Evaluation of Total Leucocyte Count Among Menstruating Female Students Aged 16-30 at Lead City University, Ibadan

Abstract

Introduction: The menstrual cycle and other physiological processes have an impact on the total leucocyte count (TLC), a crucial indicator of immunological function. TLC and immunological regulation are known to be impacted by hormonal changes, blood loss, and physiological stress during menstruation.

Aim/Objective: This study evaluated the variations in total leucocyte count among menstruating female students aged 16-30 years at Lead City University, Ibadan, Nigeria.

Method: Using a hemocytometer and manual leucocyte counting, 88 people participated in a descriptive cross-sectional study. SPSS was used to gather and analyze sociodemographic data as well as information on menstrual cycle features.

Results: Participants who were menstruation had a substantially lower mean leucocyte count (4.773 ± 0.8309 × 10^9/L) than those who were not (6.330 ± 0.9207 × 10^9/L). Leucocyte count was strongly impacted by age group, menstrual cycle length, and menstrual duration.

Conclusion: Leucocyte counts significantly drop during menstruation as a result of immunological modulation, blood loss, and hormonal changes. This emphasizes the necessity of contextualized clinical interpretation of menstrual leucocyte numbers.

Keywords: Total leucocyte count, menstruation, immune function, hormonal fluctuations, menstrual cycle.

1. Introduction

Total leucocyte count (TLC) is a physiological markers that is greatly impacted by the menstrual cycle, which is marked by cyclical hormonal changes. Research shows a significant rise in leukocyte numbers, especially monocytes and granulocytes, during the luteal phase as opposed to the follicular phase, indicating that innate immunity is regulated cycle-dependently[1]. Gender-specific immune responses are influenced by progesterone and androgens, which have immunosuppressive effects, whereas estrogen is essential for boosting humoral immunity [3]. Women's entire health depends on hormonal balance, as these changes are linked to more general health consequences such metabolic problems and reproductive issues [2]. In order to address health issues and optimize healthcare solutions for women, it is imperative to comprehend these dynamics.[4] 5].

Throughout the menstrual cycle, the total leucocyte count (TLC) varies significantly depending on hormonal swings. According to studies, TLC is higher during the secretory period, most likely as a result of heightened progesterone levels, which strengthen immune response mechanisms [6, 7, 8]. Although neutrophil counts continuously increase during this phase, other leukocyte types, like lymphocytes, exhibit less regular patterns [9][10]. Particularly during ovulation, when the danger of infection is higher, the body's adaptive immune response to possible pathogens may be reflected in the rise in TLC during the menstrual and secretory phases [10]. Nevertheless, there is a dearth of information that particularly addresses how stress, lifestyle habits, and limited resources, causing irregular cycles or pain. Supportive measures like education, healthcare access, and stress management can improve menstrual health. The necessity for research examining the potential effects of these differences on their general immunological function is underscored by this gap [7].

This study intends to examine the impact of menstruation on TLC among female students at Lead City University, Ibadan, providing insights into the physiological changes and associated health concerns for this demographic.

2. Materials and Method

2.1 Study Design and Setting

This descriptive cross-sectional study was conducted at Lead City University, Ibadan, a private institution in Nigeria with a diverse student population. The study targeted female students aged 16-30 years.

2.2 Study Design

Participants were selected through stratified sampling to ensure representation across age groups and academic levels.

2.3 Sample Size Determination

Sample size was calculated using Fisher's formula:

The calculated sample size was 88.

2.4 Study Subjects

2.4.1 Inclusion Criteria

- Female students aged 16-30 years.
- Regular menstrual cycles (21-35 days).
- Willingness to participate voluntarily.

2.4.2 Exclusion Criteria

- Use of hormonal contraceptives or medications within the past three months.
- History of chronic illnesses or recent infections.
- Pregnancy or lactation.

2.5 Materials and Equipment

- Hemocytometer
- Microscope
- EDTA tubes
- Turk's solution
- Alcohol swabs

2.6 Clinical Laboratory Investigation

2.6.1 Sample Collection and Analysis

- Venous blood (2 mL) was collected into an EDTA container from participants during menstruation (day 1-5).
- Blood samples were diluted using Turk's solution and analyzed with a hemocytometer under a microscope.
- WBC Count($\times 10^9$/L)=Number of squares counted×Dilution factor×10^6/Number of cells counted

2.7 Statistical Analysis

Data were analyzed using SPSS v23. . Continuous variables uniformly distributed were described using mean with standard deviation (SD). Descriptive statistics summarized sociodemographic data, and Chi-square tests evaluated associations between variables. A p-value of <0.05 was considered significant. Result presented in tables.

