



THE IMPACT OF AGING ON HEMATOLOGICAL HEALTH: A STUDY OF WBC, PLATELETS, AND LEUKOCYTE COUNTS

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ABSTRACT **Introduction:** Hemopoiesis, the formation of blood cells, varies with age, with a shift from active red bone marrow to fatty tissue and a decreased regenerative capacity of hematopoietic stem cells. While aging itself is not a disease, it increases susceptibility to various conditions. This study explores how age affects white blood cell (WBC) and platelet counts, and differential leukocyte counts in males and females. **Aims:** The aim of this study was to analyze and compare WBC and platelet counts across different age groups for both genders, and to evaluate differential leukocyte counts between males and females across these age groups. **Methodology:** A cross-sectional study was conducted over 18 months at Govt. Siddhartha Medical College, involving 300 healthy participants aged 31 to 60 years. Data on WBC and platelet counts were obtained from the central laboratory using a Horiba cell counter. Participants with suspected clinical diseases were excluded. ANOVA was used to assess statistical significance in differences across age groups. **Results:** The study found an increasing trend in total WBC counts with age for both males and females, with statistically significant differences ($p=0.034$ for males, $p=0.015$ for females). Platelet counts did not show a consistent age-related trend. Males had a mean platelet count ranging from 2.86 to 3.02 lakhs/ μL ($p=0.04$), while females ranged from 2.37 to 3.62 lakhs/ μL ($p=0.09$). Differential leukocyte counts showed minor gender-based variations. **Conclusion:** This study highlights age-related trends in WBC counts, with significant changes observed in both males and females. While platelet counts did not exhibit a clear age-related trend, variations among age groups were significant in males. These findings suggest potential hormonal influences and underscore the need for further research to understand the underlying mechanisms affecting haematological parameters across different ages and genders.

KEYWORDS : White Blood Cells, Platelet Counts, Age-Related Trends, Gender Differences

INTRODUCTION

Hemopoiesis is the process through which blood cells, such as RBCs, WBCs, and platelets, are formed. In young children, both the axial skeleton and the long bones contain active hemopoietic tissue. As a person ages, this active tissue is increasingly replaced by fatty tissue, transforming red bone marrow into yellow. Additionally, the capacity of hematopoietic stem cells to regenerate decreases with age.¹

While aging is not classified as a disease, the probability of encountering diseases increases considerably with advancing age. The biochemical makeup of tissues undergoes changes over time, which leads to decreased physiological function, reduced capacity for maintaining homeostasis under stress, and heightened vulnerability to diseases. After reaching maturity, the rate of mortality rises exponentially with age. Gerontological research seeks to explore the cellular and molecular foundations of aging, with the primary objectives of maximizing functional longevity and extending the overall lifespan.²

To diagnose and evaluate diseases, clinicians often examine white blood cell (WBC) counts and the differential WBC counts, which include monocytes, lymphocytes, neutrophils, eosinophils, and basophils—all derived from myeloid or lymphoid progenitors. These cells are vital to immune function. Both total WBC counts and the proportions of different WBC types are used in diagnosing diseases.^{3,10}

To ensure vascular health and facilitate clot formation at injured blood vessel sites, a sufficient supply of circulating platelets is necessary. Human platelet counts normally range from $150 \times 10^9/\text{L}$ to $400 \times 10^9/\text{L}$. Since platelets have a lifespan of around 10 days and about one-third are held in the spleen, approximately 100×10^9 platelets must be produced daily by mature megakaryocytes to maintain this normal count. This balance between platelet production, usage, and aging is essential. Thrombopoietin is the key regulatory hormone controlling megakaryocyte differentiation and platelet count under stable conditions.¹²

Various studies have found that while the total and differential white

blood cell (WBC) counts do not correlate with age, platelet counts tend to decline as individuals get older.³⁻⁸

This study aims to analyse and compare the white blood cell and platelet counts across different age groups for both males and females and also to compare the differential leukocyte counts between males and females across various age groups.

METHODOLOGY

A cross-sectional study was conducted in physiology department in collaboration with department of pathology and department of general medicine at Govt. Siddhartha Medical College, Vijayawada. The study was conducted for duration of 18 months at department of physiology and a total of 300 participants were included in the study. Study population are people aged 31 to 60 years attending general medicine outpatient department for routine health checkup. The data for complete blood counts (CBC) were obtained from the central laboratory of the Department of Pathology at Govt. Siddhartha Medical College. The Horiba cell counter was used to measure the cell counts, including WBC and platelet counts. This instrument ensures accurate and reliable measurement of blood cell components. Participants with suspicion of any clinical diseases were excluded from the study to ensure that the sample consisted of healthy individuals. ANOVA was used to compare the means of WBC and platelet counts across different age groups. This statistical test helps determine if there are statistically significant differences between the groups.

