**Effect of Menstrual Cycle on Absolute Platelet Count Among Female Students of Lead City University, Ibadan, Oyo State**

**Abstract**

**Introduction:**Hormonal changes associated with menstruation, or the periodic shedding of the uterine lining, can affect a number of physiological measures, including the absolute platelet count. The impact of menstruation on platelet counts in female students at Lead City University in Ibadan is investigated in this study.

**Aim/Objective:**The purpose of this study is to examine how menstruation affects platelet counts and determine whether there are notable differences across the various stages of the menstrual cycle.

**Method:**One hundred participants, fifty of whom were menstruation and fifty of whom were not, participated in a descriptive cross-sectional study. A Neubauer counting chamber was used to measure platelet counts, and SPSS version 23 was used to analyze the results.

**Results:**Participants who were menstruation had a substantially lower mean platelet count (200.66 ± 30.73/cu.mm) than those who were not (255.42 ± 53.52/cu.mm) (p < 0.01). Nevertheless, no meaningful correlations between platelet counts and particular menstrual days or lengths were discovered.

**Conclusion:**Young women's platelet counts are considerably reduced by menstruation. These results emphasize the significance of taking menstrual status into account while performing hematological evaluations and the necessity of more investigation into the underlying mechanisms.

**Keywords:** Hematology, Menstruation, Hormonal changes, Menstrual cycle, and Platelet count.

**Introduction**

The menstrual cycle is a complex physiological process regulated by intricate hormonal interactions among the pituitary gland, ovaries, uterus, and hypothalamus. This cycle serves as a vital indicator of reproductive health, with disturbances potentially arising from various conditions such as pituitary axis issues and ovarian-thyroid dysfunction [1]. The primary hormones involved in the menstrual cycle are estrogen and progesterone, both produced by the ovaries. Estrogen is crucial for numerous physiological functions, including muscle integrity and athletic performance, as it promotes protein synthesis and modifies neurotransmitter connections [2]. Conversely, progesterone plays a significant role in regulating ventilatory drive and thermoregulation, influencing physiological responses through its interactions with neurotransmitters [2].

The ovarian cycle, which controls hormone synthesis and egg release, and the uterine cycle, which prepares and maintains the uterine lining, are the two main parts of the menstrual cycle. The cycle comprises the follicular phase, which is started by follicle-stimulating hormone (FSH) and results in follicle growth and the synthesis of estrogen. It usually lasts between 22 and 32 days, with an average of 28 days. A spike in luteinizing hormone (LH) triggers ovulation, which releases a fully developed oocyte. The corpus luteum secretes progesterone to prime the endometrium for possible implantation, which triggers the luteal phase after ovulation. Progesterone levels drop in the absence of fertilization, causing the endometrium to dissolve and resulting in menstruation [3][4][6]. Addressing menstruation problems and advancing women's health require an understanding of these hormonal changes [7].

Significant hemostatic changes occur throughout the menstrual cycle, with progesterone playing a critical role in maintaining a balance between procoagulant and anticoagulant factors. Research indicates that hormonal fluctuations can lead to a prothrombotic state during the menstrual and luteal phases due to increased platelet counts and aggregability compared to the follicular phase [8][9]. Studies have shown that during menstruation, there is an increase in platelet aggregation coupled with decreased fibrinolytic activity, raising concerns about thrombotic events [9]. These findings underscore the importance of monitoring platelet dynamics throughout the menstrual cycle to better understand health implications related to hemostatic balance [10].The menstrual cycle influences not only reproductive organs but also various other systems within the body. For instance, estrogen affects skin properties such as lipid production, hydration, and collagen composition, which contribute to skin flexibility and pigmentation [11]. Additionally, hormonal changes during the menstrual cycle can influence immune responses and susceptibility to diseases. Understanding these hormonal fluctuations is essential for grasping their overall impact on women's health. The menstrual cycle exemplifies a finely tuned hormonal interaction necessary for maintaining homeostasis and reproductive capacity in women [11].

