

## Comparison of the total and differential leucocyte count of adult male smokers and non-smokers

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### Abstract

**Background:** The many ill effects of cigarette smoking have been proven in many studies. This includes the various parameters in blood also. The fact that white blood cells or leucocytes are indirectly associated with heart disease and cancer is also well established. **Aim:** This study was done to compare the total and differential leucocyte count of adult male smokers and non-smokers and to determine the correlation between the number of pack-years and the total leucocyte count in smokers. **Materials and Methods:** This study incorporates the analysis of 100 Males of the same socio-economic status belonging to the age group of 25-50 years. Of these 100 men, 50 men were smokers and 50 men were non-smokers. The total leucocyte count and the differential leucocyte count were estimated. **Results:** The total leucocyte count and the differential count of lymphocytes were significantly higher in smokers ( $p = 0.002$  and  $0.003$  respectively) compared to non-smokers, although within the normal range. The differential count of neutrophils was higher in non-smokers compared to that of their smoking counterparts ( $p$  value  $< 0.005$ ), although within the normal range. We could also find a positive correlation ( $r$  value =  $0.379$ ) between the total leucocyte count and the quantity of cigarettes smoked. **Conclusion:** This study has revealed the total leucocyte count and the differential count of lymphocytes in smokers was significantly higher compared to non-smokers, although within the normal range and that there was a positive correlation between the quantity of cigarettes smoked in terms of pack-years and the total leucocyte count of the smokers.

**Keywords:** differential leucocyte count, smoking, total leucocyte count, white blood cells

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### Introduction

Cigarette smoking can cause many adverse effects to our body both in the acute and chronic phase. This includes the blood and there are many studies on how smoking can affect each individual parameter of the blood. Studies done by Mohammed Asif *et al.* found that smokers had significantly higher levels of

white blood cells (WBC) or leucocytes, red blood cells (RBC) and hematocrit, whereas the Mean Corpuscular Hemoglobin (MCH) concentration and platelet count were significantly lower.<sup>1</sup> The relationship of white blood cell count to heart disease incidence and cancer mortality was assessed by Grimm Jr. *et al.* and they found a strong association irrespective of the smoking status.<sup>2</sup> A change in

the WBC count in the annual examination from the baseline was seen just prior to the coronary heart disease (CHD) event and it was found to be a significant and independent risk predictor and the WBC count also was significantly associated with cancer death.<sup>2</sup> Though there are adequate studies on the effect of smoking on total leucocyte count, the studies on the differential leucocyte count have conflicting results. In view of this, the present study was undertaken to compare the total and differential leucocyte count of adult male smokers and non-smokers and to determine the correlation between the number of pack-years and the total leucocyte count in smokers.

### Materials and Methods

This study was done on 100 males of the age group 25-50 years. Among these 50 were smokers (current) and 50 were non-smokers who had never smoked in their life time. All of them were screened for chronic diseases, any infection, lung pathologies like bronchitis, chronic obstructive pulmonary disease (COPD), bronchial asthma, etc. Among smokers we recruited only cigarette smokers and not those who used other forms of tobacco. A detailed history was taken regarding the number of cigarettes and the duration of smoking in years. With this we calculated the number of cigarettes smoked by each subject during their entire lifetime and expressed it in pack-years.<sup>1</sup>

In order to avoid diurnal variation, we did a complete blood count in the forenoon. Also to avoid the immediate effects of smoking on blood parameters, the smokers were asked to refrain from smoking at least two hours prior to the withdrawal of blood for testing. The improved Neubauer's chamber was used to calculate the total leucocyte count. A blood smear was made and stained with Leishman's stain to determine the differential leucocyte count. Then the differential count was determined by counting 100 leucocyte. The data were analyzed using Student's t- test and a

p value of <0.05 was considered significant. We also calculated the correlation co-efficient 'r' to determine the correlation between the number of cigarettes smoked in terms of pack-years and the total leucocyte count.

### Results

Our study revealed that smokers had higher total lymphocyte count ( $p = 0.002$ ) and differential lymphocyte count ( $p = 0.003$ ) compared to non-smokers, although within the normal range. Smokers however had a significantly lesser differential count of neutrophils ( $p = 0.01$ ), although within the normal range. There was no difference in the differential count of eosinophils and basophils among the two groups (Table 1). We also found a significant positive correlation ( $r = 0.379$ ,  $p = 0.002$ ) between the number of cigarettes smoked expressed as pack-years and the total leucocyte count of smokers.

