



# **Analysis of White Blood Cell Count and Its Differential Count in Gingival and Periodontal Conditions Associated with Bleeding Gingiva**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** Bleeding gingiva is caused primarily due to the accumulation of plaque and calculus which eventually leads to gingivitis or periodontitis. Other causes of bleeding gingiva can be due to improper flossing, over brushing of the teeth and gingiva, hormonal changes due to pregnancy, ill-fitting dentures and any other dental appliances impinging the gingiva. The bleeding gingiva can also indicate serious health problems like leukemia, scurvy, idiopathic thrombocytopenic purpura, vitamin k deficiency and any bleeding disorder. Persistent gingival bleeding is a sign of serious medical problems like leukemia and platelet disorders. Leukemia is a group of cancer where there is an increased number of immature or abnormal white blood cells. In this study, the WBC and their differential count is analyzed in patients with bleeding gingiva to check the possibilities for the patient to get cancer.

**Aim:** To measure and observe the WBC count and its differentials by testing the blood from patients with bleeding gingiva.

**Materials and Methods:** The study was conducted in the clinical pathology lab at Saveetha Dental College and Hospitals, Chennai. 100 subjects were subjected to the study. Subjects with chief complaint of bleeding gingiva, without systemic diseases like diabetes, hypertension, and patients with the age of above 10 were included in the study.

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**Results and Conclusion:** This study was conducted to analyze the WBC count and differential count among the patients with bleeding gingiva. No significant correlation was found between bleeding gingiva and white blood cells & their differential count in this study.

**Keywords:** WBC; differential count; neutrophil; lymphocytes; monocytes; eosinophil; bleeding gingiva; innovative method.

## 1. INTRODUCTION

Bleeding gingiva is caused primarily due to the accumulation of plaque and calculus, which eventually leads to gingivitis or periodontitis. Other causes of bleeding gingiva can be due to improper flossing, over brushing of the teeth and gingiva, hormonal changes due to pregnancy, ill-fitting dentures, and any other dental appliances impinging the gingiva. The bleeding gingiva can also indicate serious health problems like leukemia, scurvy, idiopathic thrombocytopenic purpura, vitamin k deficiency and any bleeding disorders [1].

The WBC count and differential count is the most basic measure for analyzing bleeding gingiva. White blood cells may be counted manually or with automated counters in specially built chambers (Neubauer). The latter is commonly used because it offers greater precision and speed than manual techniques. A drop of blood is thinly scattered over a glass slide, air-dried, and stained with a Romanowsky stain, most commonly the Wright or May-Grunwald-Giemsa method, to assess the differential. After that, 200 cells are counted and classified. Though machines have been developed to perform automated differential counts, they are not as effective as manual techniques with regards to reliability and ability to discover morphologic abnormalities [2].

Neutrophil chemotaxis and phagocytic activity may be assessed in the laboratory. The skin window method is semi quantitative, but it has the benefit of being easy. An abrasion is produced in the epidermis, which is then sealed with a glass cover slide for a few hours and stained to look for attached granulocytes. More complex in vitro systems have been developed, the majority of which are focused on neutrophils' ability to navigate a specific obstacle to reach an appealing stimulus [2,3].

The white blood cell and its differential count determine the total number and each type of white blood cell present in the blood. Generally, each WBC type has its unique feature. Neutrophils serve as the primary defense against

infection. Eosinophils play a role in allergic disorders and in combating parasitic infections. Basophils digest bacteria and other foreign bodies (phagocytosis) and also have some role in an allergic reaction, monocytes respond to inflammation, infection, and foreign bodies by ingesting and digesting the foreign particles [4]. Lymphocytes play both an immediate and delayed role in response to infection or inflammation [5]. Our team has extensive knowledge and research experience that has translate into high quality publications [6]. [7–20], [21–25]. This study aims to analyze the total WBC count and differential counts in the bleeding gingiva.

## 2. MATERIALS AND METHODS

This study was conducted in the clinical pathology lab at Saveetha Dental College and Hospitals, Chennai. 100 subjects were included in the study. Prior to the initiation of the study the ethical approval was provided by the institutional ethical committee. Subjects above the age of 10 were included in the study with chief complaint of bleeding gingiva, without any systemic diseases like diabetes, hypertension and with infections. Written consent was obtained from the subjects regarding collection and usage of their blood for our study purposes. A blood sample of about 2ml was collected from each patient in EDTA vacutainer tubes and was fed into 3 part automated colter counter method and analyzed. Only the total WBC count and their differential count were analyzed in this study, these counts were done using the auto- analyzer available in the institution. A Student t-test was performed to find out the significance of WBC and its differential count among patients with bleeding gingiva.

## 3. RESULTS AND DISCUSSION

Among the 100 patients, 60 were males and 40 were females. WBC count was normal for 97 subjects. WBC count was less than normal (<4000 cells per cubic mm) for 2 subjects and greater than normal (>11000 cells per cubic mm) for 1 subject. Neutrophil count was normal for

almost all the patients. It was less than normal (<40%) for one subject and more than normal (>75%) for 2 patients. Lymphocyte count was normal for 86 subjects, more than normal (>40%) for 13 subjects, and less than normal (<20%) for

1patient. The Eosinophil count was normal (2-6%) for all the subjects. No significant difference was found in the WBC and its differential count between the male and female subjects.