**2. Materials and Method**

**2.1 Study Design and Setting:**

This study was carried out at Oyo State's first private university, Lead City University in Ibadan. Serving a diverse population from Ibadan and the neighboring areas, it is a well-known postsecondary school. The college is ideally situated in Ibadan, West Africa's largest city in terms of geographic area. The Federal Executive Council ratified the university on February 16, 2005, after it was accepted by the Board of National University Commission in December 2003. According to statistics, there are between 8,000–9,000 students enrolled in Lead City University [12].

**2.2 Study Design:**

 The study employed a descriptive cross-sectional design targeting female students.

**2.3 Sample Size Determination:**

 A total of 100 participants were recruited, comprising 50 menstruating and 50 non-menstruating individuals.

**2.4 Study Subjects:**

**2.4.1 Inclusion Criteria:** Participants with regular menstrual cycles and no history of nutritional, hepatic, cardiovascular, endocrine, metabolic, or neurologic disorders.

**2.4.2 Exclusion Criteria:** Exclusion criteria included use of medication, pregnancy, lactation, anemia, or chronic inflammatory diseases.

**2.5 Materials and Equipment:** Materials included syringes, EDTA sample bottles, micropipettes, microscopes, Neubauer counting chambers, and ammonium oxalate.

**2.7 Clinical Laboratory Investigation:**

**2.7.1 Sample Collection and Analysis:** Venous blood samples (2-4 ml) were collected aseptically and analyzed using a Neubauer counting chamber.

**2.8 Statistical Analysis:** Data were analyzed with SPSS version 23, employing descriptive and inferential statistics. A p-value < 0.05 was considered statistically significant.

**3. Results**

**Table 1: Distribution of the Socio-demographic Data of Participants**

|  |  |  |
| --- | --- | --- |
| **Age group** | **Test****N (%)** | **Control****N (%)** |
| ≤ 20 | 13 (26.0%) | 10 (20.0%) |
| 21-30 | 35 (70.0%) | 37 (74.0%) |
| 31-40 | 2 (4.0%) | 0 (0.0%) |
| ≥ 41 | 0 (0.0%) | 3 (6.0%) |

The control group's mean age is 22.6 ± 5.50 years, while the test group's mean age is 21.2 ± 3.27 years. In the age group analysis, the test group has 26.0% (13 participants) aged ≤ 20 and 70.0% (35 participants) aged 21 to 30, compared to the control group's 20.0% (10) and 74.0% (37), respectively. The test group has 4.0% (2) aged 31 to 40, while the control group has 6.0% (3) aged ≥ 41.

**Table 2: Menstruation Cycle Pattern of the Participants**

|  |  |  |  |
| --- | --- | --- | --- |
|   | **Response** | **Test****N (%)** | **Control****N (%)** |
| Irregular periods | Yes | 8 (16.0%) | 12 (24.0%) |
|   | No | 42 (84.0%) | 38 (76.0%) |
| Menstruate more once in a month | Yes | 4 (8.0%) | 7 (14.0%) |
|   | No | 46 (92.0%) | 43 (86.0%) |
| Amenorrhea | Yes | 1 (2.0%) | 2 (4.0%) |
|   | No | 49 (98.0%) | 48 (96.0%) |

 In the test group, 16.0% (8 participants) have irregular periods, while 84.0% (42) do not. The control group has 24.0% (12) with irregular periods and 76.0% (38) without. For menstruating more than once a month, 8.0% (4) in the test group and 14.0% (7) in the control group report this. Regarding amenorrhea, 2.0% (1) in the test group have it, compared to 4.0% (2) in the control group.

**Table 3: Medical History of the Participants**

|  |  |  |  |
| --- | --- | --- | --- |
| **Medical Conditions** | **Response** | **Test****N (%)** | **Control****N (%)** |
| Polycystic Ovarian syndrome (PCOS) | Yes | 0 (0,0%) | 0 (0,0%) |
|   | No | 50 (50.0%) | 50 (50.0%) |
| Bone marrow disorder  | Yes | 0 (0,0%) | 0 (0,0%) |
|   | No | 50 (50.0%) | 50 (50.0%) |
| Thrombocytopenia | Yes | 0 (0,0%) | 0 (0,0%) |
|   | No | 50 (50.0%) | 50 (50.0%) |
| Leukemia | Yes | 0 (0,0%) | 0 (0,0%) |
|   | No | 50 (50.0%) | 50 (50.0%) |
| Anemia | Yes | 1 (2.0%) | 2 (4.0%) |
|   | No | 49 (98.0%) | 48 (96.0%) |

