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## A comparative study of psycho-physical and health related fitness variables of sports and non-sports college women during different menstruation cycle: A review study

**Iti Chakraborty and Sumanta Kumar Mondal**

### Abstract

Today sports and physical activity as a strategy for the empowerment of girls and women has been gaining recognition worldwide. But sports activities required different levels of fitness and abilities as per the level of competition and requirement of that particular skill or events. Menstruation is an important part of every women's life cycle. A woman begins to go through a series of hormonal changes during the menstruation cycle that occur once every month. An attempt has therefore been made in this paper to discuss the comparison of psycho-physical and health related physical fitness variables of sports and non-sports women in their different menstruation phases by a review study. The paper reviewed that the observation of performance in athletic events and had also documented specific physical, psychological and physiological changes as they relate to varying hormonal levels of the menstrual cycle. Another paper reviewed that the different phases of the menstrual cycle had little or no effect upon the relationships among body weight, percent body fat, knee extension and flexion, strength and endurance. One more paper reviewed that the sensitivity of psychological factors should be taken into consideration while planning training programme as well as should be clinically treated during menstrual phases. The paper concluded that there is considerable variation in the finding of the literature and that any reported variations in performance may well be greatly influenced by inter subject variability, the nature of fitness level, psycho-physical status and the nutritional status of the athletes and non-athletes as well as minor changes that could be attribute to the menstrual cycle. The paper recommended that further more specific investigation in the health fitness and psycho-physical variables of sports and non-sports women during menstrual phases can contribute in the training field of women for enhancement of performance.

**Keywords:** Psycho-physical, health related fitness, sports, non-sport

### Introduction

Everyone (Adolescent boys and girls) who is about to enter puberty (The process of body changes that cause a child's body to become an adult body capable of reproduction) should be taught or know the definition of menstruation. It is a part of the monthly menstrual cycle that occur in the female reproductive system that makes pregnancy possible. The normal menstrual cycle is 28 days although normal cycles vary between 22 and 36 days. The menstrual cycle consists of four phases-

1. Bleeding or Menstruation Phase- (1 to 7 days)
2. Follicular Phase-(8 to 13 days)
3. Ovulatory Phase- (14 to 21 days)
4. Luteal Phase- (22 -28 days)

Many health-related fitness factor like Cardio-vascular endurance, Muscular strength, Muscular endurance, flexibility and body composition can also affected during the menstruation cycle of a woman and during sports activity. Fitness is a basic requirement for all human full life. Sports performance is also depended on this fitness variables for better result in competition.

Menstrual cycle is controlled by the endocrine system and requires adequate hormonal and nutritional status to function.

Since the menstrual cycle is dependent on the synchronized operation between system failures can occur at any point. Menstrual cycle discomfort or distress ranges from clinically defined and physiologically menstrual symptoms.

Many women who experience premenstrual syndrome or PMS, a collection of unpleasant symptoms, such as anxiety and bloating, that typically occur one to two weeks before menstruation and might influence behavior through in the menstrual cycle. The truth is that the hormones in a woman's body can influence her moods and actions throughout the month. We know hormone level fluctuate throughout the month.

### A reviews

Jahroni. M.K, Gaeini. A and Rahimi. Z. (2008) <sup>[1]</sup>. Influence of a physical fitness course on menstrual cycle characteristics. The purpose of the study was to evaluate the effect of a period of exercise on physical and psychological symptoms of menstruation, dysmenorrhea, oligomenorrhea and amenorrhea. 250 students of Shiraz University participated in a fitness course. The study design was semi experimental with one group. Prior and after 12 weeks of a physical fitness program, subjects completed questionnaires on menstrual distress and the physical fitness training programme also. The t test was used for analysis of the data. The finding indicate that selected physical fitness exercise positively influenced menstrual symptoms.

