

Variations in Complete Blood Counts during Different Phases of Menstrual Cycle in Female Players

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Abstract

The purpose of the study was to examine the Complete Blood Counts status and variations during Different Phases of Menstrual Cycle i.e. Luteal Phase, Menstrual Phase and Follicular Phase of female players. Methodology: For the purpose of the present study, 30 unmarried female players, associated with different sports and were studying in Banaras Hindu University. The age of the subjects ranged between 20 to 25 years with having normal menstrual cycle of 28 ± 2 . Subjects with irregular cycles, gynecological disorders, history of prolonged drug intake were excluded from the study. Blood sample (3-5ml) was taken on the following days by the help of reputed and registered Pathologist and their well trained technicians on 2nd day of Menstruation (Menstrual Phase), 11th day from Menstruation (Follicular Phase) & 22nd day from Menstruation (Luteal Phase). Results: the significant difference found among all the three menstrual phases i.e.- Luteal Phase, Menstrual Phase and Follicular Phase in relation to Lymphocytes in Female Players, other than that insignificant difference was found in relation to all the above mentioned Complete Blood Counts components i.e. Hemoglobin, Total Leucocytes Count, Neutrophils, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticulocytes respectively. Conclusion: The mean value of Hemoglobin found greatest during Luteal Phase; Red Blood Corpuscles found greatest during Follicular phase; White Blood Corpuscles found greatest during Luteal Phase; Platelets found to be greatest during Luteal Phase & Serum Calcium found greatest during menstrual phase.

KEYWORDS: Haemoglobin, Total Leucocytes Count, Neutrophils, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets, Reticulocytes, Menstrual Phase, Follicular Phase & Luteal Phase.

Introduction

Menstruation/Menstrual Phase is the visible manifestation of cyclic physiologic uterine bleeding due to shedding of the endometrium following invisible interplay of hormones mainly through hypothalamus –pituitary –ovarian axis. For the menstruation to occur the axis must be responsive to the ovarian hormones (estrogen and progesterone) and the outflow tract must be patent. (D.C.Dutta, 2009).

The period extending from the beginning of a period (menses) to the beginning of the next one is called menstrual cycle. The first menstruation (menarche) occurs between 11-15 years with a mean of 13 years. It is more closely related to bone age than to chronological age. For the past couple of decades, the age of menarche is gradually

declining with improvement of nutrition and environmental condition. Once the menstruation starts, it continues cyclically at intervals of 21-35 days with a mean of 28 days. Physiologically, it is kept in abeyance due to pregnancy and lactation. Ultimately, it ceases between the ages 45-50 when menopause sets in. The duration of menstruation (menses) is about 2-7 days and the amount of blood loss is estimated to be 20 to 80 ml with an average of 35 ml. nearly 70 percent of total menstrual blood loss occurs in the first 2 days. The menstrual discharge consists mainly of dark altered blood, mucus, vaginal epithelial cells, and fragments of endometrium, prostaglandins, enzymes and bacteria. (D.C.Dutta, 2009). Blood has abundant functions in a healthy body. One of its primary tasks is to deliver oxygen and nutrients to the body's cells. The various components of blood each play an important role in human body. Blood cells are produced by stem cells in the bone marrow. Once these cells develop, they are released into the bloodstream. Red blood cells deliver hemoglobin, which is the iron-bearing protein that makes the transportation of oxygen possible. Also known as erythrocytes, red blood cells make up about 45 percent of blood. The liquid portion of the blood, plasma, makes up about 54 percent of blood's content. Although 90 percent water, plasma contains elements that are essential for sustaining health and life, including critical proteins. The remaining 1 percent of blood's composition is made up of white blood cells (leukocytes) and platelets (thrombocytes). White blood cells help protect the body from infections and disease by destroying the agents that cause illness. The tiny fragments called platelets are important in the formation of blood clots (coagulation). The average adult has about 5 quarts (4 to 5 litres) of blood coursing through his or her body. Several researches show that different phases of menstrual cycle put some noticeable fluctuations in different blood components which are very important to take proper care of women health. (Kara Rogers, 2011). TLC or total leukocyte count is a blood test that measures the number of white blood cells in the body. Any deviation from the normal range implies a disease process. Both increased and decreased values suggest some underlying abnormality. Leukocytes are white colored blood cells which protect our body against infections and diseases. They may reduce in number in certain disease making the body prone to infections. The most important infection-fighting WBC is the neutrophil. The number doctors look at is called your absolute neutrophil count (ANC). A healthy person has an ANC between 2,500 and 6,000. The ANC is found by multiplying the WBC count by the percent of neutrophils in the blood. Lymphocytosis (lim-foe-sie-TOE-sis), or a high lymphocyte count, is an increase in white blood cells called lymphocytes. Lymphocytes are an important part of the immune system. They help fight off diseases, so it's normal to see a temporary rise in the number of lymphocytes after an infection. A heightened percentage of monocytes in your blood can be caused by: chronic inflammatory disease, such as inflammatory bowel disease, a parasitic or viral infection, a bacterial infection in your heart, a collagen vascular disease, such as lupus, vasculitis, or rheumatoid arthritis. Numerous studies in this area show so many fluctuations in complete blood count during different phases of menstrual cycle in normal female or those female who are not regularly involved in any physical activity.