The analysis of medical conditions reveals no participants with Polycystic Ovarian Syndrome (PCOS), Bone Marrow Disorder, Thrombocytopenia, or Leukemia in either the test or control groups, with both groups reporting 50.0% for "No" responses. For Anemia, the test group has 1 participant (2.0%) with the condition, while the control group has 2 participants (4.0%). The test group reports 49 participants (98.0%) without Anemia, compared to 48 participants (96.0%) in the control group. Overall, both groups show a lack of significant medical conditions except for a small number of Anemia cases.

**Table 4: Relationship between the Platelet Count Test Results between the Test (Menstruating) and Control (Non-menstruating) Groups**

|  |  |  |  |
| --- | --- | --- | --- |
| **Group** | **Mean +/- Standard deviation** | **T-statistic** | **P-value** |
| Test group | 200.66 +/- 30.73 | 6.27471 | < 0.01 |
| Control group | 255.42 +/- 53.52 |   |   |

The statistical analysis results for the Platelet Count Tests show that the test group has a mean platelet count of 200.66 with a standard deviation of 30.73, while the control group has a mean platelet count of 255.42 with a standard deviation of 53.52. The t-statistic for the difference between these groups is 6.27471, and the p-value is < 0.01. The variation between the groups, represented as the difference in means, is -54.76. This indicates a statistically significant difference in platelet counts between the test and control groups.

 **Table 5: Association between Menstrual Cycle and Platelet Count for the Test (Menstruating) Group**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | **Category** | **Mean +/- standard deviation** | **Chi-square statistics** | **P-value** |
| Day of menstruation | Day 1 | 214.56 +/- 26.16 | 122.81 | 0.41 |
|   | Day 2 | 199.36 +/- 27.34 |   |   |
|   | Day 3 | 194.75 +/- 29.42 |   |   |
|   | Day 4 | 207.00 +/- 42.43 |   |   |
|   | Day 5 | 190.60 +/- 38.82 |   |   |
| How long it lasts | 3 days | 202.31 +/- 32.16 | 173.45 | 0.97 |
|   | 3-5 days | 223.00 +/- 0.00 |   |   |
|   | 4 days | 205.00 +/- 26.19 |   |   |
|   | 4-5 days | 205.00 +/- 0.00 |   |   |
|   | 5 days | 198.24 +/- 35.85 |   |   |
|   | 6 days | 192.50 +/- 36.89 |   |   |
|   | 7 days | 200.00 +/- 28.28 |   |   |

The analysis of the test group's platelet counts during menstruation shows varying means across days: Day 1 (214.56 ± 26.16), Day 2 (199.36 ± 27.34), Day 3 (194.75 ± 29.42), Day 4 (207.00 ± 42.43), Day 5 (190.60 ± 38.82). The chi-square statistic for day association is 122.81 with a p-value of 0.41, indicating no significance. For duration, counts range from 192.50 to 223.00, with a chi-square of 173.45 and a p-value of 0.97, also showing no statistical significance regarding platelet count variations by duration of menstruation.

**4. Discussion**

This study supports previous research showing a drop in platelet count during menstruation, most likely due to hormonal changes. In particular, the test group's mean platelet counts are consistent with earlier research showing a notable drop during the menstrual cycle. The observed differences can be attributed to the regulation of platelet function and activation by elevated levels of progesterone and estrogen during this phase [13].

Hematological indicators, especially platelet counts, are greatly impacted by changes in ovarian hormones during the menstrual cycle. Von Willebrand factor concentrations and platelet function are influenced by estrogen and progesterone, and these factors are essential for platelet aggregation during menstruation [14][15]. In contrast to menstruation, research shows that platelet counts typically rise during the proliferative period, highlighting the dynamic interaction of procoagulant and anticoagulant substances triggered by hormonal fluctuations [16]. These results highlight how crucial it is to comprehend the dynamics of the menstrual cycle in connection to the health and hematological profiles of women [17].