Kishali. N.F, Imamoglu. O.K.D, Atan. T and Akyol. P. (2006) <sup>[4]</sup>. Effect of menstrual cycle on sports performance. The effects of menstrual cycle on female athletes performance. 48 taek-wondo athletes, 76 judo, 81 volleyball and 36 basketball players (Total 241) elite athletes participated in the study. A questionnaire constituted from 21 questions about menstrual cycle applied. A one-way analysis of variance and scheffe tests were used to find difference between sport branch about physical and physiological characteristics. Chi Square was used to evaluate the regularity of menstrual cycle. It has been concluded in this study that the menarche age was high in the athletes. It has found that the physical performance was not affected by the menstrual period and the pain decreased during the training and competition.

Kapri. B.C. (2014) <sup>[2]</sup>. Psychosocial health status of female players during different phases of menstruation cycle. The purpose of the study was to examine the psychological status (Pain, water retention, autonomic reactions, negative affect, impaired concentration, behavior changes, arousal, control) of female players during Menstrual Phase, Follicular Phase and Luteal Phase. For this study 31 unmarried female players were selected. Who were associated with different sports and were studying in Banaras Hindu University. Age of the subjects ranged between 20 to 25 years with having normal menstrual cycle. Menstrual Distress Questionnaire has been used which was developed by Rudo F H. Moos. Data were taken in three menstruation phases in their particular day. Psychological status of this study were found a high intense severity during Menstrual Phase in comparison to Luteal & Follicular Phase in female players, only water retention was found highest during follicular phase.

Eston. G.R. (1984) <sup>[3]</sup>. The regular menstrual cycle and athletic performance. The study of fluctuation in athletic performance attributable to the menstrual cycle has been an area of considerable. Studies have included simple observation of performance in athletic events, and have also documented specific physical, psychological and physiological changes as they relate to varying hormonal

levels of the menstrual cycle. It is concluded that there is considerable variation in the finding of the literature and that any reported variation in performance may well be greatly influenced by inter subject variability, the nature of the exercise and the nutritional status of the athletes, as well as minor changes that could be attributable to the menstrual cycle.

Fraccaroli. G. (1980) <sup>[5]</sup>. Sports performance of women during the menstrual cycle. It has been examined by many authors, but the comparison of performance during all menstrual cycle has been less examined. The result of a research carried out on a group of 40 women attending the Parallel courses of Verona, of ISEF of Bologna, are illustrated. The conclusion of this research are: a less sporting efficiency in the premenstrual period, a normal or almost normal efficiency in the other period, including the menstrual one as well.

Gamberale. F, Strindberg. L. and Wahlberg. I. (1975) <sup>[6]</sup>. Female work capacity during the menstrual cycle: physiological and psychological reaction changes in physical and mental work capacity during the menstrual cycle were studied in 12 healthy women with severe menstrual distress. Physiological and psychological tests were performed before, during and after menstruation. Heart rate, pulmonary ventilation, oxygen uptake, blood lactate concentration and perceived exertion were measured during work on a bicycle ergometer at two submaximal workloads corresponding to 40-70% respectively, of individual maximal oxygen uptake. Mental work capacity was studied with the aid of performance tests of psychological functions such as attention, short term memory, perceptual speed, perception of time and reaction time. There were no changes occurred in heart rate could be observed over the three phases. But in pulmonary ventilation during work varied significantly. At the same heart rate exercise was perceived as more exerting in the menstrual phase than in either the premenstrual phase than in either the premenstrual or post menstrual phase. Among the performance tests significant result were obtained only in a test of reaction time, which was slightly impaired during the menstrual phase. The result of the performance tests do not however support the assumption that menstruation affects a woman's mental work capacity.

DiBreezzo. R, Fort. L.I. Brown. B. (1991) <sup>[7]</sup>. Relationships among strength, endurance, weight and body fat during three phases of the menstrual cycle.