RESULTS

Table 1: Mean of total WBC counts of males and females

Age group (in years)	Mean of total WBC count among males (thousand/cu mm)	SD	P value	Mean of total WBC count among females (thousand/cu mm)	SD	P value
31-40	0.73	0.12	0.034	0.63	0.512	0.015

41-50	0.84	0.13	0.74	0.32	
51-60	0.87	0.16	0.77	0.37	

In the study, 147 out of 300 participants were male, and 153 were female. The analysis of total white blood cell (WBC) counts revealed the following findings. The mean total WBC count for males ranged from 0.73 thousand/ μ L to 0.87 thousand/ μ L. This range indicates variability in WBC counts among the male participants across different age groups. The mean total WBC count for females ranged from 0.63 thousand/ μ L to 0.77 thousand/ μ L. This range reflects the variation in WBC counts among female participants across various age groups. The study observed an increasing trend in total WBC counts with age for both males and females. This trend suggests that as individuals age, their WBC counts tend to rise.

The differences in WBC counts among the various age groups were statistically significant. For males, the p-value was 0.034, and for females, it was 0.015. These p-values indicate that the observed differences in WBC counts with age are statistically significant and not due to random chance.

Table 2: Mean of total platelet count among males and females

Age group (in years)	Mean platelet Count among males (lakhs/cu mm)	SD	P value	Mean platelet Count among females (lakhs/cu mm)	SD	P value
31-40	3.02	0.66	0.04	2.37	0.18	0.09
41-50	2.86	0.63		3.56	0.44	
51-60	2.95	0.73		3.62	0.38	

The mean platelet count for males ranged from 2.86 lakhs/ μ L to 3.02 lakhs/ μ L. The analysis did not reveal any significant trend—either upward or downward—in platelet counts with increasing age. However, the differences in platelet counts between the various age groups were statistically significant, with a p-value of 0.04. This indicates that while there was no discernible trend, the variation in platelet counts among age groups was statistically significant.

The mean platelet count for females ranged from 2.37 lakhs/ μ L to 3.62 lakhs/ μ L. Similar to the male participants, there was no noticeable trend in platelet counts with age in females. The analysis showed no significant change in platelet counts across age groups, with a p-value of 0.09. This p-value suggests that the differences in platelet counts among different age groups were not statistically significant in females.

Table 3: Differential Leukocyte Count among males and females

Age group (in years)	Mean of Neutrophil (%)	SD	Mean of Lymphocyte (%)	SD	Mean of others (%)	SD
Males						
31-40	63.78	8.90	28.83	6.50	7.39	3.78
41-50	57.43	8.13	32.60	5.42	9.97	3.87
51-60	56.45	6.14	33.21	5.12	10.34	4.12
Females						
31-40	58.34	4.54	32.45	3.68	9.21	2.98
41-50	59.45	3.89	31.69	5.21	8.86	3.34
51-60	60.25	5.34	30.29	4.20	9.46	4.56

The study examined the mean counts of various white blood cell types, including neutrophils, lymphocytes, and other cells such as monocytes, eosinophils, and basophils, for both males and females, as detailed in Table 3. For males, the mean neutrophil count ranged from 56.45% to 63.78%, while for females, it ranged from 58.34% to 60.25%, indicating that females had a somewhat narrower range of neutrophil counts. The mean lymphocyte count among males varied from 28.83% to 33.61%, whereas in females, it ranged from 30.29% to 32.45%, showing that males had a broader range of lymphocyte counts. Additionally, the mean counts of other white blood cells like monocytes, eosinophils, and basophils ranged from 7.39% to 10.34% in males and from 8.86% to 9.21% in females, with females showing slightly higher counts. These findings reflect typical variations in white blood cell distributions between genders, highlighting minor differences in cell counts that are generally within expected physiological ranges.

DISCUSSION

The present study found that total white blood cell (WBC) counts increase with age for both males and females, indicating a general upward trend in WBC counts as people grow older. The differences in WBC counts across different age groups were statistically significant. Our findings are consistent with those of Padalia et al.,¹² who also reported a similar increase in WBC counts among males. Conversely, Balasubramaniam et al.³ found no significant correlation between WBC count and age. Additionally, the results of Bovill et al.⁴ support the trend observed in our study.

In our study, although no clear trend in platelet counts was observed among males and females, the variation in platelet counts across different age groups was statistically significant among males. However, the differences in platelet counts between age groups were not significant for females. According to Padalia et al.,¹² females consistently have higher platelet counts across all age groups. Similarly, Balasubramaniam et al.³ reported comparable results. Additionally, Biino et al.⁶ found that mean platelet counts decrease progressively for both males and females, with females having higher platelet counts than males.

The differential white blood cell count reveals that in males, there is an increase in neutrophils and a decrease in lymphocytes with age. Conversely, in females, neutrophils decrease and lymphocytes increase as they age. The counts of other cells, such as eosinophils, basophils, and monocytes, exhibit a slight increase in males but remain unchanged in females. These age-related variations in differential counts are consistent with the findings of Padalia et al.,¹² and Shirakura et al.,⁵ who observed similar trends in both males and females.

CONCLUSION

In conclusion, our study highlights distinct age-related trends in hematological parameters for both males and females, with significant changes in males and less pronounced variations in females. These differences may be attributed to hormonal influences, underscoring the need for further research to understand the underlying mechanisms. The findings contribute valuable insights into the impact of aging on blood cell counts and emphasize the importance of considering gender-specific factors in hematological assessments.

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