



## Hematological Changes Induced by Cigarette Smoking

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### Abstract

**Introduction:** Smoking is an important preventable cause of mortality worldwide. The prevalence of pulmonary and cardiovascular disease, cataracts and some cancers is higher in smokers than in non smokers. About 1.3 billion people are regular smokers worldwide and every day 8,000 to 10,000 young people start to smoke, risking rapid addiction to nicotine. The aim of this study was to examine haematological changes associated with smoking to create awareness in public and plan launching anti-smoking campaigns.

**Materials and Methods:** A total of 80 healthy volunteer male subjects out of which 40 smokers and 40 non-smokers; The smokers with the history of smoking for at least five years having age's between 20-60 years, coming to SGT Medical College. A careful history and medical examination was done. The subjects practicing vigorous exercise and those working in such industries or in atmosphere where the chance of dust and fumes present were excluded from the study. All the selected subjects fulfilled the criteria of no respiratory tract infection during previous 3 months and were quite healthy at the time of test. They were asked about the number of cigarettes smoked per day and duration. After taking sample, Hemoglobin (Hb), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC), WBC count, RBC count and platelet count levels were determined by Sysmex XN-550 blood cell counter.

**Results:** The highest percentage of smokers on basis of number of cigarettes smoked per day were 45% (1-5 cigarettes/day) and showed a significant increased in Hb, PCV, MCV, MCHC and blood cell counts in smokers as compared to non smokers but no significance difference related to number of cigarettes smoked per day.

**Conclusion:** The present study confirms the results from previous studies, which also highlighted the destructive and oxidative effects of cigarette smoke and its harmful effects on smokers and non-smokers alike.

### Introduction

Smoking is an important preventable cause of mortality worldwide. The prevalence of

pulmonary and cardiovascular disease, cataracts and some cancers is higher in smokers than in non smokers.<sup>[1-5]</sup> About 1.3 billion people are regular

smokers worldwide and every day 8,000 to 10,000 young people start to smoke, risking rapid addiction to nicotine.<sup>[6]</sup>

It is manner in which tobacco is burnt and smoke is inhaled by different ways i.e cigarette, cigar, beedi and pipe. It is complex external and internal stimulus consisting of visual, tactile, mechanical (mouth movement, gustatory, olfactory and irritating factor).<sup>[7]</sup> The inhaled smoke contains many harmful substances such as CO<sub>2</sub>, hydrogen cyanide, heavy metals and free radicals.<sup>[8]</sup> These free radicals in tobacco smoke bind with cholesterol to damage the blood vessels and heart muscle (also a major cause of heart disease)<sup>[9]</sup> The damaged caused by cigarette smoking is influenced by the number of cigarettes smoked, duration of smoking, how the tobacco is prepared and cigar filter.<sup>[10]</sup>

In healthy persons, however, cigarette smoking causes an increase in Hb levels, probably mediated by exposure to carbon monoxide (CO), which lead to shift to the left of the dissociation curve, resulting in a reduction in the ability of Hb to deliver oxygen to the tissues. To compensate for this decreases oxygen delivery, smokers maintain a higher Hb level than non smokers.<sup>[11]</sup> The number of RBCs also do not remain unaffected by smoking over prolonged periods, however, changes in the number and duration of smoking can alter its count.<sup>[12]</sup>

The aim of this study was to examine haematological changes associated with smoking

to create awareness in public and plan launching anti-smoking campaigns.

### Methods

A total of 80 healthy volunteer male subjects out of which 40 smokers and 40 non- smokers; The smokers with the history of smoking for at least five years having age's between 20-60 years, coming to SGT Medical College & Hospital Gurugram during the period 01<sup>st</sup> Oct to 31<sup>st</sup> Dec 2017. A careful history and medical examination was done. The subjects practicing vigorous exercise and those working in such industries or in atmosphere where the chance of dust and fumes present were excluded from the study. All the selected subjects fulfilled the criteria of no respiratory tract infection during previous 3 months and were quite healthy at the time of test. They were asked about the number of cigarettes smoked per day and duration. After taking sample 2.5 ml venous K2-EDTA blood was collected from each subject. Hemoglobin (Hb), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC), WBC count, RBC count and platelet count levels were determined by Sysmex XN-550 blood cell counter. The data were analyzed by using SSPS (version 20), < 0.05 considered as significant level.

