

Assessment of Complete Blood Count Parameters in Smokers and Non-Smokers

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ABSTRACT

Background:

Most previous studies looked at smoking and diet separately. Some studied how smoking affects the blood, while others focused on vegetarian and non-vegetarian diets. These studies are useful, but they do not show how both factors work together. In real life, people have both habits at the same time, which can affect complete blood count results. So, this study aims to analyse smoking and diet together to better understand their combined effect on blood health.

Objective:

Assessment of Complete Blood Count Parameters in Smokers and Non-Smokers.

Material & Methods:

A cross-sectional comparative study was conducted in the Department of Pathology, NIMS Hospital, Jaipur. Sampling technique: purposive. A total of 184 participants were included in the study, equally divided into smokers (92) and non-smokers (92). Each of these groups was further categorised based on dietary habits into vegetarian and non-vegetarian subgroups, with 46 participants in each category, resulting in four equal groups.

Results:

Mean age was highest in vegetarian smokers (57.32±17.62 years; median 55 years). Haemoglobin levels were significantly lower in vegetarians and higher in smokers ($p < 0.0001$). RBC count was associated with diet and WBC with smoking, while platelet count showed no significant difference.

Conclusion:

This study concludes that diet and smoking significantly affect haemoglobin levels, with higher levels in smokers and non-vegetarians. Smoking also influences WBC count, while platelet count remains unaffected.

Keywords: Smoking, Complete blood count, Haemoglobin, Vegetarian, Non-vegetarian, RBC, WBC, Platelet

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INTRODUCTION

Previous research has largely focused on smoking habits and dietary patterns separately, either evaluating the effects of smoking on haematological parameters or examining how diet, such as

vegetarian versus non-vegetarian intake, influences blood profiles. Although these studies provide valuable insights, they do not fully address the combined effects of these lifestyle factors. In real-life scenarios, smoking and dietary habits often coexist and may interact to influence physiological

outcomes, including complete blood count (CBC) parameters. Therefore, the present study aims to bridge this gap by simultaneously analysing both factors to provide a more comprehensive understanding of their combined effects on haematological health.

Assessment of CBC parameters provides important insights into an individual's physiological and pathological condition, as it reflects the functioning of red blood cells, white blood cells, haemoglobin, and platelets. Lifestyle factors, particularly smoking and dietary habits, significantly influence these parameters. Cigarette smoking introduces toxic substances into the bloodstream, resulting in elevated white blood cell counts, variations in haemoglobin concentration, and reduced oxygen-carrying capacity due to carboxyhaemoglobin formation. These changes may lead to systemic inflammation, weakened immunity, and increased risk of chronic diseases, making comparison between smokers and non-smokers essential to understand these alterations [1].

Dietary habits also play a vital role in maintaining normal blood parameters. Vegetarian diets may sometimes lack essential nutrients such as iron and vitamin B12, which are necessary for haemoglobin synthesis and red blood cell formation, potentially leading to lower haemoglobin levels. In contrast, non-vegetarian diets generally provide these nutrients in adequate and bioavailable forms, supporting healthier blood profiles [2]. This study, therefore considers both smoking and dietary patterns together to evaluate their combined influence on CBC parameters.

Smoking remains a major global health concern and is associated with multiple diseases. It induces changes in various blood parameters, with haemoglobin levels often increasing as a physiological response [3]. Studies on otherwise healthy individuals have shown that regular smoking significantly alters haemoglobin levels, white blood cell count, red blood cell count, hematocrit, mean corpuscular volume, and mean corpuscular haemoglobin concentration, indicating its harmful effects on blood health [4]. Additionally, smoking is linked to serious conditions such as cancer, chronic obstructive pulmonary disease (COPD), gastrointestinal disorders, metabolic syndrome, and autoimmune diseases, demonstrating its widespread impact on overall health [7].

Anaemia is another important global health issue, resulting from blood loss, decreased production, or

increased destruction of red blood cells. Its prevalence varies based on gender and dietary habits, with females more commonly affected by mild to moderate anaemia, while non-vegetarian diets are associated with better haemoglobin levels due to the presence of vitamin B12 [5]. Low haemoglobin levels may also result from inadequate nutrient intake or poor absorption. Vegetarian diets, in particular, may lead to deficiencies of iron, vitamin B6, and vitamin B12, which are essential for normal red blood cell production [6].

