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Effects of Tobacco Smoking on Haematological Parameters: Haemoglobin and White Blood Cells

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Abstract

Background: It is very well established that tobacco smoking is one of the risk factors for various diseases like stroke, cardiovascular diseases, chronic obstructive pulmonary disease (COPD) and various types of cancers. Alterations in haematological parameters may be one of the causes for these diseases. *Aim:* The present study was undertaken to evaluate the relationship between tobacco smoking and haematological parameters like haemoglobin levels and levels of white blood cells. *Materials and Methods:* The study recruited a total of 60 adult men of whom 30 were chronic smokers and the other 30 were non-smokers. Blood sample drawn from each of these subjects was assessed for the following parameters: Haemoglobin (Hb) levels, total leucocyte count (TLC), differential count (DC) of neutrophils, eosinophils, lymphocytes and monocytes. The smoking status was confirmed by measuring serum cotinine levels of the subjects. *Statistical analysis:* The values were compared between smokers and non-smokers using unpaired student's t test. *Results:* There was a statistically significant increase in Hb levels (15.42±1.24 vs 14.40 ±1.10), DC of eosinophils (6.781±5.02 vs 4.47±3.64) and absolute eosinophil count (519.06±217.25 vs 346.56±104.42) among smokers when compared to non-smokers. Also increase in TLC, DC of neutrophils and decrease in DC of lymphocytes and monocytes were found which were statistically not significant. *Conclusion:* Hence it can be concluded that tobacco smoking leads to alterations in haematological parameters and may be responsible for development of certain diseases and smoking cessation programmes should be integrated with basic health care system.

Keywords: Tobacco Smoking; Haemoglobib (Hb); White Blood Cells (WBCs).

Introduction

Tobacco use is the leading preventable cause of death accounting for more than 5 million annual deaths worldwide. The annual tobacco attributable death is expected to reach 8 million by 2030. Whereas in India a recent study on mortality associated with smoking, estimated that about 9 million people die due to smoking. Further for every ten deaths in adults, one death in India is related to smoking [1]. The morbidity associated with smoking is enormous. It is very well established that smoking is one of the risk factors for various diseases like stroke, chronic obstructive pulmonary disease (COPD), cardiovascular diseases such as hypertension and myocardial infarction, peripheral vascular disease,cancers of several organs, osteoporosis, and susceptibility to different types of infections [2]. Though mechanisms have been hypothesized in each of these diseases, alterations in haematological parameters may be responsible for development of certain diseases, especially occlusive vascular diseases. Many of the haematological reference values are significantly affected by both active and passive smoking [3,4].

With this background, the present study was planned to evaluate the relationship between tobacco smoking and haematological parameters like haemoglobin (Hb) and white blood cells.

Materials and Methods

Following institutional ethics committee and research committee approvals, a total of 60 adult men in the age group of 30-50 years with 30 men being chronic smokers (defined as those with a history of minimum 20 pack years of smoking, study group) and other 30 being never smokers (controls) were recruited.A detailed history regarding current smoking status, number of cigarettes smoked per day and years of smoking was obtained by using a pre tested questionnaire.

Inclusion and Exclusion Criteria

Study group: This group consisted of 30 willing men of the age group of 30-50 years with a history of minimum 20 pack years of cigarette or beedi smoking [5]. A pack year is given by the formula ([number of cigarettes or beedis smoked per day X number of years]÷20)[6].To confirm smoking status, serum cotinine levels of all subjects were measured using the Qualisa ELISA kits and a value of more than 12.5 ng/ml was taken as cut off [7]. All men who were on medication or suffered from any ailment at the time of study including diabetes mellitus, COPD and hypertension were excluded.

Control group: Non-smoking men in the age group of 30 to 50 years, with no history of past or present tobacco use, not on any medication, not suffering from any disease at the time of study. The non-smoking status was confirmed by serum cotinine levels<12.5 ng/ml.

Collection of Blood Sample

Under aseptic precautions, 3 ml blood was drawn from antecubital vein and collected in EDTA bottles and sent for evaluation immediately. The serum cotinine, total leucocyte count (TLC), differential counts (DC) of neutrophils, lymphocytes, eosinophils and monocytes and haemoglobin (Hb) levels were measured on each of the samples drawn. Haemoglobin levels were estimated using automated haematology cell counter. The TLC and DC were done using automated analyser (Mindray BC 5300 5 parts differential analyser).

