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## Effect of cigarette smoking on leucocyte in males of Kanyakumari district

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### Abstract

Tobacco cigarette smoking is one of the major leading causes of death throughout the world.. Present study was done to compare the changes in leucocytes of male smokers and non smokers of Kanyakumari district. 150 consenting subjects of which 30 controls (non-smokers) and 120 cases (smokers) were studied. Smokers were divided into four groups based on number of cigarettes smoked per day. Blood samples processed using Hematology analyser. The smokers had significantly different white blood cells counts ( $p < 0.0001$ ) including neutrophils, lymphocytes, monocytes and eosinophils. There was no significant change in the percentage of basophils.

**Conclusion:** Our findings showed that cigarette smoking has a significant effect on leucocytes and these counts changed significantly with increasing number of cigarettes smoked per day.

**Keywords:** smoking, total leucocyte count, differential leucocyte count, tobacco

### Introduction

The most common form of consumption of tobacco today is by smoking manufactured cigarettes [1, 2]. Tobacco smoke produced by cigarette contains many harmful carcinogenic substances [3] and is associated with oxidative damage to the lungs [4]. The exact mechanisms of occurrence of these disorders in smokers are not known, but it is presumed that it may be due to abnormalities in the blood rheology, infection and inflammation, oxidative stress, and alterations of antithrombotic and fibrinolysis system [5]. Since observational studies are usually prone to confounding and reverse causation, it is still uncertain whether tobacco smoking causally influences the hematopoietic system. This is an important question, as smoking is a potential reversible risk factor, and if smoking is causally associated with the hematopoietic system, it can ultimately change the understanding of many hematologic diseases [6,7].

### Materials and Methods

A cross sectional study comparing male non-smokers and male smokers from Kanyakumari district, India was performed between January and October 2020. 20-40 years, 150 healthy male subjects consisting of 30 non-smokers and 120 smokers divided into four groups of 30 each with various reported number of cigarettes smoked) were enrolled into the study after written informed consent. Healthy male smokers were included in the study. All subjects who reported any comorbidity including diabetes, primary hypertension or concurrent medication for any comorbidity or recent history of blood transfusion/donation (< 6months) were excluded from the study. Hence five groups of male study subjects were identified as follows:

Group A – Non smokers (Controls)

Group B – Smokers (1 to 10 cigarettes per day)

Group C - Smokers (11 to 20 cigarettes per day)

Group D - Smokers (21 – 30 cigarettes per day)

Group E - Smokers (more than 30 cigarettes per day)

On the reporting day, the blood samples were collected at the morning between 8.00 to 9.0 am with all aseptic precaution. 2ml venous blood was drawn and it was mixed with the anticoagulant- EDTA. WBC count were done within 5 hours of sample collection. All samples were processed using Hematology analyser.

The following blood parameters from the Haematology analyser results were tabulated and statistically analysed.

(a) Total Leukocyte count (WBC) (per cu.mm)

(b) Differential Leukocyte count (Neutrophils, Lymphocytes, Monocytes, Eosinophils and Basophils) (%)

Statistical analysis was tabulated in Microsoft Excel worksheets and Data was analysed using WinPepi statistical software. Continuous data were presented as Mean±SD. Statistical significance of difference in the mean values was tested by independent sample t-test. A p value of less than

0.05 was considered statistically significant.

### Results

A total of 150 adult males were included in the study, of which 30 were non-smokers and 120 were smokers. There was no statistically significant difference in the baseline characteristics between non-smokers and smokers (Age (in years): 26.5±4.46 vs 29.1±4.37 p = 0.458).

**Table 1:** Comparison of leucocytes between Controls (Non-smokers) (n = 30) and Cases (Smokers) (n=120).

Blood cell count	Non smokers (Controls) Mean±SD (n = 30)	Smokers (Cases) Mean±SD (n = 120)	p value
WBC count (per cu.mm)	6358.65±1140.58	9313.55±1641.9	<0.0001
Neutrophils(%)	49.38±2.94	64.07±3.2	0.002
Lymphocytes(%)	33.21±2.52	28.35±3.94	<0.0001
Monocytes(%)	4.85±0.81	3.89±1.24	<0.0001
Basophils(%)	0.25±0.42	0.16±0.23	0.173

Smokers showed statistically significant difference in leucocytes (except Basophils ) when compared to Non-smokers.

**Table 2:** Comparison of WBC count between Controls (Non-smokers) and four groups of Cases (Smokers) with different number of cigarettes smoked per day. (n = 30 in each group)

Study Parameters Subject groups	WBC count (per cu.mm)	
	Mean±SD	p value
Group A (Non-Smokers) (Controls)	569.75±1140.62	
Group B (Cases) (1- 10 cigarettes per day)	7349.0±1165.64	0.014
Group C (Cases) (11- 20 cigarettes per day)	9462.0±1143.2	<0.0001
Group D (Cases) (21-30 cigarettes per day)	9606.5±774.6	<0.0001
Group E (Cases) (> 30 cigarettes per day)	10048.6±1783.74	

Compared to Non-smokers, WBC count were significantly higher among all sub-groups of smokers with different number of cigarettes smoked per day.