21 female subjects, ages 18-36, with normal menstrual cycles and no dysfunction were tested for strength and endurance of the knee flexors and extensors on a cybex 11 isokinetic dynamometer. Each subject was tested at three speeds (60 degree, 180 degrees and 240 degrees/sec) during three phases of the menstrual cycle: menses (Within 24 hours of onset), ovulation (13-14 days from onset) and luteal (10 days from ovulation). The data were analyzed descriptively and by Pearson Product-Moment correlations with each phase of the cycle and between cycle phases. Result were indicated high correlation among most strength measures at the three test speed for each phase during the cycle phases. The conclusion of the study were the different phases of the menstrual cycle had little or no effect upon the relationships among body weight, percent body fat, knee extension and flexion strength or endurance.

Hunter. S., Schraer. R, Landers. DM, Buskirk. E.R and Harris. DV. (1979) <sup>[8]</sup>. The effect of total oestrogen concentration and menstrual cycle phase on reaction time performance during the pre-menstrual-menstrual phase of the cycle and the relationship of plasma oestrogen concentration

to react on time. 18 young women using oral contraceptive and 18 young women normally cyclic were included in this study. Testing once per week throughout two menstrual cycle consisted of simple, complex and choice reaction time tests and blood sampling also. No significant differences in performance were found on the simple and complex tasks. A direct relationship between oestrogen concentration and reaction time performance could not be supported by the finding.

Loucks. J and Thompson. H. (1968) <sup>[61]</sup>. Effect of menstruation on reaction time. Research in the area of menstruation is necessary because of controversial attitudes towards physical activity at specific times during the cycle. These attitudes are not always based on scientific fact. As was stated by Jewell Nolen in an investigation of menstrual problems, there are "basic deficiencies in knowledge or attitudes among the subjects that would intensify the problems of menstruation". 44 college women to determine the effect of menstruation on total body reaction time. He concluded that the menstrual cycle does not affect total body reaction time.

Kumar. S., Mufti. M. and Kisan. R. (2013) <sup>[62]</sup>. Variation of reaction time indifferent phases of menstrual cycle. The study was conducted on 30 healthy, regularly menstruating female subjects were in the age group of 18-25 years. Influence of different phases of menstrual cycle on Auditory Reaction Time (ART) And Visual Reaction Time (VRT) was evaluated by using a portable audio visual reaction time apparatus. There were significant increases in ART and VRT during Luteal phase, as compared to those in Follicular phase.

Guler. D. and Gunay. M. (2019) <sup>[9]</sup>. Investigation of the effect of menstruation period on sportive performance of women's Futsal players. A total 8 healthy, active and volunteer women players who had a regular menstruation period and didn't use any regulatory medical supplement (Oral contraceptive) were recruited for this study. To analyse data, means of age, height, body weight and BMI values of the players, standard deviation, minimum and maximum values were calculated. Two way ANOVA tests from non-parametric tests was employed to determine. If there is a difference among menstrual phases. Finding indicate that flexibility, vertical jump and anaerobic power values showed significant decreases, while other performance variables did not show statistical significant differences among menstrual cycle. It had been concluded that menstrual cycles of women futsal players do not affect the flexibility, power, speed, anaerobic and aerobic power performance.

Is there a difference toward strength, muscular endurance, anaerobic power and hormonal changes between the three phases of menstrual cycle of active girls. 20 young girls were selected randomly in the age group 20 to 30. Hormonal changes in Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), one repetition maximum of upper body and lower body and muscular endurance test in the three phases of the menstrual cycle were measured. Also, running based anaerobic sprint test (REST) was used to estimate anaerobic power. The result indicate that there was no significant difference between muscular strength and endurance in the three phases of menstrual cycle. Also the result, indicated no significant difference in anaerobic power in the three phases of menstrual cycle. In contrast, there was a significant difference between LH and FSH levels in the menstrual cycle phases.