Statistical Analysis

The data collected was recorded using MS- Excel 2007 (Microsoft Corporation, Redmond, WA). The mean and standard deviation were calculated, the unpaired student's t test was performed to compare the means between cases and controls. A p value ≤ 0.05 was considered significant. All statistical analysis were performed with the help of SPSS (Statistical Package for Social Sciences) version 20.0 (IBM Corp., Armonk, NY).

Results

The mean age of the study group was 39.2 (± 8.2) years. The mean height was 164.7 (± 7.23) cm. The mean weight was 55.76 (±9.5) kilograms. It was observed that there was a statistically significant increase in Hb levels among chronic smokers when compared to non-smokers. (Table 1, Figure 1)

The DC of eosinophils and absolute eosinophil count were increased among smokers which were statistically significant (Table 1, Figure 2, Figure 3).

Total leucocyte count and neutrophil count were increased but were not statistically significant. Also lymphocyte count and monocyte count were decreased, but were not statistically significant (Table 1).

Table 1: Effect of tobacco smoking on Hb, DC of eosinophils, absolute eosinophil count, total leucocyte count and DC of neutrophils, lymphocytes and monocytes

Parameters	Smokers Mean ± SD	Non smokers Mean ± SD	p value
Haemoglobin in g%	15.42±1.24	14.40±1.10	0.001
DC of eosinophils in %	6.781±5.02	4.47±3.64	0.018
Absolute eosinophil count	519.06±217.25	346.56±104.42	0.012
Total leucocyte count	8234.37± 2688.52	7693.75± 1651.57	0.17
DC of neutrophils in %	58.06± 8.27	55.75± 8.79	0.14
DC of lymphocytes in %	33.22± 6.83	34± 6.1	0.32
DC of monocytes in %	3.5± 1.74	4± 1.4	0.10

