



P-ISSN: 2394-1685  
E-ISSN: 2394-1693  
Impact Factor (ISRA): 5.38  
IJPESH 2022; 9(2): 333-336  
© 2022 IJPESH  
[www.kheljournal.com](http://www.kheljournal.com)  
Received: 10-01-2022  
Accepted: 13-02-2022

**Komal Borkar**  
Intern, Dr. APJ Abdul Kalam  
College of Physiotherapy,  
Pravara Institute of Medical  
Sciences, Loni, Maharashtra,  
India

**Pradeep Borkar**  
Associate Professor, Department  
of Orthopaedic Physiotherapy,  
Dr. APJ Abdul Kalam College of  
Physiotherapy, Pravara  
Institute of Medical Sciences,  
Loni, Ahmednagar,  
Maharashtra, India

**Corresponding Author:**  
**Komal Borkar**  
Intern, Dr. APJ Abdul Kalam  
College of Physiotherapy,  
Pravara Institute of Medical  
Sciences, Loni, Maharashtra,  
India

## Analysis of physical performance during follicular phase vs luteal phase of menstrual cycle in eumenorrheic and young women

**Komal Borkar and Pradeep Borkar**

**DOI:** <https://doi.org/10.22271/kheljournal.2022.v9.i2f.2488>

### Abstract

**Background:** Over the decade there has been increases in the number of women participating in exercise, physical and recreational activities. This active participation of women attributes to increase demand of physical performance. It has been seen that these performances have been affect over the different phases of menstrual cycle. Fluctuation of hormones in different phases can affect the performance in different ways.

**Aim:** The present study aims to assess and compare the physical performance during follicular phase and luteal phase of menstrual cycle in eumenorrheic and young women.

**Methodology:** After the study design was formulated, ethical clearance was taken from IEC. The study was a comparative type where the physical performance was compared in follicular phase and luteal phase. The study involved 40 regularly menstruating women between the age group 18-24 years. The participants were assessed for functional and sprint performance. The comparison of mean and standard deviation of follicular phase and luteal phase was done.

**Outcome Measures:** Functional performance was measured by single hop test and sprint performance was measured with 30m sprint test.

**Results:** The functional performance of follicular phase showed  $120.7 \pm 13.35$ cm on left side and  $125.4 \pm 12.27$ cm on right side whereas for luteal phase it was  $124.1 \pm 12.73$ cm on left side and  $127.8 \pm 11.83$ cm on right side. The sprint performance of follicular phase showed  $7.75 \pm 0.54$ sec whereas luteal phase showed  $7 \pm 0.6$ sec.

**Conclusion:** The study concluded that eumenorrheic women showed better physical performance in luteal phase when compared to follicular phase.

**Keywords:** Physical performance, menstrual cycle, eumenorrheic women

### Introduction

The menstrual cycle is a natural process which is orchestrated by hormones like estrogen, progesterone, follicle stimulating hormone (FSH) and luteinizing hormone (LH). Studies have shown that estrogen can influence the cardiovascular system (including blood pressure, heart rate and rhythm, and vascular flow), substrate metabolism, and even the brain itself. Progesterone and other progestins, on the other hand, appear to mainly affect thermoregulation, ventilation, and, to a lesser extent, the choice and usage of fuel for energy needs<sup>[1]</sup>. These changes are conventionally divided into phases –early follicular phase (days 1-5), late follicular phase (days 6-12), ovulation (days 13-15), early luteal (days 16-19), mid-luteal (days 20-23) and late luteal (days 24-28)<sup>[2]</sup>.

There is a specific pattern of changes that occurs in menstrual cycle, especially the fluctuation of hormones that occurs in different phases like the follicular phase, is characterized by low levels of estrogen and progesterone; the ovulatory phase, is characterized by high level of estrogen and low level of progesterone; whereas luteal phase is characterized by high levels of estrogen and progesterone<sup>[3]</sup>. As many studies have shown that there is effect on physical activities during menstrual phase due to premenstrual factors such as fatigue, bloating, cramping, irritability, tender breasts, and vaginal discharge.<sup>[4]</sup> whereas recent studies have shown that physical activities of the women are hampered due this alteration in hormones.