### Results

Results were displayed as tables

**Table 1:** The frequency and percentage of smokers on basis of number of cigarettes smoked per day.

Number of cigarettes/day	Frequency	Percentage %
1 – 5 cigarettes	18	45.0
6 – 10 cigarettes	13	32.5
11 – 15 cigarettes	6	15.0
15 – 20 cigarettes	3	7.5
Total	40	100

**Table 2** Show a significance increased in Hb, PCV, MCV, MCHC and blood cell counts in smokers as compared to non smokers (Age wise changes show no significance difference).

Hematological values	Smokers	Non - Smokers	P – value
Haemoglobin g/dl	16.70 ± 1.93	13.1 ± 1.0	0.001
PCV %	49.67 ± 3.31	40.2 ± 2.1	0.001
RBC x 10 <sup>21</sup> /L	6.01 ± 2.13	5.1 ± 0.4	0.008
MCV /fl	87.14 ± 12.23	86.5 ± 4.5	0.756
MCH /pg	30.13 ± 4.14	28.1 ± 1.15	0.001
MCHC g/dl	34.02 ± 1.43	32.0 ± 1.0	0.004
TWBC x 10 <sup>9</sup> /L	10.10 ± 4.3	5.8 ± 0.8	0.001
Platelets x 10 <sup>9</sup> /L	241.52 ± 44.34	231.4 ± 52.1	0.334

**Table 3:** Hb levels, RBC, WBC and platelet counts show no significance differences related to number of cigarettes smoked per day.

Number of cigarettes/day	Frequency	Haemoglobin g/dl (mean)	RBC x 10 <sup>21</sup> /L (mean)	TWBC x 10 <sup>9</sup> / L (mean)
1 – 5 cigarettes	18	16.7 ± 1.5	6.2 ± 0.24	10.1 ± 1.87
6 – 10 cigarettes	13	16.1 ± 1.4	6.1 ± 0.34	10.0 ± 1.6
11 – 15 cigarettes	6	17.1 ± 1.2	6.4 ± 0.23	10.9 ± 1.31
15 – 20 cigarettes	3	17.9 ± 1.1	6.5 ± 0.1	10.5 ± 2.47

## Discussion

Cigarette smoke has 4000 harmful substances among which CO and tars are the main toxic substances. CO can diffuse rapidly across alveolar capillaries, bind firmly to Hb (with binding ability of 200-250 times greater than that of O<sub>2</sub>) forming HbCO which causes tissue hypoxia leading to increased values of RBC count, Hb and PCV.<sup>[13]</sup>

In present study cigarette smoking revealed adverse effects on blood cell counts, including (Hb, PCV, MCH and MCHC, red cell count, white blood cells count). There is significant increased in Hb, PCV, MCH and MCHC values of smokers in relation to non smokers but MCV and platelet count did not show significant differences. Similar results were obtained by *Kondo et al* (1993).<sup>[14]</sup>

The higher values of PCV as observed by our study are favoured by other studies also Two recent studies in 2012 and 2013 in Saudi Arabia and India respectively also found the similar rise in hematocrit in the smokers.<sup>[15,16]</sup>

Salamzada et al in his cross sectional study done in Iran also favours our study as he found higher values of RBC count and Hb. He also favors our study by observing no difference in MCV in two groups of smokers and non- smokers. On the other

hand, observed lower values of MCH and MCHC while our study shows higher value of MCH and MCHC. The differences detected between peripheral blood leucocytes and erythrocytes composition of smokers and non- smokers may be reflections of the gaseous and solid phases of cigarette smoke, toxic product effects on the bone marrow as well as the adaptive, defensive and immunologic reactions of the body to long-term active smoking.<sup>[17]</sup>

The study showed significant increase in white blood cell count and insignificant difference in platelet count in comparison between smokers and non- smokers, which is consistent with Butkiewicz et al.<sup>[18]</sup> We observed that full blood count is highly recommended for heavy smokers to monitor adverse effects of cigarette smoking considered as risk factors leading to secondary polycythemia, pulmonary or cardiovascular disease.

## Conclusion

The present study confirms the results from previous studies, which also highlighted the destructive and oxidative effects of cigarette smoke and its harmful effects on smokers and non- smokers alike.

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