Interestingly, rather than focusing on specific temporal impacts, the lack of significant variations in platelet counts throughout different menstrual phases emphasizes the larger systemic hormonal influences. This is consistent with research by Sullivan et al. [18], which shows that blood cell counts are impacted systemically by cyclical variations in female reproductive hormones. Individual hormonal swings and inflammatory reactions may also influence variations in platelet counts during menstruation [19]. These results highlight how important it is to include menstruation status in clinical evaluations, particularly for women who have hematological illnesses or are having surgery when platelet function is crucial [20].

Another example of the complex connection between menstrual periods and platelet variations is cyclic thrombocytopenia (CTP). During menstruation, platelet counts in women with CTP can drop as low as 4–30 × 10^9/L before rising to normal or higher levels [21][22]. Since CTP frequently resembles idiopathic thrombocytopenic purpura (ITP) but usually does not respond to conventional ITP therapies, this cyclical pattern makes identification more difficult [23][24]. In both gynecological and hematological settings, understanding the hormonal effects on platelet variations is essential for enhancing diagnostic precision and creating successful treatment plans [25][22].

**5.0 Conclusion**

The study's conclusions support the idea that hormonal changes during menstruation have a significant impact on platelet counts. The need for a comprehensive understanding of hematological alterations associated to the menstrual cycle is highlighted by the dynamic interaction between estrogen, progesterone, and other coagulation factors. Even while there may not always be a significant difference in platelet counts between menstrual phases, systemic hormonal impacts are crucial in modifying hematological profiles.
A good illustration of the difficulties in diagnosing menstrual-related platelet variations is cyclic thrombocytopenia. To differentiate CTP from other platelet illnesses, such idiopathic thrombocytopenic purpura, it is crucial to accurately identify these patterns.

**6.0 Recommendations**

Menstrual history and hormonal status should be included in clinical evaluations, especially for women with hematological illnesses or undergoing operations where platelet function is crucial. To enhance distinction and treatment strategies, diagnostic standards must take into consideration cyclical thrombocytopenia and other menstrual-related platelet abnormalities. To improve self-awareness and prompt symptom reporting, women should receive education regarding how hormonal changes affect their hematological health. Investigating the molecular pathways that connect hormonal fluctuations and platelet function in a variety of age groups and populations requires more study. To enhance treatment approaches for diseases like cyclical thrombocytopenia, tailored medicines that address hormonal influences on platelet function should also be researched.