Recently women are seen to be more physically involved in sports, athletics, workout at gym and other activities which further make them vulnerable to injuries. Hormonal changes in menstrual cycle influences factors like aerobic and anaerobic capacities, changes in soft tissues, muscular strength, proprioception, neuromuscular co-ordination and postural control, agility, joint stability, muscle stiffness, balance, or ligament laxity [5, 6]. Joint position sense is also an important factor that should be taken into consideration especially the position sense of knee joint as it is influenced by central as well as peripheral mechanisms such as muscles, tendons, articulate, cutaneous and ACL receptors [7].

The study aims to assess the levels of physical performance of eumenorrheic and young women in follicular phase and luteal phase of menstrual cycle.

### Materials and Methods

**Design:** A comparative study was conducted in Dr. APJ Abdul Kalam College of Physiotherapy. Study duration determined was 6 months with a sample size of 40 females.

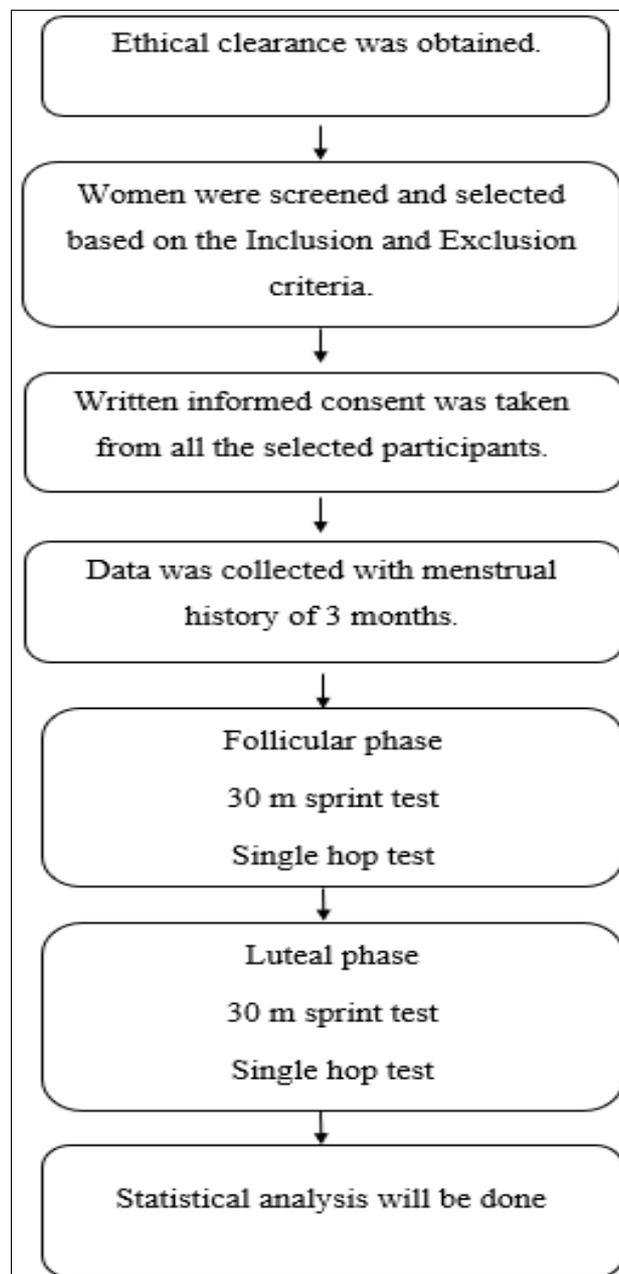
Study design was prepared and approval from the institutional ethical committee was taken. The demographic data of the participant was obtained which includes name, age, weight, height, dominance, information about the menstrual cycle of last 3 months, any abnormal symptoms, any medications taken, any physical injury in last 2-3 months, etc.

