**Original Research Article**

# Comparative study of hematological profile among smokers and non-smokers in rural part of South India

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## Abstract

**Background:** Tobacco cigarette smoking is one of the major leading causes of death throughout the world. Smoking has both acute and chronic effect on hematological parameters. The aim of the present study was to assess the extent of adverse effects of cigarette smoking on biochemical characteristics in healthy smokers.
**Materials and methods:** Totally 68 subjects were included in the study. 34 current smokers who came from in and around Chidambaram to the RMMC and Hospital who fulfilled the inclusion criteria were selected as an experimental group. Another 34 non-smokers of the same age group were included separately in this study as a control group. So a total of 68 respondents were contacted for the study. The primary data were collected for 6 months in the year 2017. Hematological parameters were analyzed using standard methods.
**Results:** The mean Hb level in smokers was less than that of the nonsmokers and it was significant at 5% level ($p<0.05$). Regarding the differential, count means eosinophil and polymorph values were high in the smokers but the lymphocyte value was less in smokers and these changes were significant at 1% level ($p<0.01$). The WBC-Total count and the ESR value changes were nonsignificant.
**Conclusion:** Effects of smoking on alterations of the hemostatic and fibrinolytic system, antioxidant status and hematology parameters were extensively studied, but the studies presented inconsistent results. The present study was conducted to compare the effect of cigarette smoking on some hematological parameters between smokers and age-matched non-smoker controls.

**Key words**

Nicotine, Hematological Parameters, Hemoglobin, Total Cell Count.

## Introduction

Smoking is the most important public health problem. Many studies conducted have proved its deleterious effects on many organ systems mainly respiratory, reticuloendothelial system and cardiovascular systems [1]. According to data reported from the World Health Organization 2, there are about 2.4 billion people worldwide that have consumed tobacco in the forms of smoking, chewing, snuffing or dipping. WHO also estimates that tobacco-related deaths will amount to 8.3 million in2030 and one billion deaths during the 21$^{st}$ century [2]. It has been estimated that an average of 7 minutes of life is lost for each cigarette smoked, roughly the time taken to smoke it [3]. A person who begins smoking at the age of 15 years has an average of 8 years of reduced longevity, and one starting after 25 years of age faces an average 4-year reduction. Coronary heart disease, cancer, and various respiratory diseases account for the majority of excess mortality related to cigarette smoking [4]. Smokers average a 16 fold increased the risk of acquiring lung cancer; a 12 fold increased the risk of acquiring COPD and a two-fold increased risk of having a myocardial infarction as compared to non-smokers. Since early 1950, several studies have shown a direct relation between smoking, hematological parameters, peripheral vascular disease, and stroke [5]. The link between smoking and pulmonary diseases was first recognized in the 1870's but it was not until 1964 that the US Surgeon General's report warned of a potential relationship between smoking and emphysema [6]. Heavy smoking is the commonest cause of ischemic heart disease and death in 30-40 years of the age group who are likely to be free from other myocardial risk factors. Alterations in the hematological parameters may be responsible for the high risk of occlusive vascular disease in chronic smokers [7]. Chronic smoking seems to cause an upward shift of hemoglobin dissociation curve, which may decrease the utility of hemoglobin levels in the detection of anemia in smokers, suggesting that hemoglobin cut-off values should be adjusted for smokers to compensate for masking the effect of smoking on detection of anemia [8].

## Materials and methods

Totally 68 subjects were included in the study. 34 current smokers who came from in and around Chidambaram to the RMMC and Hospital who fulfilled the inclusion criteria were selected as an experimental group. Another 34 non-smokers of the same age group were included separately in this study as a control group. So a total of 68 respondents were contacted for the study. The primary data were collected for 6 months in the year 2017. Hematological parameters were analyzed using standard methods.

### Method of sample selection

Obviously, the sample did not include female smokers or children which are uncommon in this part of the country and hence it was not included in the sample size. The selected sample size is justified by their habit of smoking and full cooperation in the survey.

The test and the control group were assessed for their general health including height, weight, to be normal. Blood samples were collected. Hematological Investigations-Sysmex Auto Analyzer.It is an advanced model of electronic counter Sysmex- 1000. The analysis was done in the 24 hours clinical laboratory of Rajah Muthiah Medical College Hospital. The instrument is fully automatic and analyses hematological values by using a combination of hydraulic unit and pneumatic unit.

### Inclusion criteria

- Smokers of the age group above 20.
- Smokers of shorter as well as longer duration (chronic smokers).

- Smokers with smoking-related bronchitis.

**Exclusion criteria**

- Smokers of the age group less than 20 and more than 50.
- Smokers with major respiratory problems except for smoking-related bronchitis.
- Smokers with cardiac problems.

