60	8 (17.0)	13 (28.9)	8 (19.5)
61-70	6 (12.8)	11 (24.4)	4 (9.8)
>70	2 (4.2)	3 (6.7)	1 (2.4)
Total	47 (100)	45 (100)	41 (100)

- On analyzing the number of cigarettes smoked per day (Table 2), it was found that majority (81%) of the current smokers smoked 1-10 cigarettes per day. Similarly, among the ex-smokers, majority (80%) smoked 1-10 cigarettes per day.

Table 2: Number of cigarettes smoked by the current smokers and ex-smokers per day

Number of cigarettes smoked per day	Current smokers Numbers (Percentage)	Ex smokers Numbers (Percentage)
1-5	15 (31.9)	19 (42.2)
6-10	23 (48.9)	17 (37.8)
11-15	2 (4.3)	1 (2.2)
16-20	6 (12.8)	5 (11.1)
21-30	1 (2.1)	0 (0)
>30	0 (0)	3 (6.7)
Total	47 (100)	45 (100)

- On analyzing the duration of smoking (Table 3), it was found that among current smokers, 36% smoked cigarettes for about 16-20 years and 26% smoked for about 26-30 years. Among the ex-smokers, about 42% smoked cigarettes for about 1-10 years and 33% smoked for about 11-20 years.

Table 3: Number of years of smoking in Current smokers and ex-smokers

Number of years of smoking	Current smokers Numbers (Percentage)	Ex smokers Numbers (Percentage)
1-5	2 (4.3)	12 (26.7)
6-10	9 (19.1)	7 (15.5)
11-15	5 (10.6)	7 (15.5)
16-20	17 (36.2)	8 (17.8)
21-25	1 (2.1)	3 (6.7)
26-30	12 (25.5)	3 (6.7)
>30	1 (2.1)	5 (11.1)
Total	47 (100)	45 (100)

- On analyzing the duration of cessation of smoking in ex-smokers (Table 4), it was found that 35% had quit smoking about <1 year ago and 53% had quit smoking about 2-10 years ago.

Table 4: Duration of cessation of cigarette smoking in ex-smokers

Sl.No.	Duration of cessation	Numbers (Percentage)
1	< 6 months	10 (22.2)
2	6 months – 1 year	6 (13.3)
3	1 – 2 years	2 (4.4)
4	2-5 years	14 (31.1)
5	6-10 years	10 (22.2)
6	11-15 years	1 (2.2)
7	16-20 years	1 (2.2)
8	>20 years	1 (2.2)
	Total	45 (100)

- On comparing the hematological parameters among current smokers, ex-smokers and non smokers (Table 5), it was found that chronic smokers have statistically significant elevated levels of MCH, MCHC, Neutrophils and Lymphocytes compared to non smokers.

Table 5: Correlation of hematological parameters in Current smokers, ex-smokers and non smokers

Sl. No.	Parameter	Current smoker (0) N=47	Ex smoker (1) N=45	Non smoker (2) N=41	p Value
1	Age	47 (24, 74)	55 (23, 75)	40 (18, 89)	0.003
2	Number of years of smoking	20 (0.5, 40)	15 (1, 50)	NA	< 0.001
3	Number of cigarettes per day	10 (0, 30)	10 (2, 50)	NA	< 0.001
4	Duration of cessation (in Months)	NA	60 (2, 360)	NA	< 0.001
5	Hemoglobin	13±2.01	12.64±1.95	12.43±1.37	0.33
6	RBC	4.1 (3, 5.1)	4.1 (3.1, 6.7)	4 (3.4, 5.5)	0.89
7	Hematocrit	38.06±5.25	38.14±5.76	37.47± 4.15	0.81
8	MCV	92.31±8.61	89.98±7.68	90.6±8.82	0.39
9	MCH	31.75±4.99	29.81±2.8	30.15±3.73	0.04
10	MCHC	34.2 (24.3, 51.6)	33.3 (26.3, 37.4)	32.6 (28.6, 43.3)	0.06
11	RDW	14 (11.7, 24)	14.7 (12.4, 25.1)	14.4 (12.7, 20.5)	0.12
12	TLC	8838.34±2182.02	9004.44±1866.69	8434.15±1677.59	0.38
13	Neutrophils	65 (41, 84)	62 (50,86)	62 (49,82)	0.022
14	Eosinophils	3 (1, 11)	3 (1, 12)	3 (1, 17)	0.59
15	Basophils	0	0 (0, 1)	0	0.38
16	Monocytes	5 (2, 18)	6 (1, 12)	6 (2, 13)	0.52
17	Lymphocytes	29.04±7.84	27.36±7.83	23.22±6.33	0.001
18	Platelets	2.79 (1.28,4.06)	2.96 (1.49, 6.45)	2.88 (1.67, 4.97)	0.3
19	PCT	0.25±0.07	0.25±0.06	0.27±0.07	0.334
20	MPV	8.87±0.97	8.52±0.74	8.78±0.76	0.125
21	PDW	14.9±1.85	15.51±2.07	15.16±1.59	0.29

Discussion

Smoking causes very serious health hazards. It is implicated in the causation of benign conditions like peptic ulcer [2,3] chronic obstructive pulmonary diseases like chronic bronchitis and emphysema, acceleration of atherosclerosis and thus causing ischemic heart diseases resulting in morbidity and mortality and proved causal association of various malignancies of upper aero-digestive tract, genitourinary tract, breast and pancreas [4].