On the basis inclusion and exclusion criteria the samples were identified. Informed consent was taken after explaining the procedure to the participant. Further to begin with menstrual history of the participants was obtained. And predicted mid follicular and mid luteal phase dates are noted for each sample.

The physical tests 30 m sprint test and single hop test (SHT) are taken for sprint performance and functional performance respectively. Single hop test is conducted by both dominant and non-dominant lower extremity

### Selection Criteria

Participants were eligible for study if they were aged between 18-24 years, Eumenorrheic women (21-45 days cycle), females who have cleared menstrual history questionnaire, and participants willing to give consent form. Exclusion criteria included participants with history of any systemic illness and recent injuries, females with diagnosed PCOS and PCOD.

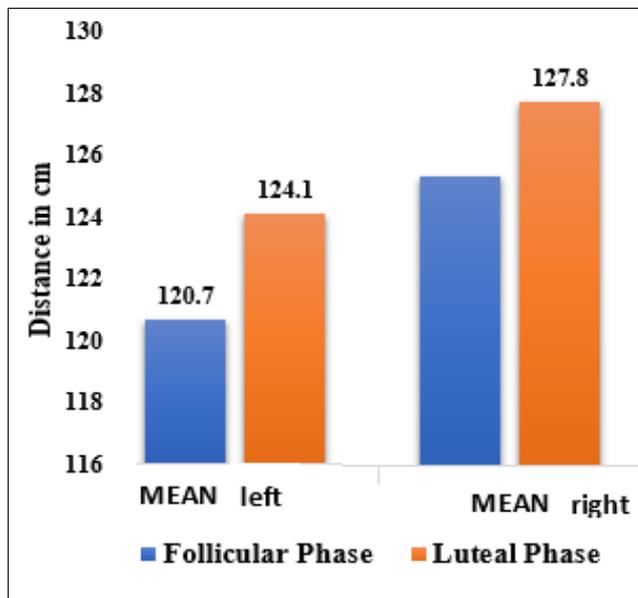


**Fig 1:** Follow chart of Procedure

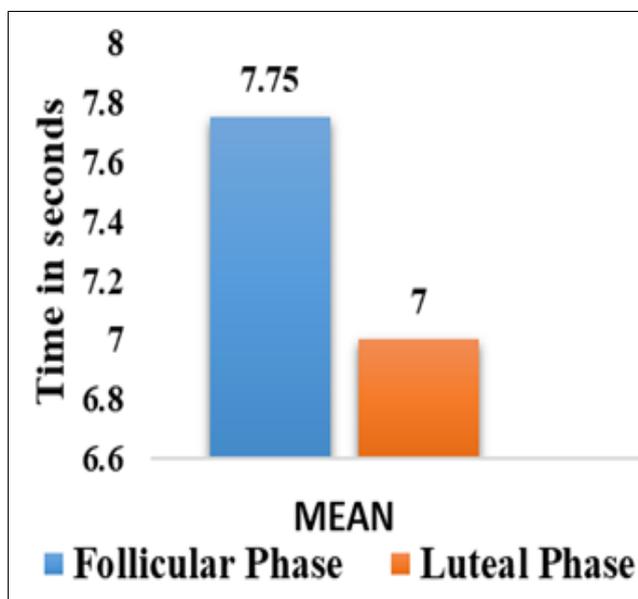
### Results

**Table 1:** Table comparing baseline measurements

	Mean	Standard deviation
Age	21.87	0.79
BMI	22.2	3.51



**Fig 2:** A graphical representation of Mean on single hop test in Functional Performance in Follicular phase and luteal phase.



**Fig 3:** A graphical representation of Mean on 30m sprint test in Sprint Performance in Follicular phase and luteal phase.

The functional and sprint performance was compared in follicular phase and luteal phase of menstrual cycle. The data was collected on the 7th day and 21st day of menstrual cycle for women with 28 days cycle. Following were the results obtained:

The comparison of mean and standard deviation was taken into consideration for functional performance which was measured by single hop test. Scores found were  $120.7 \pm 13.35$  cm for left extremity and  $125.4 \pm 12.27$  cm for right extremity in follicular phase of menstrual cycle. Whereas it was  $124.1 \pm 12.73$  cm for left extremity and  $127.8 \pm 11.83$  cm for right extremity in luteal phase of menstrual cycle.