3. Results

3.1 Demographic Characteristics of The Study Population

A total number of 88 female students of Lead City University, Ibadan were recruited for the study. The ages of the participants ranged from 16 to 30 years with a mean age and standard deviation of 22.48 ± 3.815. They were categorized into two groups based on their menstruation status as at the time of the study, the menstruating ladies were 51 (58%), non-menstruating ladies are 37 (42%) with a mean age and standard deviation of (21.76 ± 3.374, 23.46 ± 4.200) respectively. The participants were categorized into different age groups with age group 16-20 years having the highest percentage (34; 38.6%) and age group 26 – 30 years being the least (22; 25%). The study population cuts across the five levels of education in the university with participation well captured from the 100 to 500 level classes, with relatively well dispersed representation; 100 level (n=28; 31.8%), 200 level (n=20; 22.7%), 300 level (n=8; 9.1%), 400 level (n=18; 20.5%), 500 level (n=14; 15.2%) (Table 1). Majority of the participants (93.2%) were single with 6 (6.8%) being married. Majority of the participants practice Christianity (69.3%) with Islam (30.68%).

3.2 Leucocytes Count Evaluation of the Study Population

The leucocyte counts of the participants ranged from 3.6 to 8.0 (x10^9/L) with mean and standard deviation of 5.427 ± 1.1598 (Table 1). The leucocyte count by menstruation was evaluated with the menstruating group ranging from 3.6 to 8.0 (x10^9/L) with mean and standard deviation of (4.773 + .8309) and non-menstruating group ranged from 4.5 to 8.0 (x10^9/L) with mean and standard deviation of (6.330 ± .9207) (Table 2).

Table 1: Leucocyte count of the study population

	N	Mean	Std.

			Deviation
Leucocyte count (x10^9/L)	88	5.427	1.1598
Valid N (listwise)	88		

Table 2: Mean of Leucocyte count by menstruation

Menstruating	Mean	N	Std. Deviation

NO	6.330	37	0.9207
YES	4.773	51	0.8309
Total	5.427	88	1.1598

3.3 Relationship Between Leucocyte Count and Age Groups

Comparison of three age groups revealed that there is significant decrease in leucocyte count for the menstruating group with age group 26 – 30 years having the highest value in the group

(Table 3). Also, there is a significant increase in leucocyte count in age group 26 – 30 years in the total population (Table 3), a similar upward trend was observed in the leucocyte count of the non-menstruating group for age group 16 - 20 years (Table 4).

Table 3: Mean and standard deviation of the total population

Leucocyte count (x10^9/L)

Age Group	Mean	N	Std. Deviation
16 - 20 years	5.421	34	1.1129
21 - 25 years	5.150	32	1.0731
26 - 30 years	5.841	22	1.2768
Total	5.427	88	1.1598

Table 4: Mean and standard deviation of the menstruating and non-menstruating group

Leucocyte count (x10^9/L)

Menstruating	Age Group	Mean	N	Std. Deviation
YES	16 - 20 years	4.900	23	0.7410
	21 - 25 years	4.530	20	0.6225
	26 - 30 years	5.012	8	1.3664
	Total	4.773	51	0.8309
NO	16 - 20 years	6.509	11	0.9762
	21 - 25 years	6.183	12	0.8441
	26 - 30 years	6.314	14	0.9820
	Total	6.330	37	0.9207

3.4 Relationship Between Leucocyte Count and Length Of Cycle

Comparison of length of cycle revealed that participants in the menstruating group showed a decrease in leucocyte count with 26 days length of cycle showing the highest in leucocyte count for the menstruating group (Table 5). Also, there is a significant increase in leucocyte count in participants with 25 days in the total population (Table 5), a similar trend was observed in the leucocyte count of the non-menstruating group for 25 days length of cycle (Table 5).

Table 5: Mean and standard deviation of the menstruating and non-menstruating group.

Leucocyte count (x10^9/L)

Menstruating	Length of your cycle	Mean	N	Std. Deviation
YES	25	4.575	4	0.9032
	26	4.993	14	1.0171
	27	4.622	9	0.7120
	28	4.770	23	0.7618
	29	3.900	1	0
	Total	4.773	51	0.8309
NO	25	7.167	3	0.7638
	26	6.417	6	0.9517
	27	5.837	8	1.1488
	28	6.383	18	0.8205
	29	6.300	2	0.0000
	Total	6.330	37	0.9207

3.5 Relationship Between Leucocyte Count and Durations of Menstruation

Comparison of durations of menstruation revealed that participants in the menstruating group showed a decrease in leucocyte count with 6 days duration of menstruation showing the highest in leucocyte count for the menstruating group (Table 6). Also, there is a significant increase in leucocyte count in participants with 6 days in the total population (Table 6). A similar increase trend was observed in the leucocyte count of the non-menstruating group for 3 days duration of menstruation (Table 6).