**Table 3:** Comparison of Neutrophils (%) and Lymphocytes (%) between Controls (Non-smokers) and four groups of Cases (Smokers) with different number of cigarettes smoked per day. (n = 30 in each group)

Subject groups	Neutrophils (as percentage)		Lymphocytes (as percentage)	
	MeanSD	p value	MeanSD	p value
Group A (Non-Smokers) (Controls)	60.48±2.94		41.21±2.42	
Group B (Cases) (1- 10 cigarettes per day)	62.9±3.68	0.100	28.3±3.39	0.21
Group C (Cases) (11- 20 cigarettes per day)	63.65±3.97	0.043	26.40±4.93	<0.0001
Group D (Cases) (21-30 cigarettes per day)	64.6±3.8	0.001	27.5±3.88	0.004
Group E (Cases) (> 30 cigarettes per day)	65.10±4.3	<0.0001	27.1±3.42	<0.0001

Neutrophils, Lymphocytes, were found to be significantly higher in blood counts among Smokers when compared to non-smokers. With the increase in the number of cigarettes

smoked per day (Group B to Group E), Neutrophils increased progressively while lymphocytes reduced.

**Table 4:** Comparison of Monocytes (%), Eosinophil (%) and Basophils (%) between Controls (Non-smokers) and four groups of Cases (Smokers) with different number of cigarettes smoked per day. (n = 30 in each group)

Subject groups	Monocytes (as percentage)		Eosinophil (as percentage)		Basophils (as percentage)	
	Mean±SD	p value	Mean±SD	p value	Mean±SD	p value
Group A (Non-Smokers) (Controls)	4.99±0.92		4.3±1.18		0.22±0.42	
Group B (Cases) (1- 10 cigarettes per day)	4.1±1.29	0.023	5.45±1.15	<0.0001	0.11±0.35	0.430
Group C (Cases) (11- 20 cigarettes per day)	4.00±0.91	<0.0001	5.53±1.29	<0.0001	0.24±0.31	0.782
Group D (Cases) (21-30 cigarettes per day)	3.90±1.6	0.005	5.62±0.83	<0.0001	0.06±0.21	0.041
Group E (Cases) (> 30 cigarettes per day)	3.5±1.0	0.017	5.76±0.98	<0.0001	0.12±0.30	0.174

Monocytes were significantly reduced among smokers when compared to non-smokers. With increasing in the number of cigarettes smoked per day (Group B to Group E), Eosniophils

increased progressively. There was no significant change in percentage of Basophils among Smokers when compared to non-smokers

## Discussion

WBC count is a commonly evaluated haematological parameter. It is a simple marker for endothelial injury<sup>8</sup>. We found that WBC count was higher among smokers, irrespective of the number of cigarettes smoked per day, when compared to non-smoker controls ( $p < 0.0001$ ). Similar findings were discussed in few literature<sup>18, 91</sup>. WBC count increased with the increase in number of cigarettes smoked per day. It is due to the inflammatory effects of cigarette smoke on bronchial mucosa. It is also an important risk factor for vascular wall thickening and subclinical atherosclerosis<sup>101</sup>. Hence, significantly increased WBC counts with any amount of smoking (even less than five cigarette per day) can pose a higher risk of atherosclerosis and cardiovascular risk.

The result of present study had greater similarity with the finding of Friedman<sup>111</sup>. They suggested, smoking induced increased leukocyte count could be due to nicotine-induced release of catecholamines. He also stated that the irritant effect of cigarette smoke on respiratory tree with resultant inflammation might be a contributory factor for higher WBC count which may also be the cause of higher WBC count in our study. Hence Smokers with increase leukocyte count might have high risk for developing cancer, cardiovascular, cerebrovascular, respiratory diseases<sup>122</sup>.

Literature reporting the effects of different number of cigarettes smoked per day on differential leucocyte count is limited. The EPIC-Norfolk study<sup>133</sup> concluded WBC count, as a marker of inflammation, to be independently associated with incident heart failure in men but not women. Granulocyte count has been reported to increase among smokers<sup>144</sup>. Significant rise in eosinophil count, all types of WBC and Neutrophil count has also been demonstrated among<sup>15, 16, 171</sup>. In our study, Neutrophil, Lymphocytes, Monocytes and Eosinophils show statistically significant change among current smokers ( $p < 0.0001$ ) irrespective of the number of cigarettes smoked per day. Monocytes were found to decrease among smokers when compared to non-smokers. But Basophils showed no significance.

## Conclusion

Results of our study conclude that there is a significant increase in leucocyte count amongst smokers. It leads to change in viscosity of blood, reduce the velocity of blood flow thus predisposing to deep vein thrombosis, stroke and embolism. Significant increase in WBC count amongst smokers supports the available evidence in favour of inflammatory changes due to smoking, progression of atherosclerosis and coronary plaque. Hence the early detection of leucocyte changes in smokers helps in preventing the complications.

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