Previous studies in the literature on hematological parameters in smokers and non smokers have demonstrated contradictory findings. Abdulnabi et al. [5], Asif et al. [6], Inal et al. [7] and Nadia et al. [8] have shown an increase in Hemoglobin, WBC count, Hematocrit, Lymphocyte count and RBC indices and decrease in Monocyte count, Basophil count and Platelet count in their studies. But, Ahmed et al. [9] and Aftab et al. [10] showed increase in Platelet count in smokers when compared to non smokers. Similarly some studies differed in the value of Monocyte count in smokers and Non smokers. Asif et al. [6] and Aula and Qadir et al. [11] have shown an increase in Monocyte count whereas, Rawat et al. [12] has shown a decrease in Monocyte count in smokers. On contrary to the above studies, Iqbal et al. [13] and Al-Taee et al. [14] demonstrated a decrease in RBC count and Hemoglobin in smokers when compared to non smokers. Ahmed et al. [9], Al-Taee et al. [14], Lakshmi et al. [1] and Aula and Qadir et al. [11] have shown increase in Neutrophil count in smokers. But, Sunil et al. [15] and Asif et al. [6] have shown decrease in Neutrophil count in smokers. Likewise, Sunil et al. [15] Asif et al. [9] and Aula and Qadir et al. [14] have demonstrated increase in Lymphocyte count, whereas, Ahmed et al. [9] and Al-Taee et al. [14] have shown decrease in Lymphocyte count in smokers. In our study we found that chronic smokers have statistically significant elevated levels of MCH, MCHC, Neutrophils and Lymphocytes compared to non smokers.

Abdulnabi et al. [5] in their study found that increased level of Hemoglobin, Hematocrit, RBC and WBC. They have examined 30 smokers and 30 non smokers between the 25-40 age groups. But in our study the sample size is more and we had representation from all age group. The increase in lymphocytes in smokers is mainly the T cell population. Smoking causes increased Nicotine level in the blood which is responsible for the elevated cortisol levels which in turn causes the change in the both the count and functions of the lymphocytes. Further other components in the cigarette smoke causes increased level of cytokine release like IL – 6 from damaged endothelium which further aggravates the function of WBCs [16]. Increase in the duration of smoking aggravates the changes in the hematological parameters in the smokers [17].

Some studies have found that if a chronic smoker quits smoking, the blood parameters return to normal after sometime [18,19]. But for some time chronic smokers and ex-smokers have most parameters in the similar range. This may be due to the fact that some of the ex-smokers, who were once chronic smokers, have a very short duration of cessation of smoking. But as per definition of the selection criteria, we have included them also under ex-smoker category.

Pattern of cigarette smoking and age of the individual also play a role in the changing of the hematological parameters. Smoking can alter the hemoglobin value because of some compensatory mechanism, but in some smokers, tolerance potential of the individual may mask these changes.

Smoking can cause altered endothelial function and the altered endothelium release many molecules in the circulation. These markers can predict as a marker of cardiovascular disease. But the technical feasibility and financial constraints make this procedure more difficult [20].

In these circumstances, increased WBC counts can serve as a least expensive and most easily available biomarker in the smokers to detect the endothelial damage. But other confounding factors like co existing infection and other illness has to be ruled out carefully before taking this into consideration.

Increased level of hemoglobin and hematocrit in the chronic smokers can increase the blood viscosity and can cause stasis of blood. Further increased fibrinogen levels in smokers, with platelet dysfunction and endothelial injury by chronic smoking can aggravate the chance for thrombus formation [21-23].

Some of our study participants had very chronic history of smoking from the childhood and even few had history of smoking for about 40 to 50 years. Hence these findings further emphasize the need for creating the awareness about the health hazards of smoking in the younger generation to prevent the emergence of this serious addictive behavior.

Conclusion

Chronic smoking causes altered hematological parameters. In our study we found that chronic smokers have statistically significant elevated levels of MCH, MCHC, Neutrophils and Lymphocytes compared to that of non smokers. Even in the ex-smokers, though not comparable to as that of current smokers, similar elevations were observed. In this study awareness was created among the smokers, especially in the younger generation about the various hazards of smoking and many smokers agreed and pledged to quit smoking which was a very positive sign of success of this study. In future it was intended to follow up these patients to re interview and reemphasize them the hazards of smoking.

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Conflicting Interest

(If present, give more details): Nil

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Key Messages: Though tobacco has been implicated as an etiological agent for various chronic diseases, including many infections, malignancies, cardiac and respiratory illnesses, and its acute and chronic impact on hematological parameters has been less explored. Studying the haematological parameters in current smokers and comparing it with ex-smokers and non smokers gave us an idea about when the abnormal parameters in current smokers return to near normal after quitting smoking. By creating awareness about the ill effects of smoking in chronic smokers, we did an earliest intervention of cessation of smoking in many study participants which can reverse some of the ill effects, thus preventing future serious health hazards.

Abbreviation:

RBC – Red Blood Cell count,

MCV – Mean Corpuscular Volume

MCH – Mean Corpuscular Hemoglobin,

MCHC – Mean Corpuscular Hemoglobin

Concentration,

RDW – Red cell Distribution Width,

TLC – Total Leucocyte Count,

PCT – Plateletcrit,

MPV – Mean Platelet Volume,

PDW – Platelet Distribution Width

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