The comparison of mean and standard deviation was taken into consideration for sprint performance which was measured by 30m sprint test. Scores found were  $7.75 \pm 0.54$  seconds in follicular phase of menstrual cycle whereas  $7.0 \pm 0.6$  seconds in luteal phase.

The results showed that physical performance was better in luteal phase as compared to luteal phase of menstrual cycle.

## Discussion

The study aimed to compare these levels of physical performance in both follicular phase and luteal phase. The results indicated that eumenorrhic women showed better physical performance in luteal phase when compared to follicular phase.

There are a few mechanisms that suggest that the lower levels of estrogen and progesterone during follicular phase of menstrual cycle has a negative influence on physical performance. Firstly, the estrogen is known for its anabolic effect in addition to its role in regulating substrate metabolism through increasing glycogen uptake and sparing glycogen stores [2, 8]. Furthermore, it has been shown to have antioxidant and membrane stabilizer properties, which might offer protection against exercise-induced muscle damage and reduce inflammatory responses [9]. Additionally, estrogen is believed to have neuroexcitatory effects, wherein it reduces inhibition and increases voluntary activation [10]. As a result, when estrogen rises during luteal phase, it is reasonable that it affects the muscular performance whereas it also improves the physical performance [8]. Progesterone may also have anti-estrogenic effect, which further benefit the performance of estrogen in ovulatory phase where the estrogen is high without the involvement of progesterone, while comparing it to luteal phase when both estrogen and progesterone are at higher levels [11].

In resemblance to the current study, Kelly lee McNulty conducted a systematic review as well as meta-analysis to understand the effects of Menstrual cycle on exercise performance in eumenorrhic women where they concluded that exercise performance reduces during early follicular phase as compared to any other phase of menstrual cycle [2].

In current study functional performance and sprint performance have been used to assess the physical performance of eumenorrhic women. The functional test used in the study was single hop test. Estrogen influences the neuromuscular performance as the receptors (alpha and beta) of these hormones were identified in the skeletal muscle, which further affects the performance [5]. The partial inhibition of lysyl oxidase activity, due to a high estrogen milieu might explain the decreasing of the fiber enzymatic cross-linking and hence of the loss of mechanical force production is seen in follicular phase which affects the performance negatively [7].

In the current study comparison of functional performance of follicular phase and luteal phase of menstrual cycle was done which statistically showed that luteal phase has better functional performance when compared to follicular phase of menstrual cycle. These findings also complemented by a study conducted by Aline Tiemi Kami *et al.* suggesting that the functional performance was better in phases with higher estrogen level when compared in three different phases of menstrual cycle. They also mentioned that phases of menstrual cycle should be taken into considerations while development of prevention programs as well as the neuromuscular rehabilitation of young healthy girls.

Secondly, in this study, 30m sprint test was used to assess sprint performance of the eumenorrhic women. Sprinting is used to check the running performance in athletes [12]. Many studies have showed that the numbers and cross-sectional area of muscle fibers are high in leg extensor muscles of female sprinters [12]. Estrogen has a dramatic effect on musculoskeletal function. It has been seen by many researchers that estrogen increases muscle mass, strength and increases the collagen content of connective tissues [13].

Thereby when estrogen increases a better sprint performance is seen. As a result, when comparison of sprint performance was done between follicular phase and luteal phase it statistically showed better performance in luteal phase over follicular phase.

Thus, we conclude that physical performance which was assessed by functional performance and sprint performance was reduced in follicular phase of menstrual cycle when compared luteal phase of menstrual cycle.

### Conclusion

Present study showed significant difference in level of physical performance during different phases of menstrual cycle.

Study also revealed that level of physical performance when assessed on functional and sprint activities was better during luteal phase when compared with follicular phase of menstrual cycle in eumenorrhic and young women.

### Limitations

As the study was time bound the sample size taken was small. In the current study, hormonal levels were not measured using blood samples and measurement of serum hormone levels to examine the accurate phases of menstrual cycle.