**Table 1. Average total count of white blood cells, neutrophils, lymphocytes, eosinophils in males**

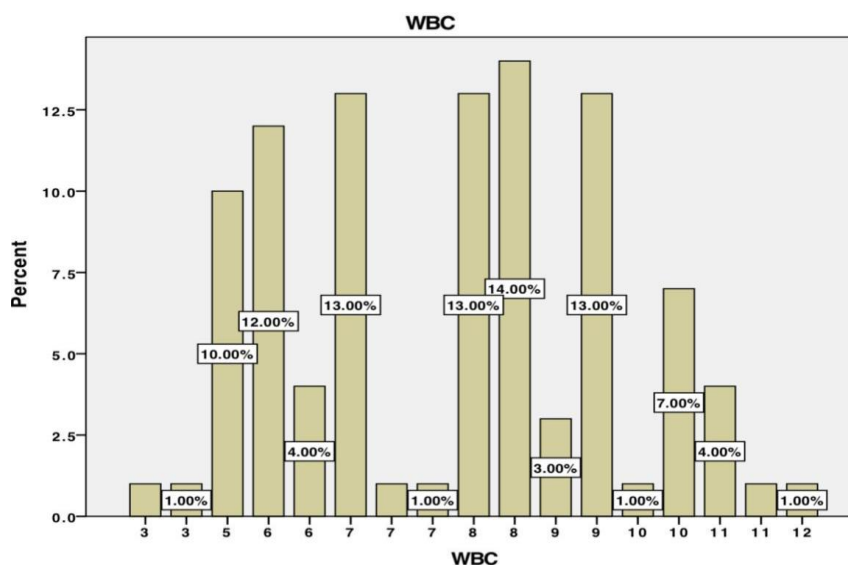
Age (in years)	Total count WBC	Neutrophils	Lymphocytes	Eosinophil
10-20	9042.9	57.9	38	4.2
20-40	8160.7	62.7	33.9	3.7
>40	8687.5	62.3	33.9	3.7

**Table 2. Average total count of white blood cells, neutrophils, lymphocytes, eosinophils in females**

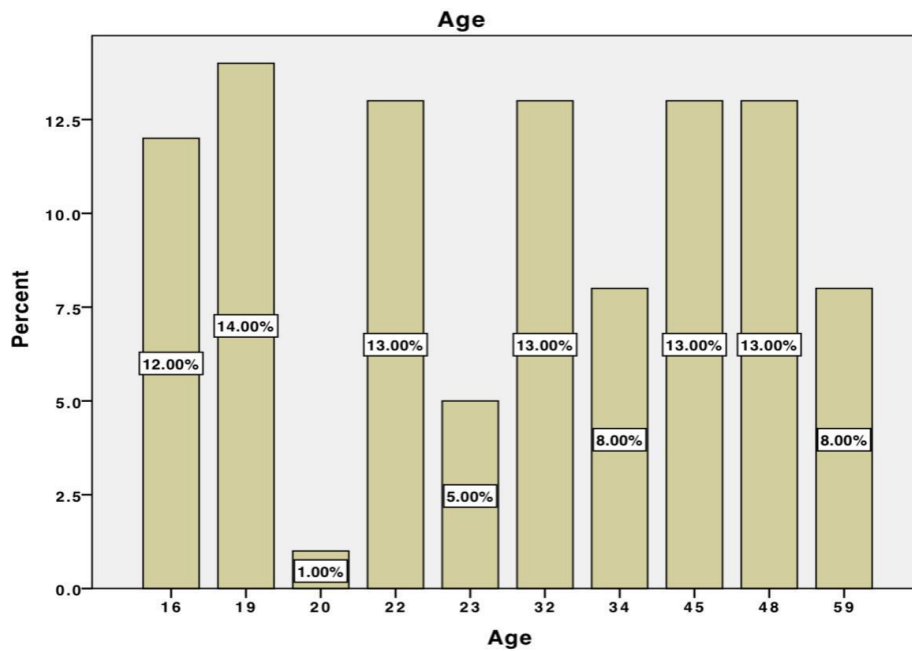
Age (in years)	Total count WBC	Neutrophils	Lymphocytes	Eosinophil
10-20	8925	61	35.5	3.5
20-40	7942.9	61.5	34.7	3.7
>40	8633.3	57.8	38.6	3.5

**Table 3. Normal value of total white blood cell count, neutrophil, lymphocyte, and eosinophil**

Total count WBC	4000-11000 cells/mm <sup>3</sup>
Neutrophils	40-75%
Lymphocyte	20-40%
Eosinophil	1-6%