Sarwar. R., Niclos. B.B. and Rutherford. O.M. (1996) <sup>[10]</sup>. The effect of the different phases of the menstrual cycle on skeletal muscle strength, contractile properties and

fatiguability was investigated in ten young, healthy females. It were compared with a similar group on the combined (non-phasic) oral contraceptive pill (OC). Cycle phases were divided into the early and mid-follicular, mid-cycle (Ovulatory) and mid and late luteal. Subjects were studied weekly through two complete cycles. Measurements included quadriceps and handgrip maximum voluntary isometric force and the relaxation times, force-frequency relationship and fatigue index of the quadriceps during percutaneous stimulation at a range of frequencies from 1 to 100 Hz. In the women not taking the OC there was a significant increase of about 11% in quadriceps and handcrips strength at mid-cycle conspared with both the follicular and luteal phases. Accompanying the increases in strength there was a significant slowing of relaxation and increase I fatiguability at mid-cycle. No changes in any parameter were found in the women taking the OC.

Jaiswal. N. (2017) <sup>[11]</sup>. Consequences of menstrual cycle on soccer playing ability- A psychological study. 50 female soccer players between age range 18-28 years who took part in university or national le vel tournament. /soccer playing ability of these selected subjects was as curtained approximately 2 days before during and 2 days after the menstruation. Similarly, cooper's JCR test was admi nistered to each subject approximately 2 day before, during and 2 days after the menstruation. Psychological test for anxiety were selected for this study. Performance obtained by motor fitness test like chin-ups, shuttle run and vertical jump. Soccer skill performance has been observed by five items namely-kicking (left-right), throwing, dribbling and kicking for accuracy. The result indicate that soccer playing ability differ significantly during different phases of menstrual cycle. The result were same for motor fitness. It was observed that soccer playing ability and motor fitness reduce significantly before and during menstruation as compared to post menstruation period. Anxiety had no significant association with playing ability of female soccer players but significantly associated with their motor fitness. The result of this study therefore confirms the previous theories associated with sports performance in a way that in a sport like soccer execution of basis fundamental skill is pre-requisite for any good players. Since psycho-physical ability of female soccer players get affected before and during menstruation, its reflects negatively on their soccer playing ability.

Xaane AK Jansede. J. (2003) <sup>[34]</sup>. Effects of the menstrual cycle on exercise performance. This article reviews the potential effects of the female steroid hormone fluctuations during the menstrual cycle on exercise performance. The measurement of estrogen and progesterone concentration to varity menstrual cycle phase was a major consideration in this review. The significance of this finding should be questioned due to the low reproducibility of the time to exhaustion test. Practical implication for female endurance athletes may be the adjustment of competition schedules to their menstrual cycle, especially in hot, humid conditions. The small scope of the current research and its methodological limitation warrant further investigation of the effect of the menstrual cycle on prolonged exercise performance.

Each woman had different characteristics of menstrual cycle. The main problem is the determination of period in which the measuring would be carried out, so that the result could be directly linked to a certain hormone or phase of the menstrual cycle. Generally it could be said that menstrual contractility and maximum oxygen consumption, lactate level, heart rate, breathing volume, hemoglobin levels. Therefore, women who

compete in anaerobic and aerobic sports do not have to adjust competition schedules to their menstrual cycle. On the other hand the increase of the body temperature in the luteal phase of the menstrual cycle, possible Cardiovascular strain in this phase, influence of progesterone on the respiratory center, the rise of breathing frequency and volume can have negative influence on long term intensive sports activities. For this sort of activity female athletes were recommended to adjust their competition schedule to menstrual cycle.

To investigate changes in self-reported physical fitness, performance, and side effects across the menstrual cycle (MC) phases among competitive endurance athletes and to describe their knowledge and communication with coaches about the MC.