The nutritional adequacy of plant-based diets continues to be widely studied. Although such diets may provide sufficient protein and most vitamins, vitamin B12 deficiency can lead to metabolic and neurological complications. Additionally, high fibre and phytate content may reduce the absorption of minerals like iron and zinc. In contrast, non-vegetarian diets provide bioavailable vitamin B12 and heme iron, although excessive intake of animal products may increase the risk of chronic diseases [8].

Cigarette smoking persists as a serious public health issue with widespread physiological effects, including alterations in haematological parameters and oxygen transport capacity. It can affect white blood cell counts and haemoglobin levels, although the clinical significance of these changes requires further investigation [9]. There is no safe level of tobacco exposure, as all forms are harmful and contribute to various diseases [10]. Smoking also reduces oxygen transport by forming carboxyhaemoglobin, leading to hypoxia and changes in CBC components such as RBCs, WBCs, haemoglobin, hematocrit, and platelets [11].

Nutrition is essential for proper blood cell production, as it supplies key nutrients such as iron, vitamin B12, folic acid, and proteins. Poor dietary habits can result in deficiencies and abnormal CBC values. Although many studies have explored the individual effects of smoking and diet, their combined influence on haematological health remains less studied [12]. Therefore, this study aims to assess CBC parameters to better understand the overall impact of smoking and dietary habits on blood health.

MATERIALS AND METHOD

This study was a comparative cross-sectional study in which the purposive sampling technique was used. The duration of the study was six months tests were performed in the Department of Pathology, NIMS Hospital, Jaipur. *Sample size:* groups were

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further categorised based on dietary habits into vegetarian and non-vegetarian subgroups, with 46 patients in each category, resulting in four equal groups. *Sample collection:* Venous blood (3 mL) was collected by venipuncture under aseptic conditions and transferred into EDTA-containing tubes to prevent clotting. CBC parameters were analysed using an automated haematology analyser following standard laboratory protocols. The participants were informed about the purpose of the study, and those who were willing to participate were included after obtaining written informed consent

Classify subjects into four groups:

- Vegetarian smokers V
- Vegetarian non-smokers V
- Non-vegetarian smokers N
- Non-vegetarian non-smokers N

STATISTICAL ANALYSIS

The data were analysed using descriptive and inferential statistics. Continuous variables like age were expressed as mean \pm standard deviation (SD) and median (IQR), while categorical variables such as gender, smoking status, dietary habits, and CBC parameters were presented as frequencies and percentages. The Chi-square test was used to compare groups (smokers vs non-smokers and vegetarians vs non-vegetarians). A p-value < 0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 25.0.

RESULT

A total of 184 subjects were included in the present study, comprising both smokers and non-smokers with vegetarian and non-vegetarian dietary habits. The findings of the study are presented in the following tables.

Table 1 presents the descriptive statistics of age according to diet type and smoking habits. The mean age was highest among vegetarian smokers (57.32 \pm 17.62 years), while non-vegetarian non-smokers showed relatively lower mean age values.

Table 1: Descriptive statistics of age of subjects according diet type and smoking habits

Groups		Minimum	Maximum	Median (IQR)	Mean \pm SD
Vegetarian	Smokers	19	83	55 (45.25-71)	57.32 \pm 17.62
	Non-Smokers	18	85	45 (31-60.5)	45.46 \pm 17
Non-Vegetarian	Smokers	18	79	41.5 (25-56.75)	43.48 \pm 17.76
	Non-Smokers	18	101	37 (26-57)	43.6 \pm 20.38

Table 2 shows the distribution of CBC parameters based on diet type. A significant (p-value supported) association was observed for haemoglobin and RBC count ($p < 0.05$), whereas WBC count and platelet count did not show a significant association.