**Fig. 1. Percentage distribution of white blood cells in the study subjects, Y-axis representing the percentage of population and X-axis representing WBC count. The least 1% of population have 3000 cells, 7000cells, 10,000 cells and 12,000cells per cubic millimeter of blood, 10% have 5000 cells per cubic millimeter of blood, 16% have 6000 cells per cubic millimeter of blood, 13% of population have both 7000 cells and 9000 cells per cubic millimeter of blood. 14% of the people involved in this study are have around 8,000 cells per cubic millimeter of blood, 3% have 9000 cells per cubic millimeter of blood, 7% of population have 10,000cells per cubic millimeter of blood, 4% of the population have 11,000 cells per cubic millimeter of blood**



**Fig. 2. Percentage population among the various age groups, Y-axis representing the percentage population and X-axis representing the age. 12% of the population in the study belongs to age group of 16 years, 14% belongs to 19 years, 1% belongs to 20 years, 13% belongs 22 years, 5% belongs to 23 years, 13% belongs to 32 years, 8% belongs to 34 years, 13% belongs to 45 years to 48 years, 8% of population belongs to above 50 years of age**

This study was conducted to analyze the WBC count and differential count among the patients with bleeding gingiva. Figure 1 shows the Percentage distribution of white blood cells in the study subjects. The highest percentage observed in the graph is 14% of the people involved in this study are having around 8,000 cells per cubic millimeter of blood and the least is 1% of people are involved in this study are having 3,000 and 12,000 cells per cubic millimeter of blood. Fig 2 shows the Percentage population among the various age groups. The highest percentage observed is 14% of the total population are the age group of 19 years and least observed is only 1% of the age group of 20 years.

The research was conducted on 100 patients with chronic periodontitis. In the subjects, there were no evident changes in the values of clinical parameters of periodontitis when compared to normal values [26]. Table 1 shows the average value of the total count of white blood cells, neutrophils, lymphocytes, eosinophils in males. Males with bleeding gingiva, in the age group of 10-20 years showed a mean value of total WBC count was 9042.9 cells/cubic mm, in the age group of 20-40 years have a mean value of total WBC count was 8160.7cells/cubic mm and in the age group of above 40 years showed a mean

value of total WBC count was 8687.5 cells/cubic mm. When we compared all the age groups, the mean value of the WBC count is more in the age group of 10-20 years when compared to other age groups. The chi-square analysis was done to rule out the association, in which we found that there is no significant association between the age group of males with bleeding gingiva and the WBC counts [27,28].

Table 2 shows the average total count of white blood cells, neutrophils, lymphocytes, eosinophils in females. Females with bleeding gingiva, in the age group of 10-20 years showed a mean value of total WBC count was 8925 cells/ cubic mm, in the age group of 20-40 years showed a mean value of total WBC count was 7942.9cells/cubic mm and females of the age group of above 40 years showed a mean value of total WBC count was 8633.5 cells/cubic mm. When we compared the WBC count among the different age groups of females who have bleeding gingiva, males' females with 10-20 years have a higher WBC count than the other age groups. Chisquare analysis showed that there is no significant difference in the age groups of females with bleeding gingiva and WBC counts. A study done by Ajmani et al in 2017, showed that drug-induced pancytopenia leads to bleeding gingiva.

In this study, the author highlighted that WBC count in females with elderly age group had a low total count, which was well correlated with our study [29].

Table 3 shows the value of total white blood cell count, neutrophil, lymphocyte, and eosinophil.

Except for neutrophils, other WBC differentials which are lymphocyte and eosinophil are normal in both males and females in the bleeding gum patients, but when analyzing the neutrophils, a slight increase in the number of neutrophils is observed in the bleeding gum patients in both males and females by comparing table 1 and table 2 with table 3. The mean value of WBC and its differential count was normal in both males and females with bleeding gingiva. It was found correlated with the previous study done in 2021 by Alnor et al. [30].

The mean value of WBC and its differential count was normal in both males and females. The normal value of the WBC is 4000 to 11000 cells/cm [31], the normal value for neutrophils is 40-75%, the normal value of lymphocytes is 20-40% and the normal value of eosinophil is 1-6%. Earlier studies [32] have demonstrated elevation of total leukocyte count in periodontitis [33,34] and lowering of leukocyte levels following periodontal therapy [33,35]. Exaggerated leukocytes and neutrophils of host response are a very important component in the pathogenesis of periodontal disease. Hyper-reactive white blood cells can be induced in patients with infections such as periodontal disease and promote atherosclerosis at distant sites, particularly in areas of disturbed blood flow [36]. This hyper-reactivity might be due to their circulating through the periodontal lesions or might be a constitutive feature of patients with periodontal disease [34]. The minor bleeding from the gingiva, may not alter the WBC counts and differential counts for both males and females. Vice versa, the moderate to severe reduction in WBC counts and differential counts leads to bleeding gingiva in both males and females.

This study included the patients with only bleeding gingiva, no other systemic illnesses were included. These limitations may be overcome in the future by including systemic illnesses which cause bleeding gingiva as defining criteria.

## 4. CONCLUSION

Within the limitations of the study, we conclude that there is no association between the WBC count and differential counts among the males and females with bleeding gingiva. The statistical analysis also proved the same. Hence, minor bleeding from the gingiva will not produce any changes in the WBC parameters.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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