Greater than before participation of women in sports has led to greater awareness of the menstrual cycle alterations that repeatedly accompany exercise and training. This raised consciousness has inspired more scientists to examine the etiologic mechanisms responsible for such changes and has led many athletes to seek medical attention. As

well, menstruation has become less of a road back in achieving sports goals for women. Numerous studies have been undertaken to scrutinize the effects of different phases of menstruation cycle on Complete blood cells, but results have often been inconclusive and contradictory. The reason behind conducting this study was that, so many past studies pointed out that due to menses there are so many haematological fluctuations occurs in female body during different phases of menstruation cycle. The female regularly involved in physical activity as they are players, are too facing these kinds of fluctuations in their blood. This study endeavored to reexamine these components measured by standard methods. In the present study the curiosity of the investigator has taken an initiative to find out the Complete Blood Count status and its variations in females players during menstrual phase, follicular phase and luteal phase of menstruation cycle with lots of effort.

Objectives of the Study

1. To examine the haematological status (Haemoglobin, Total Leucocytes Count, Neutrophils, Lymphocytes, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticulocytes) in Different Phases of Menstrual Cycle i.e. Luteal Phase, Menstrual Phase and Follicular Phase in female players.
2. To discover the haematological variations during Different Phases of Menstrual Cycle i.e. Luteal Phase, Menstrual Phase and Follicular Phase in female players.

Significance of the study:

1. The study will be helpful for developing understanding in coaches and trainers to design a program and take a precaution during competition.
2. The present study will be helpful to understand the haematological (Haemoglobin, Total Leucocytes Count, Neutrophils, Lymphocytes, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Haemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticulocytes) health status of sports women during different phases of menstrual cycle.
3. The study will be helpful to take the precautionary measures and develop the potential in coaches and teachers to tackle this sensitive time more wisely. It is also be helpful for preparing a suitable dietary pattern which can fulfill the need of better performance in sports which are affected by the blood related fluctuations occurs in different phases of menstrual cycle.

Research Methodology

For the purpose of this study, 30 unmarried female players, associated with different sports and studying in Banaras Hindu University were voluntarily selected as subjects. The age of the subjects ranged between 20 to 25 years with having normal menstrual cycle of 28 ± 2 . Subjects with irregular cycles, gynecological disorders, history of prolonged drug intake were excluded from the study.

Selection of Components

Keeping in the view about specific purpose of the study, the following Complete Blood Count were selected:

- 1) Haemoglobin
- 2) Total Leucocytes Count
- 3) Neutrophils
- 4) Lymphocytes
- 5) Eosonophils
- 6) Monocytes
- 7) ESR
- 8) Red Blood cells
- 9) HCT Haematocrit
- 10) PCV Packed Cell Volume
- 11) MCV Mean Corpuscular Volume
- 12) MCH Mean Corpuscular Haemoglobin
- 13) MCHC Mean Corpuscular Hemoglobin Concentration
- 14) Platelets
- 15) Reticulocytes

Design of the Study

Time series design was used. The time series design has only one group but attempts to show change that occurs when the test/ treatment is administered differs from the times when it is not.