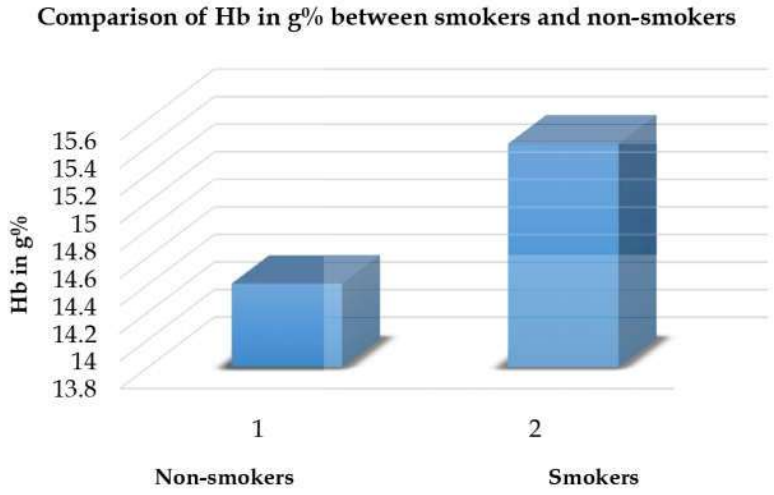

Fig. 1: Comparison of haemoglobin (Hb) levels between smokers and non-smokers

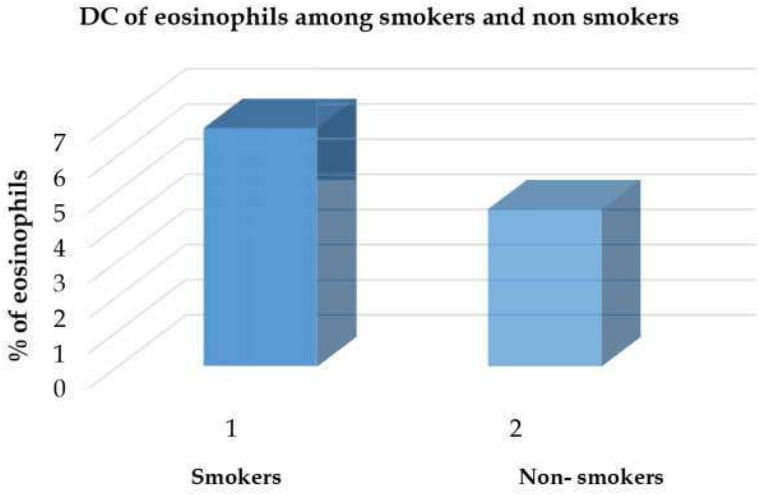

Fig. 2: DC of eosinophils among smokers and non smokers

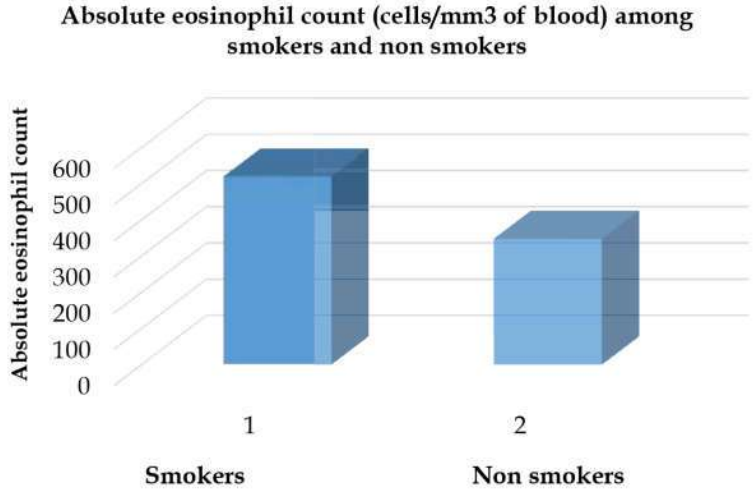

Fig. 3: Absolute eosinophil count (cells /mm^3 of blood) among smokers and non smokers

Discussion

Tobacco smoking has long been implicated as a factor responsible for various changes in haematological parameters. The present study was conducted to assess the effect of smoking on haematological parameters like Hb and white blood cells. Haemoglobin levels are affected by various factors. In our study we found an increase in haemoglobin levels among smokers when compared to non-smokers. Tobacco smoke contains various components which are detrimental to health. These include tar, nicotine, ammonia, carbon monoxide (CO), carbon dioxide, acrolein, formaldehyde, hydroxyquinone, acetone and cadmium [8]. Carbon monoxide present in tobacco smoke has very high affinity for Hb (nearly 200 times) as compared to that of oxygen and hence combines more readily with haemoglobin than oxygen to form carboxyhaemoglobin [9]. The reduced oxygen in blood causes increased production of red blood cells and also haemoglobin. This upward shift in haemoglobin distribution curve caused due to smoking will reduce the utility of haemoglobin level to detect anaemia and will have a masking effect on detection of anaemia [10]

The differential count of eosinophils and absolute eosinophil count were found to be significantly increased among smokers. This is in accordance with studies by Taylor et al. [11] and Halonen et al [12]. Van der Lende et al. [13] showed that eosinophilia, considered as a marker of allergy, was related to lower level of FEV1 (forced expiratory volume in first second). One of the studies considers eosinophilia as a risk factor for chronic airflow limitation among adults [14]. These findings suggest that chronic smokers are at an increased risk of developing compromised lung function status and airway diseases.

In the present study we also found an increase in total leucocyte count and differential count of neutrophils which were not statistically significant. The most probable reasons could be nicotine induced catecholamine release, inflammation of bronchioles and chronic tissue damage [15,16]. Lymphocyte count and monocyte count were found to be decreased (not significant). Decrease in lymphocyte count may be due to rise in neutrophil count.

In a study by Ernst et al. [17], a correlation was found between altered WBC count and the risk of myocardial infarction and stroke. The rheologic properties of blood are affected by WBCs. They participate in endothelial injury by adhering to the endothelium and damaging it with toxic oxygen compounds and proteolytic enzymes. All these changes in haematological parameters may be due to the toxic effects of solid and gaseous phases of tobacco smoke on the bone marrow as well as adaptive and immunologic reactions of body to long term active smoking [9]. These findings further emphasize the need to integrate effective smoking cessation interventions into basic health care system and to control second hand tobacco smoke exposure.

Conclusion

In the present study, chronic smokers were found to have higher Hb levels and eosinophil counts when compared to non-smokers. Though there were differences in other parameters like total leucocyte count, DC of neutrophils and lymphocytes, they were statistically insignificant. A larger study is advisable to confirm findings and also to correlate these findings with lung function status and serum cotinine status.

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