Table 6: Mean and standard deviation of the total population

Leucocyte count (x10^9/L)

How many days does your menstruation last?	Mean	N	Std. Deviation
3	5.547	30	1.1398
4	5.514	7	0.8153
5	5.244	34	1.1605
6	5.950	4	1.7059
7	5.423	13	1.2742
Total	5.427	88	1.1598

3.3 Impact of Menstrual Cycle Characteristics

- **Age:** Leucocyte counts decreased with age in menstruating participants but increased in non-menstruating participants.
- **Cycle Length:** Participants with a 26-day cycle showed the highest leucocyte counts.
- **Duration of Menstruation:** Six-day durations were associated with the highest leucocyte counts.

4. Discussion

This study illustrates the physiological effects of menstruation on leucocyte counts, showing notable oscillations driven by blood loss, food depletion, and hormone swings. While some studies indicate that leucocyte counts decline during menstruation, other studies show that they rise. For example, one study found that the mean count during menstruation was 6080 ± 33, while the pre-menstrual count was 5313 ± 22 [13]. The intricacy of immunological responses during menstruation is shown by these conflicting results. While lymphocyte levels stay largely constant throughout the menstrual cycle, leukocyte subpopulations—especially neutrophils—show significant fluctuations, with increases noted during ovulation and the mid-luteal phases [11][12]. These counts are further influenced by age, menstrual duration, and cycle length, which reflects the complex interaction between immunological responses and hormone levels [14].
Existing research supports these findings, which are consistent with the immunomodulatory functions of progesterone and estrogen. During pregnancy, progesterone's immunosuppressive actions preserve immunological homeostasis, which is necessary for maternal-fetal tolerance, by promoting a Th2-like cytokine profile [15][16]. On the other hand, at low concentrations, estrogen promotes T-cell activation and Th1-driven immunity, while at greater concentrations, it inhibits these effects [16][17]. Progesterone seems to have protective benefits, while estrogen is linked to a higher risk of autoimmune disorders, demonstrating these mixed roles [18][19]. The need for more study to clarify their clinical significance is highlighted by this hormonal dualism.
From a clinical standpoint, preventing misinterpretation requires an awareness of how fluctuations in leucocyte counts are related to menstrual phases. Leucocyte counts must be interpreted contextually due to significant changes, during the secretory phase and around ovulation [20][21]. Because of the increased risk of infection and nutritional deficits, prolonged or heavy menstruation also calls for greater monitoring [22][23]. Menstruation-related inflammatory processes can interfere with appropriate immune response and food absorption, which highlights the significance of individualized patient care plans. All things considered, these results show that in order to maximize healthcare for women, a comprehensive knowledge of how the menstrual cycle affects immunological parameters is required.

5. Conclusion

Leucocyte counts significantly alter during menstruation, mostly due to hormonal changes, blood loss, and physiological stress. Leucocyte counts decreased among menstruating women in this study, indicating the impact of age, menstrual cycle length, and menstruation duration on these differences. The results highlight the need for context-sensitive clinical evaluations in order to distinguish pathogenic situations from physiological alterations. Understanding these cyclical fluctuations can help women's healthcare initiatives, guide treatment decisions, and increase diagnostic accuracy. Furthermore, treating issues like nutritional deficits and protracted bleeding may help reduce the health concerns that come with menstruation. All things considered, this study offers insightful information about the intricate relationship between immune modulation and menstruation, supporting the use of customized strategies in clinical and public health initiatives aimed at women's health.

6. Recommendation

Future research should include a variety of populations, such as women with menstrual problems, and look into longitudinal patterns of leucocyte variations over several menstrual cycles. It is crucial to conduct research on how lifestyle choices like nutrition, stress, and exercise affect immune function. Clinical procedures will be further enhanced by a deeper comprehension of how hormonal contraceptives affect leucocyte dynamics. These initiatives will guarantee inclusive and thorough approaches to women's health, improving personalized care and diagnostic accuracy.

Ethical approval and Consent

Ethical approval was obtained from Lead City University’s Ethics Committee. Participants provided informed consent, ensuring confidentiality and voluntary participation.

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