**Table 1: Comparison of the total leucocyte count and differential leucocyte count of adult male smokers and non-smokers**

	Parameters	Smokers (n=50) Mean $\pm$ SD	Non-smokers (n=50) Mean $\pm$ SD
1.	Total leucocyte count (cells/mm <sup>3</sup> )	9230 $\pm$ 140.6	7210 $\pm$ 70.21*
2.	Differential leucocyte count		
	Neutrophil (%)	50.4 $\pm$ 4.2	59.2 $\pm$ 0.50*
	Eosinophil (%)	4.9 $\pm$ 0.56	5.0 $\pm$ 0.46
	Lymphocyte (%)	39.0 $\pm$ 0.54	34.1 $\pm$ 0.32*
	Monocyte (%)	2.5 $\pm$ 0.12	2.5 $\pm$ 0.13
	Basophil (%)	0.18 $\pm$ 0.03	0.23 $\pm$ 0.02
3.	Pack-years	10.60 $\pm$ 0.50	–

\*p value of <0.05 was considered significant; the number of cigarettes smoked by each smoker expressed in pack-years.<sup>1</sup>

## Discussion

In our study we found that the smokers had a significantly higher value of total leucocyte count (although within the normal range) and that there was a positive correlation between the number of pack-years of cigarettes smoked and the total leucocyte count ( $r = 0.379$ ,  $p = 0.002$ ). A similar study done by Mohammed Asif *et al.* also revealed that smokers had significantly higher levels of total leucocyte count.<sup>1</sup> A possible explanation for this could be hemoconcentration that causes an elevated total leukocyte count in smokers.<sup>3</sup> The effect on other blood parameters such as rise in hemoglobin, eosinopenia and altered hemostatic function has also been reported, and it was also established that this rise in hemoglobin might not be due to hemoconcentration but as a consequence of hypoxia and due to raised levels of carboxy-hemoglobin in the blood of smokers.<sup>3</sup>

Smoking as a stress factor affecting the adrenal gland was proved in studies done by Cryer *et al.*, who have reported higher plasma 11-hydroxy corticosteroid level in smokers due to hypoxia induced by nicotine which stimulates the adrenals to secrete corticosteroids.<sup>4</sup> This might be a possible explanation for increased total leucocyte count. Cardiovascular toxicity of nicotine is attributed to the same reason that the effect of cigarette smoking on the coronary blood flow is catecholamine mediated. Benowitz *et al.* state that nicotine causes hemodynamic consequences by sympathetic neural stimulation and this causes systemic catecholamine release.<sup>5</sup> The increase in coronary vascular resistance is blocked by alpha adrenoreceptor blocking agents. In addition to mediating the hemodynamic effects of smoking, the catecholamines could contribute to arrhythmogenesis. Catecholamine release could be attributed to the greater risk of sudden cardiac death in smokers than in nonsmokers.

The elevated leucocyte count may be due to the irritant effect of cigarette smoke on respiratory tree with resultant inflammation as studied by

Calverly *et al.*<sup>6</sup> The relationship between leukocytosis and the quantity and duration of smoking was proved by Petitti *et al.* in a study involving 62,541 adult smokers.<sup>7</sup> Our study also showed similar results as we found a significant positive correlation between the number of cigarettes smoked by the smokers in terms of pack-years and their total leucocyte count.

How this neutrophilia affects the major organs was studied by Hansen *et al.* and they found that accumulating polymorphonuclear leucocytes can contribute to myocardial damage.<sup>8</sup> Many recent studies have shown that leukocytosis is a risk factor for coronary artery disease. Bain *et al.* studied the acute changes in hematological parameters on cessation of smoking. They found that within two weeks of cessation, a rapid return towards normalcy was seen in the elevated hemoglobin concentration, packed cell volume (PCV), red cell count, white cell count, neutrophil, lymphocyte and platelet count indicating that at least some of the abnormalities in these parameters are acute, reversible effect of cigarette smoking rather than being a response to tissue damage.<sup>9</sup> The results of our study have to be taken into consideration in the context of these findings of other researchers.

## Conclusion

This study has revealed the total leucocyte count and the differential count of lymphocytes in smokers was significantly higher compared to non-smokers, although still within normal limits, and that there was a positive correlation between the quantity of cigarettes smoked in terms of pack-years and the total leucocyte count of the smokers.

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**Conflicts of interest:** Nil

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