Administration of Test

All the subjects received an explanation of nature and purpose of the study and gave their formal written consent to participate in the present study. Prior to obtain data, the subjects were asked to give completed self made questionnaire regarding their medical history, medications, current health conditions and menstrual cycle which was prepared with the help of expert. All subjects were asked to submit their report on regular menstrual cycles for last three cycles. Utmost care was also taken to obtain clinical based data regarding their health status to maintain research decorum. Subjects with irregular cycles, gynecological disorders, history of prolonged drug intake were excluded from the study. Research scholar also made a request to all volunteers for not taking any kind of medication during study without prior information to the scholar. 3-5ml venous blood samples were taken during different phases of menstrual cycle. The required data were taken under the following phases of menstruation cycle:

- (a) Menstrual phase (2nd day of menstruation)
- (b) Follicular phase (11th day from the menstruation starts)
- (d) Luteal phase (22nd Day from the menstruation starts)

Statistical Technique

The below mentioned statistical technique was used to fulfill the need of objectives of the study:

1. Descriptive Statistics
2. One way Analysis of Variance (ANOVA)

ANOVA test was used at 0.05 level of significance. All statistical calculations were done by using standard statistical software SPSS 20.0 version.

Results and Findings of the Study

Table No. 1: Descriptive Statistics & test of Significance of Complete Blood Counts Components

Biochemical Components	Phases	N	Mean	SD	df	F-value	p-value
Haemoglobin	Luteal Phase	30	11.5600	1.33096	87	.279	.757
	Menstrual Phase	30	11.3300	1.07676			
	Follicular Phase	30	11.5000	1.28841			
	Total	90	11.4633	1.22699			
Total Leucocyte Count	Luteal Phase	30	8.6733	2.01904	87	.972	.382
	Menstrual Phase	30	8.6567	1.84516			
	Follicular Phase	30	8.0567	1.98697			
	Total	90	8.4622	1.95124			
Neutrophills	Luteal Phase	30	62.8000	6.57267	87	1.403	.251
	Menstrual Phase	30	64.4667	7.26225			
	Follicular Phase	30	61.3667	7.64507			
	Total	90	62.8778	7.20616			
Lymphocytes	Luteal Phase	30	33.2000	6.57267	87	3.603*	.031
	Menstrual Phase	30	30.0000	6.62284			
	Follicular Phase	30	34.4667	6.72993			
	Total	90	32.5556	6.83368			
Eosonophills	Luteal Phase	30	2.5000	.82001	87	2.914	.060
	Menstrual Phase	30	3.0000	.87099			
	Follicular Phase	30	2.6000	.85501			
	Total	90	2.7000	.86700			
Monocytes	Luteal Phase	30	1.5667	.85836	87	.276	.760
	Menstrual Phase	30	1.5667	.77385			
	Follicular Phase	30	1.4333	.77385			
	Total	90	1.5222	.79645			
ESR	Luteal Phase	30	19.7667	7.85069	87	.080	.923
	Menstrual	30	20.4667	6.39899			

	Phase						
	Follicular Phase	30	20.3000	6.88902			
	Total	90	20.1778	6.99852			
Red Blood Cells	Luteal Phase	30	4.6200	.53642	87	.759	.471
	Menstrual Phase	30	4.4873	.40318			
	Follicular Phase	30	4.6177	.48312			
	Total	90	4.5750	.47609			
HCT (Haematocrit)	Luteal Phase	30	37.4833	3.20227	87	.498	.610
	Menstrual Phase	30	36.6733	2.55004			
	Follicular Phase	30	37.3733	4.25829			
	Total	90	37.1767	3.39100			
PCV(packed cell volume)	Luteal Phase	30	34.8433	3.94625	87	.063	.939
	Menstrual Phase	30	34.5367	2.80092			
	Follicular Phase	30	34.5933	3.80018			
	Total	90	34.6578	3.51485			
MCV(mean corpuscular volume)	Luteal Phase	30	78.2033	7.32207	87	.443	.644
	Menstrual Phase	30	79.4933	6.92596			
	Follicular Phase	30	77.7200	8.31954			
	Total	90	78.4722	7.49796			
MCH(mean corpuscular haemoglobin)	Luteal Phase	30	24.5000	3.16740	87	.010	.990
	Menstrual Phase	30	24.5933	2.96287			
	Follicular Phase	30	24.4900	3.04374			
	Total	90	24.5278	3.02495			
MCHC(mean corpuscular haemoglobin concentration)	Luteal Phase	30	31.7567	1.95778	87	.735	.482
	Menstrual Phase	30	31.2767	1.10631			
	Follicular Phase	30	31.5367	1.41701			
	Total	90	31.5233	1.53000			
Platelets	Luteal Phase	30	2.3340	.55281	87	.632	.534
	Menstrual Phase	30	2.5063	.64199			
	Follicular Phase	30	2.4283	.58502			