For categorical variable chi-square test was used. P value of < 0.05 was considered as statistically significant.

## Results

The comparison between smokers and nonsmokers in relation to hematological variables was as per **Table - 1**. The mean Hb level in smokers was less than that of the nonsmokers and it was significant at 5% level ($p<0.05$). Regarding the differential, count means eosinophil and polymorph values were high in the smokers but the lymphocyte value was less in smokers and these changes were significant at 1% level ($p<0.01$). The WBC-Total count and the ESR value changes were nonsignificant.

**Table – 1:** Comparison between smokers and non-smokers in relation to hematological variables.

| **Hematological Variables** | **Smokers (Experiment Group) N=34** | | **Non-smokers (Control Group) N=34** | | **Mean Diff** | **t value** | **P-value** |
|---|---|---|---|---|---|---|---|
| **Mean** | **SD** | **Mean** | **SD** | | | | |
| HB (gins %) | 11.06 | 1.07 | 11.56 | 1.16 | -0.5 | 11.87 | 0.02* |
| TC (Per c. mm) | 8282.35 | 2617.71 | 8817.65 | 1475.96 | -535.3 | 7.55 | **0.67 NS** |
| Polymorph (%) | 56.94 | 7.77 | 56 | 7.77 | 0.94 | 9.25 | 0.00** |
| Lymphocyte (%) | 37.68 | 7.76 | 38.12 | 8.82 | -0.44 | 9.64 | 0.00** |
| Easinophil (%) | 5.44 | 3.36 | 4.12 | 2.61 | 1.32 | 15.94 | 0.00 |
| ESR-30 mm | 7.12 | 5.84 | 4.03 | 1.66 | 3.09 | 12.57 | 0.08 |
| ESR-l hr | 14.03 | 10.83 | 8.76 | 3.23 | 5.27 | 10.82 | 0.25 |

(*significant at 5% level, **significant at 1% level, NS-Non significant)

## Discussion

Nowadays there is increasing evidence that apart from the known risk factors as cigarette smoking, diabetes & hypertension, inflammation also plays an important role in the progression of coronary heart disease [9]. Elevated WBC counts as observed in smokers along with high C reactive proteins are associated with an increased incidence as well as mortality from coronary heart disease. Some studies have shown that neutrophil count rises and lymphocyte count shows a decrease, while few studies have shown that both theses counts are increased [10]. Hence, in our study, the subjects chosen were all active smokers and casual blood samples were taken i.e. the subjects were not asked to smoke cigarettes or abstain from smoking prior to tests. Our findings reveal that the lymphocyte count increases from a mean value of 32.4% in non-smokers to 38.3% in smokers, which is found to be statistically significant [11]. Increase in hemoglobin concentration is believed to be mediated by exposure of carbon monoxide and some scientists suggested that an increase in hemoglobin level in blood of smokers could be a compensatory mechanism [12]. Carbon monoxide binds to Hb to form carboxyhemoglobin, an inactive form of hemoglobin having no oxygen carrying capacity. Carboxyhemoglobin also shifts the Hb dissociation curve in the left side, resulting in a reduction in the ability of Hb to deliver oxygen to the tissue [13]. To compensate for the decreased oxygen delivering capacity, smokers maintain a higher hemoglobin level than a non-smoker. In a study made by Salamzadeh, et al. the hematocrit and Hb level were significantly higher in smokers and among the smokers, the RBC count was significantly increased as the intensity of smoking increases. Whitehead et al.

in their study observed that hemoglobin concentration and hematocrit were significantly increased in those smoking more than 10 cigarettes per day. Increased number of erythrocytes and values of hematocrit in male smokers can be explained by the fact that tissue hypoxia caused by the increased creation of carboxyhemoglobin leads to an increased secretion of erythropoietin, thus increasing erythropoiesis [14]. Carbon monoxide from the tobacco smoke also leads to an increase in permeability of the capillaries which decreases the volume of plasma, which finally mimics the condition of polycythemia, characterized by an increased share of the erythrocytes in the blood volume, which is reflected also through increased values of hematocrit. Verma RJ, et al. demonstrated in their study that the current smokers had as much as 30% higher leukocyte counts in their peripheral blood than nonsmokers, and the increases had been reported in polymorphs nuclear leukocytes, which appear to have normal chemotactic, microbicidal, and secretory function [15].

## Conclusion

From the present study, we can conclude that continuous cigarette smoking increases erythrocyte count, hemoglobin concentration, hematocrit, leukocyte count, mean corpuscular volume and mean corpuscular hemoglobin concentration and these alterations might be associated with a greater risk for developing atherosclerosis, polycythemia vera, chronic obstructive pulmonary disease and/or cardiovascular diseases.

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