Methods: The responses of 140 participants (Older than 18 y) competing in biathlon or cross-country skiing at the international level were analyzed. Data were collected via an online questionnaire addressing participants' competitive level, training volume, MC history, physical fitness, and performance during the MC, MC-related side effects, and knowledge and communication with coaches about the MC and its effects on training and performance.

### Results

About 50% and 71% of participants reported improved and reduced fitness, respectively, during specific MC phases, while 42% and 49% reported improved and reduced performance, respectively. Most athletes reported their worst fitness (47%) and performance (30%) and the highest number of side effects during bleeding ( $p < .01$ ; compared with all other phases). The phase following bleeding was considered the best phase for perceived fitness (24%,  $p < .01$ ) and performance (18%,  $p < .01$ ). Only 8% of participants reported having sufficient knowledge about the MC in relation to training, and 27% of participants communicated about it with their coach.

### Conclusions

A high proportion of athletes perceived distinct changes in fitness, performance, and side effects across the MC phases, with their worst perceived fitness and performance during the bleeding phase. Because most athletes indicate a lack of knowledge about the MC's effect on training and performance and few communicate with coaches on the topic, the authors recommend that more time be devoted to educating athletes and coaches.

Ross Julian *et al.* (2021) [63] the aim of the study was to investigate whether menstrual cycle phases influence the physical performance during soccer match-play.

Methods: Fifteen elite female soccer players, with physiologically normal menstrual cycles, competed in matches over a four-month period. Physical performance was assessed via GPS and expressed as meters per minute, and separated into four individualised thresholds (Low, high, very high and sprinting). Seventy-six complete individual match observations, 36 from the follicular and 40 from the luteal phase were recorded. The differences in physical match performance parameters between the cycle phases were evaluated using a mixed linear model.

Results: The results of the current study indicate that very high-intensity running distance was significantly greater during the luteal phase compared to the follicular phase ( $5.90 \pm 2.16$  m.min<sup>-1</sup> vs.  $6.64 \pm 2.72$  m.min<sup>-1</sup>;  $p = 0.02$ ). However, this finding was accompanied by large variations across matches (CV = 39.5%).

Conclusions: Overall, the results suggest that the menstrual cycle phase does not influence match physical performance of female soccer players to a significant degree. Therefore, at present, interventions or other methods of coping with menstrual cycle phase do not seem necessary on a group/team level to maximise competitive physical performance.

### Discussion of finding

After a careful investigation and going through the available literature and the research studies done by various researcher's investigation Psycho-Physical and Health Related Fitness Variables of Sports and Non-Sports College Women During Different Menstruation Cycle it was seen that women athlete's performance is very less effected or in different words has no effect due to menstruation cycle period. It is because the women athletes psychological and physical abilities are not affected by menstrual cycle.

The existence of low and high responders should also be investigated; Julian *et al.* (2017) [35], and Kishali. N. F. *et al.* (2006) [4] suggested that some athletes may be more or less susceptible to changes in performance as a result of MC phase. Given that some athletes report their performance to be affected by MC phase and others do not and it is known that some females are more susceptible to experiencing severe menstrual symptoms than others, it is feasible there are individual differences in the extent to which MC phase affects performance. It would be useful to determine if low and high responders to these MC phase effects exist, and if they do, how these responders can be identified. Sub-group analyses conducted between athletes with and without pre-menstrual syndrome should also be performed to determine if pre-menstrual syndrome predisposes athletes to greater MC-based changes in performance.

Jahroni. M.K, Gaeini. A and Rahimi. Z. (2008) [1] suggested after investigating the Influence of a physical fitness course on menstrual cycle characteristics that selected physical fitness exercise positively influenced menstrual symptoms.

Eston. G.R. (1984) [3]. In his study on the regular menstrual cycle and athletic performance also supported the same results as in his study the finding showed that there was considerable variation in the finding of the literature and that any reported variation in performance may well be greatly influenced by inter subject variability, the nature of the exercise and the nutritional status of the athletes, as well as minor changes that could be attributable to the menstrual cycle.