	Total	90	2.4229	.59196			
RC(reticuloytes)	Luteal Phase	30	1.1333	.23243	87	.211	.810
	Menstrual Phase	30	1.0953	.20656			
	Follicular Phase	30	1.1173	.24222			
	Total	90	1.1153	.22554			

Level of significance =0.05

Table No.1 reveals the significant difference found among all the three menstrual phases i.e.- Luteal Phase, Menstrual Phase and Follicular Phase in relation to Lymphocytes in Female Players, other than that insignificant difference was found in relation to all the above mentioned Complete Blood Counts components i.e. Hemoglobin, Total Leucocytes Count, Neutrophils, Eosonophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Hemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticuloytes respectively.

Since the One Way Analysis of Variance is found significant in relation to Lymphocytes in Female Players, the least significant difference Post Hoc Test (LSD) is applied to find out the differences of the paired means during all the three phases of menstrual cycle, mean difference for the same are presented in Table No.2.

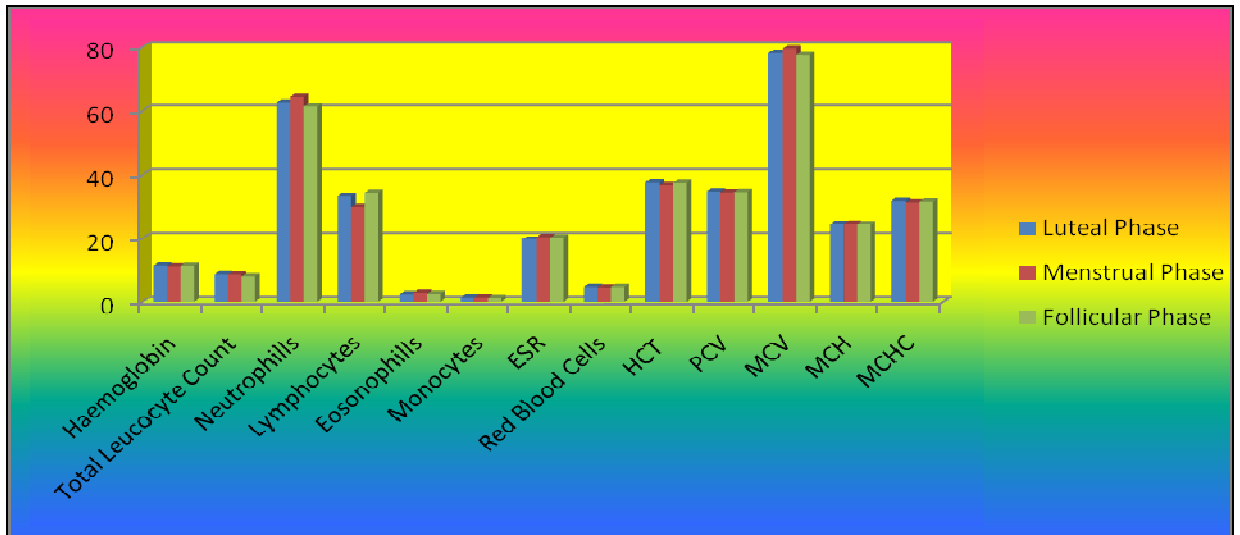
Table No.2:- Multiple Comparisons of Lymphocytes in Female Players during Luteal Phase, Menstrual Phase & Follicular Phase

(I) group	(J) group	Mean Difference (I-J)	Sig.
Luteal Phase	Menstrual Phase	3.20000	.065
Luteal Phase	Follicular Phase	-1.26667	.462
Menstrual Phase	Follicular Phase	-4.46667*	.011

Thus it is evident that in Table No.2:-

- ❖ Insignificant Mean Difference was found between Luteal Phase and Menstrual Phase =3.20000, as p-value>0.05;
- ❖ Insignificant Mean Difference was found between Luteal Phase and Follicular Phase =1.26667, as p-value>0.05;
- ❖ Significant mean difference was found between Menstrual Phase and Follicular Phase =-4.46667*, as p-value<0.05 respectively in relation to Heamatological Components.