### Clinical Implications

Physiotherapists and coaches shall consider the phases of menstrual cycle while designing exercise protocols and sport specific regimes.

### Future Scope of Study

The further studies can check the hormonal levels using blood samples and measurement of serum hormone levels to check the accurate phases of menstrual cycle.

### References

- Constantini NW, Dubnov G, Lebrun CM. The menstrual cycle and sport performance. *Clinics in sports medicine*. 2005 Apr 1;24(2):e51-82.
- McNulty KL, Elliott-Sale KJ, Dolan E, Swinton PA, Ansdell P, Goodall S, *et al.* The effects of menstrual cycle phase on exercise performance in eumenorrhic women: a systematic review and meta-analysis. *Sports Medicine*. 2020 Oct;50(10):1813-27.
- Dutta DC. *Textbook of Gynaecology*, 7<sup>th</sup> edition, New Delhi, Jaypee Brothers medical publishers Ltd, 2013.
- Posthuma BW, Bass MJ, Bull SB, Nisker JA. Detecting changes in functional ability in women with premenstrual syndrome. *American journal of obstetrics and Gynecology*. 1987 Feb 1;156(2):275-8.
- Kami AT, Vidigal CB, Macedo CD. Influence of menstrual cycle phases in functional performance of healthy and young women. *Fisioterapia e Pesquisa*. 2017 Oct;24:356-62.
- Lago-Fuentes C, Padrón-Cabo A, Fernández-Villarino M, Mecías-Calvo M, Muñoz-Pérez I, García-Pinillos F, *et al.* Follicular phase of menstrual cycle is related to higher tendency to suffer from severe injuries among elite female futsal players. *Physical therapy in sport*. 2021 Nov 1;52:90-6.
- Fouladi R, Rajabi R, Naseri N, Pourkazemi F, Geranmayeh M. Menstrual cycle and knee joint position sense in healthy female athletes. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2012 Aug;20(8):1647-52.
- Baltgalvis KA, Greising SM, Warren GL, Lowe DA. Estrogen regulates estrogen receptors and antioxidant gene expression in mouse skeletal muscle. *PLoS one*. 2010 Apr 13;5(4):e10164.
- Isacco L, Boisseau N. Sex hormones and substrate metabolism during endurance exercise. In *Sex Hormones, Exercise and Women*, Springer, Cham, 2017, 35-58.
- Ansdell P, Brownstein CG, Škarabot J, Hicks KM, Simoes DC, Thomas K, *et al.* Menstrual cycle-associated modulations in neuromuscular function and fatigability of the knee extensors in eumenorrhic women. *Journal of Applied Physiology*. 2019 Jun 1;126(6):1701-12.
- Frankovich RJ, Lebrun CM. Menstrual cycle, contraception, and performance. *Clinics in sports medicine*. 2000 Apr 1;19(2):251-71.
- Bezodis NE, Willwacher S, Salo AI. The biomechanics of the track and field sprint start: a narrative review. *Sports medicine*. 2019 Sep;49(9):1345-64.
- Chidi-Ogbolu N, Baar K. Effect of estrogen on musculoskeletal performance and injury risk. *Frontiers in physiology*, 2019, 1834.
- Bhoir KV, Borkar P. Effect of functional mobility exercises on ankle range of motion and balance in airhostess.
- Pawar SB, Borkar P. Effect of ladder drills training in female kabaddi players. *International Journal of Physical Education, Sports and Health*. 2018;5(2):180-4.
- Logde A, Borkar P. Effect of retro walking on hamstring flexibility in normal healthy individual. *Int J Phys Educ Sports Health*. 2018;5(3):71-3.
- Brijwasi T, Borkar P. To study the effect of sports specific training program on selective physical and physiological variables in basketball players.
- Mathew S, Janbandhu K, Borkar P. Effectiveness of Eccentric Exercise and Neuromuscular Electrical Stimulation on Quadriceps Function in Grade II Osteoarthritis-A Randomized Control Trial.