Fraccaroli. G. (1980) [5]. Gamberale. F, Strindberg. L. and Wahlberg. I. (1975) [6]. Sports performance of women during the menstrual cycle. Female work capacity during the menstrual cycle The result of the performance tests do not however support the assumption that menstruation affects a woman's mental work capacity.

However the results of the study done by DiBreezzo. R, Fort. L. I. Brown. B. (1991) [7]. Investigating Relationships among strength, endurance, weight and body fat during three phases of the menstrual cycle suggested that there were the different phases of the menstrual cycle had little or no effect upon the relationships among body weight, percent body fat, knee extension and flexion strength or endurance.

The variation in findings of different research scholars largely depends upon the conditions and maturity level of the subjects taking part in the studies. Psychological trait of the women athletes also play a curtail role in the ups and down seen in the performance before and during the menstruation cycle period.

## Conclusions

A large number of female athletes believe specially the beginners and non-mature athletes that their performance is impacted by MC phase, but the research pertaining to objective measures of performance throughout the MC in eumenorrhic athletes does not provide a definitive indication of how performance may fluctuate throughout the MC. Many studies have suggested that performance does not fluctuate or vary between different MC phases. In the studies that did observe a MC effect to performance, there were inconsistencies in findings but strength and aerobic performance were most commonly reported to be impaired during the late luteal phase (22 - 28 days), and anaerobic performance was most frequently reduced in the late follicular phase (8-13 days). With regards to perceived performance, the late luteal phase was also one of the phases athletes perceived their performance declined. The research that finds the MC does have a mediating role in physical performance shows that MC phases affect strength, aerobic and anaerobic performance differently. If at all training is to be modified based on MC phase, the predominant performance variable being utilized and aims of training sessions must be carefully considered. In examining the literature, there are many unsolved questions related to the effect of MC phase on athletes that still may need to be investigated, and in attempting to determine why performance may or may not fluctuate, it became evident there are also inconsistent findings on mechanistic outcomes, such as muscle and tendon stiffness or substrate metabolism, throughout the MC. Therefore, further research is needed to throw more light on un answered questions for the betterment of the academic, athlete and applied sport science communities' understanding of how the MC actually affects athletes' performance and factors underpinning performance to inform decision-making and develop effective athlete management strategies to maximize performance and maintain health.

## Summary

It has been an issue of debate since long time about the effect of menstrual cycle upon sports performance. It has been observed in many review papers that significantly menstrual cycle does affect physical, psychological, physiological and biological aspects of women athletes. More women are engaged in sports now a days and their athletic performance is becoming increasingly more remarkable. One of the many important factors that may alter athletic performance is hormonal changes in the body.

Exercise training has obvious health benefits, but high training loads can have an adverse effect on the normal menstrual cycle. Young girls who undertake intense exercise training in conjunction with having a low body mass and a low percentage of body fat may experience a delayed menarche. The female sex steroid hormones oestrogen and progesterone had potential effects on exercise capacity and performance through numerous mechanisms including substrate metabolism, cardio-respiratory function and thermoregulation. These hormones may also influence psychological factors and increase the incidence of injuries. Consequently, changes in hormone level improve or decrease performance at various times throughout the menstrual cycle (Constantini *et al.* 2005) [24]. Women players gave the best performance during their beginning of the menstruation period. One study concluded that menstruation cycle of women's volleyball players do not effect the flexibility, muscular strength, endurance, speed and anaerobic power

performance (Iskender Guler 2019) [9].

In a nutshell, it can be concluded that many study stated that the sensitivity of fitness and psycho-physical facts i.e. Pain, Reaction time, Behaviour change. Speed of movement, flexibility, percentage body fat, endurance, strength should be taken into consideration while planning training programme. In the present study, researcher want to compare the health related fitness and psycho-physical variables in the four phases of menstrual cycle for better result in the high level performance.

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