Table 2: Distribution of CBC parameters of vegetarian & non-vegetarian subjects

Variables		L	No	H	Chi-square test	P - Value
Haemoglobin	Vegetarian	55	26	4	68.55	< 0.001
	Non-Vegetarian	9	50	39		
RBC Count	Vegetarian	40	36	9	13.744	0.0104
	Non-Vegetarian	22	53	23		
WBC Count	Vegetarian	29	51	5	0.207	0.9167
	Non-Vegetarian	35	56	7		
Platelet Count	Vegetarian	18	61	6	2.858	0.23957
	Non-Vegetarian	24	72	2		

Comparison between smokers and non-smokers regarding CBC measurements is described in Table

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2 below. It is clear that there were significant differences in Hb concentration and WBC numbers ($p < 0.05$) while RBC numbers and platelets showed no significant difference.

Table 3: Distribution of CBC parameters of smokers & non-smokers subjects

Variables		L o w	No r m a l	H i g h	Chi- squa r e t e s t	P - V a l u e
Hae mogl obin	Smok ers	9	26	33	43.76	< 0.0001
	Non- Smok ers	55	50	10		
RBC Coun t	Smok ers	17	37	14	3.857	0.1454
	Non- Smok ers	45	52	18		
WB C Coun t	Smok ers	16	46	6	6.458	0.0396
	Non- Smok ers	48	61	6		
Plate let Coun t	Smok ers	18	50	0	0.758	0.38393
	Non- Smok ers	24	83	8		

Table 3 indicates the variation in CBC parameters among smoking and nonsmoking vegetarians. A noticeable variation existed in the hemoglobin parameter ($p < 0.05$), while no significant variations existed between RBC, WBC, and platelets.

Table 3: Distribution of CBC parameters of vegetarian smokers & non-smokers subjects

Vegetarian		L o w	No r m a l	H i g h	Chi- squa r e t e s t	P - V a l u e
Haem oglob in	Smok ers	7	11	4	14.06	0.00018
	Non- Smok ers	48	15	0		
RBC Coun t	Smok ers	6	13	3	4.693	0.09569
	Non- Smok ers	34	23	6		

WBC Coun t	Smok ers	5	16	1	2.02	0.36417
	Non- Smok ers	24	35	4		
Platel et Coun t	Smok ers	5	17	0	0.043	0.83617
	Non- Smok ers	13	44	6		

Table 4 shows the comparison of CBC parameters between non-vegetarian smokers and non-smokers. Hemoglobin and WBC count showed statistically significant association ($p < 0.05$), whereas RBC and platelet counts were not significant.

Table 4: Distribution of CBC parameters of non-vegetarian smokers & non-smokers subjects

Non- Vegetarian		L o w	No r m a l	H i g h	Chi- squa r e t e s t	P - V a l u e
Haem oglob in	Smok ers	2	15	29	19.74	0.00005
	Non- Smok ers	7	35	10		
RBC Coun t	Smok ers	11	24	11	0.148	0.92849
	Non- Smok ers	11	29	12		
WBC Coun t	Smok ers	11	30	5	6.06	0.04843
	Non- Smok ers	24	26	2		
Platel et Coun t	Smok ers	13	33	0	0.667	0.41423
	Non- Smok ers	11	39	2		

DISCUSSION

The present study assessed the impact of smoking and dietary habits on complete blood count (CBC) parameters. The majority of participants belonged to the 21–40 years age group, which is consistent with observations reported in earlier studies, including previous research by Sari M et al, 2018. Haemoglobin levels demonstrated a significant association with both smoking and dietary patterns,

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with higher values noted among smokers and individuals consuming a non-vegetarian diet. This could be attributed to carbon monoxide exposure in smokers and higher iron intake in non-vegetarians, findings that align with previous research. Red blood cell (RBC) count showed a significant relationship with dietary habits but not with smoking, highlighting the importance of nutrition in erythropoiesis. In contrast, white blood cell (WBC) count was significantly associated with smoking, suggesting an underlying inflammatory response, which is in accordance with earlier studies. Platelet count, however, did not exhibit any significant association with either smoking or dietary habits.

In summary, the results of the present study are consistent with existing literature and suggest that both smoking and dietary practices play a significant role in influencing haematological parameters, particularly haemoglobin levels and WBC count

CONCLUSION

The findings of this study indicate that smoking and dietary patterns have a measurable impact on haematological parameters. Haemoglobin levels were significantly influenced by both factors, while RBC count was more closely related to diet and WBC count to smoking habits. Platelet count remained largely unaffected. These findings highlight the importance of avoiding smoking and maintaining a balanced diet to support normal haematological status and overall health

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