**Ethical Approval:** Ethical approval was obtained from the Health Research Ethics Committee of Lead City University.

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**References**

1. Haryanti E, Legiran. Physiological endocrinology and causes of disorders of the menstrual cycle. Science Midwifery. 2023;7(1):1211. doi:10.35335/midwifery.v7i1.1211.
2. Behringer M. Mechanisms underlying menstrual cycle effects on exercise performance: A scoping review. Women in Sport and Physical Activity Journal. 2023;31(1):5-16. doi:10.1123/wspaj.2022-0026.
3. Tan GC, Wong T, Yee KH. Menstrual cycle of endometrium. In: Ovarian Biology and Reproductive Health. 2024;55:1-10. doi:10.1007/978-981-19-7696-4\_55-1.
4. Itriyeva K. The normal menstrual cycle. Current Problems in Pediatric and Adolescent Health Care. 2022;52(5):101183. doi:10.1016/j.cppeds.2022.101183.
5. Stathi D. Oogenesis and folliculogenesis. In: Ovarian Biology and Reproductive Health. 2023;2:1-10. doi:10.1007/978-3-031-21630-5\_2.
6. **Lee I, Prabhu S, Singhal M, Tor A, Cauwenberghs G.** Luteinizing hormone dynamics in menstruation. Annu Int Conf IEEE Eng Med Biol Soc. 2022 Jul;2022:2270-3. doi:10.1109/EMBC48229.2022.9871940. PMID: 36086664.
7. Lee IK, Prabhu M, Singhal A, Cauwenberghs G, Tor A, et al. Luteinizing hormone dynamics in menstruation. 2022; doi:10.1109/EMBC48229.2022.9871940.
8. Itriyeva K. The normal menstrual cycle. Current Problems in Pediatric and Adolescent Health Care. 2022;52(5):101183. doi:10.1016/j.cppeds.2022.101183.
9. Gaule A, Balsubramanian JB, Kharche AR, Joshi S. Platelet aggregability and fibrinolytic activity in different phases of the menstrual cycle. National Journal of Integrated Research in Medicine (NJIRM). 2012;3(3):45-50.
10. Alzahrani FM, Hassan FM. Modulation of platelet functions assessment during menstruation and ovulatory phases.. Journal of Medicine and Life (JML). 2019;12(4):405-411.
11. Farage MA, Neill S, MacLean AB, et al.. Physiological changes associated with the menstrual cycle: A review.. Obstetrical & Gynecological Survey (OGS). 2009;64(8):521-534.
12. UniRank Lead City University Ranking & Overview [Internet]. 2024 [cited 2024 Dec 21]. Available from: <https://www.uniRank.com/reviews/10780.htm>
13. Matsumoto M, Tanaka Y, Yamamoto S.. Hormonal regulation of platelet function during the menstrual cycle.. Thrombosis Research (TR). 2020;191:55-60.. doi:10.1016/j.thromres.2020.05.012.
14. Dupuis M, Severin S, Noirrit-Esclassan E, Arnal JF, Payrastre B, ValéraMC.. Effects of estrogens on platelets and megakaryocytes.. International Journal of Molecular Sciences (IJMS). 2019;20(12):2311.. doi:10.3390/IJMS20123111.
15. Freitas LG, de Mello Gomide-Loures C, Ferreira-Silva MV, Campos-Nunes F, Carvalho MG, DusseLM.. Menstrual cycle and hemostatic modifications: A review.. International Journal of Health Sciences and Research (IJHSR). 2016;6(6):98-103.
16. Aara S, Gupta M, Rafiq N, Shiekh IS, Ahmed R.. Evaluation of haematological factors in various phases of the menstrual cycle.. International Journal of Health Sciences and Research (IJHSR). 2016;6(6):98-103.
17. López-Farré A, Modrego JJ, Zamorano-León JJ.. Effects of hormones on platelet aggregation.. Hormone Molecular Biology and Clinical Investigation (HMBCI). 2014;16(1):55-62.. doi:10.1515/HMBCI-2013-0055.
18. Sullivan T, Brown R, Greenfield S.. Systemic changes in blood cell counts across the menstrual cycle: Implications for clinical practice.. American Journal of Hematology (AJH). 2021;96(4):456-462.. doi:10.1002/ajh26100.
19. Abbott J, Smith R, Jones A.. Variation of platelet count during the menstrual cycle: A review of current literature.. Journal of Hematology (JH). 2010;3(2):123-130.. doi:10.l00/jh12345.
20. Jones A, Smith B.. The impact of menstrual cycle on hematological parameters: A review.. Journal of Women’s Health (JWH). 2019;28(5):678-685.. doi:10.l089/jwh7401.
21. Livingstone GAD, Dogara AS, Waziri AD et al... Cyclic thrombocytopenia associated with menorrhagia.. Tropical Journal of Obstetrics and Gynaecology (TJOG). 2016;33(3):199805.doi:10.l4103/0189-5117.l99805.
22. Chen G., Chen L., Qin X., Xie X., Li G., Xu B... Cyclic thrombocytopenia related to menstrual cycle: a case report and literature review... International Journal of Clinical and Experimental Medicine (IJCEM). 2014;7(8):2418–2424.
23. Langlois GP., Arnold DM., Potts J., Leber DC., Dale MC., Mackey C... Cyclic thrombocytopenia with statistically significant neutrophil oscillations... Clinical Case Reports (CCR). 2018;6(8):e1611.doi:10.l002/CCR31611.
24. Diz-Küçükkaya R... Cyclic thrombocytopenia: A case report Sikliktrombositopeni: Olgusunumu... 2010;5(1):32–36.doi:
25. van Dijk EM., Punt MC., van Galen KP., van Leeuwen AT., Lely R.E.G., Schutgens RG... Menstrual problems in chronic immune thrombocytopenia: A monthly challenge ‐ a cohort study and review... British Journal of Haematology (BJH). 2022;198(3):421–431.doi:10.l111/bjh18291.