Figure 1: Graphical Presentation of Mean Value of Selected Heamatological Components in Female Players during Different Phases of Menstrual Cycle



Discussions on Findings

The result of the present study revealed significant difference found among all the three menstrual phases i.e.- Luteal Phase, Menstrual Phase and Follicular Phase in relation to Lymphocytes in Female Players, other than that insignificant difference was found in relation to all the above mentioned Complete Blood Counts components i.e. Hemoglobin, Total Leucocytes Count, Neutrophils, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Hemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticulocytes respectively. The result of this study has not revealed any significant difference in the change of blood characteristics among different phases of the menstrual cycle. Increase in differential lymphocyte count during Luteal phase in comparison to menstrual phase is due to increase in number of Helper T cells, cytotoxic T cells & Natural killer cells (Faas et al.), that occurs under the influence of steroids which are present during the Luteal & the Follicular phase. The result insignificant difference of the present study may be associated to the fact that the subject of this study were female players who were actively involved to sports at higher level which might have nullified the negative effect in blood components due to hormonal balance resulting involvement in regular physical activity, that could have been otherwise affected the normal female during different phases of the menstrual cycle. Similar Kind of study conducted by **Rajnee, Vinod Kumar Chawla, Raghuveer Choudhary, Bijendra Kumar Binawara, Sunita Choudhary** (2010) entitled **Haematological and Electrocardiographic Variations during Menstrual Cycle** with the objective to find out the Haematological and Electrocardiographic Variations during Menstrual Cycle. The study reveals that the total leukocyte count and total platelet count significantly increased ($p < 0.001$) around mid cycle, however total eosinophil count significantly decreased ($p < 0.05$) during the same period. Differential leukocyte count, bleeding time, clotting time, heart rate, P-R interval and Q-T interval did not show any significant change during

different phases of menstrual cycle, although some mild changes were observed. The logic behind the result of the study evident that blood Red Blood Cells counts were not fluctuating and remains almost constant during Luteal Phase, Menstrual Phase & Follicular Phase of Menstruation Cycle in female players because these subjects are due to proper diet and regular exercise in a systematic and scientific way.

Conclusion

1. **Significant** difference found among all the three menstrual phases i.e.- Luteal Phase, Menstrual Phase and Follicular Phase in relation to Lymphocytes in Female Players
2. **Insignificant** difference was found in relation to Complete Blood Counts components i.e. Hemoglobin, Total Leucocytes Count, Neutrophils, Eosinophils, Monocytes, ESR, Red Blood cells, HCT Haematocrit, PCV Packed Cell Volume, MCV Mean Corpuscular Volume, MCH Mean Corpuscular Hemoglobin, MCHC Mean Corpuscular Hemoglobin Concentration, Platelets & Reticulocytes

References

1. Dalton, K. (1979). Once a month: The menstrual syndrome, its causes and consequences. Hassocks, Sussex: Harvester Press.
2. Dalton, K. (1985). The Premenstrual Syndrome and Progesterone Therapy. Chicago: Year Book Medical Publishers.
3. Dutta D.C.(2009).Textbook on Gynaecology including contraception(Fifth Edition).Kolkatta: New Central Book Agency.
4. Dutta D.C.(2009).Textbook on Gynaecology including contraception(Fifth Edition).Kolkatta: New Central Book Agency.
5. Elsimar, M.Coutinho & Sheldon, J.Segal.(1999).Is Menstruation Obsolete? New York: Oxford University Press.
6. Faas MM, Bouman A, Moes H, Heineman MJ, De Leij LF, Schuiling G.(2000)., The immune response during the luteal phase of the ovarian cycle: a Th2 type response. Fertil Steril; 74: 1008-1013.
7. Gerard J. Tortora, Bryan Derrickson.(2009). Principles of Anatomy & Physiology (12th Edition). Hoboken : John Wiley & Sons,Inc..
8. Gupta S.L.,Gupta Hitesh.(2011).Research Methodology, Text & Cases with SPSS Application. Second Edition.International Book House Pvt. Limited New Delhi.
9. Jerry R. Thomas, Jack K. Nelson, Stephen J. Silverman. (2005).Research Methods in Physical Activity. Fifth Edition.
10. Rajnee, Vinod Kumar Chawla, Raghuveer Choudhary, Bijendra Kumar Binawara, Sunita Choudhary(2010).Haematological and Electrocardiographic Variations during Menstrual Cycle. Pakistan Journal of Physiology, 6(1),18-21.
11. Rogers, K. (2011).The Human Body Blood Physiology and Circulation. Newyork: Britannica Educational Publishing.
12. Verma J. Prakash, (2000).Sports Statistics. Gwalior: Venus Publications.