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# Does Menstrual Cycle Affects Muscle Performance Capability among Garment Workers

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**Original Research Article**

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**Abstract:** Garment factories in India is the second largest sector for employment, approximately 60% of the population employed in the garment industry are women. Menstrual cycle is a physiological phenomenon during reproductive life of women. Its phases are influenced by alteration in the concentration of hormones such as estrogen and progesterone. Fluctuating levels of sex steroids across normal menstrual cycle affect sensory- motor association of an individual. So this study was done to assess the muscle performance capability in terms of hand grip strength (strength of upper limb muscles) as Maximum Voluntary Contraction (MVC) and time for fatigue at 30% of MVC during Menstrual, Proliferative and Secretory Phase of menstrual cycle among 54 garment workers. Maximum voluntary contraction was higher during secretory phase than proliferative and menstrual phase. And time to fatigue at 30% MVC was also found to be higher during secretory and proliferative phase compared to menstrual phase. Overall muscle performance capability was found to be better during secretory phase of menstrual cycle, may be due to increased blood flow to the muscle and glycogen storage under the influence of estrogen and progesterone. Estimation of female sex hormones during different phases and its correlation to muscle performance may reveal more facts.
**Keywords:** menstrual cycle, garment, women, muscle performance, maximum voluntary contraction, time to fatigue.

## INTRODUCTION

India is one of the fast growing economies in the world; the textile industry in India is an area which contributes to the economic growth. In India, the readymade garment industry is providing employment to more than 3 million people and the majority is from low socioeconomic status covering both men and women [1].

The workers in the garment factories are mainly exposed to prolonged sitting, prolonged standing, highly repetitive work, lifting of heavy objects, working with their hands lifted to shoulder level or even higher, and working with their back twisted or bent forward, that have been shown to predict impaired work ability and enhance long-term sickness [2]. The workers also perform hard work and work for long hours. According to the data available, approximately 60% of the population employed in the garment industry are women [3].

In women the reproductive function is cyclical and is characterized by cyclical endocrine profile. Both estrogen and progesterone have individual, interactive and sometimes opposing physiological actions. Fluctuating levels of sex steroids across normal menstrual cycle affect sensory- motor association of an individual [4]. The changes in muscle strength, relaxation and fatigability in humans during menstrual cycle may be due to fluctuations in sex steroid levels, in particular estrogen [5].

There are two schools of thought; one school of thought suggests that different menstrual phases affect physical performances [6-9]. Another school of thought suggests, different menstrual phases do not affect physical performance [10-12].

However, not much is known due to the fact that in previous studies the ages of the subjects varied, and task performance differed due to job characteristics. With garment industry employing most of unskilled labor, it demands physical performance of the employees.

This study aimed to gain fundamental knowledge for the purpose of managing women's occupational health and safety, by assessing muscle performance capability in terms of hand grip strength (strength of upper limb muscles) and time for fatigue

during sustained sub maximal isometric handgrip strength exercise during different phases of menstrual cycle among garment workers.

## MATERIALS AND METHODS

### Sample

Fifty six (56) female garment workers in the age group of 20-30 years with regular menstrual cycle from 5 different ready-made garment industries of Bengaluru were recruited for the study. History of irregular menstrual cycle, present history of fever, history suggestive of neurological abnormalities, any limb deformities, and history of systemic diseases like diabetes mellitus, hypertension and history suggestive of muscular weakness were excluded from the study. It was further confirmed that the subjects had not taken hormones, oral contraceptives, or other reserve medicine within 24 h of the experiment, that they had never conceived a child, and that they are not currently suffering from any gynecological disorders.

### Procedure

Appointment was scheduled in prior through phone call, for each subject during three phases of their menstrual cycle – Menstrual, Proliferative and Secretory Phase. The experiment was done at respective garment factory; between 9am and 11am during the break. Ethical clearance from the institute and Written informed consent was obtained from all subjects prior to the study

General physical examination was done. Muscular performance was assessed in terms of Maximum Voluntary Contraction and Time to Fatigue. After explaining the procedure, Hand grip strength of dominant hand was measured using Computerized Hand dynamometer. The participants were advised to sit in a chair with their elbow by their side, flexed to right angles, and a neutral wrist position and they were advised to contract the forearm flexor muscles maximally. MVCs (maximally voluntary contraction) were performed with a 2 min rest interval between each contraction. The MVC was the highest score recorded over five consecutive trials [13].

The subjects were well motivated and received verbal encouragement during the performance of the MVC. After noting the MVC, 30% MVC was calculated. Subjects were advised to maintain, sustained submaximal contractions of handgrip strength at 30% intensities, as long as possible voluntarily. Then, time for fatigue for the 30% MVC was noted. Muscle strength was expressed in Newton and time to fatigue in seconds [14].

### Statistical Analysis

SPSS16.0 was used for statistical analysis. The results were expressed in terms of Mean±SD. For comparing the MVC and time for fatigue at 30% of MVC between different phases of menstrual cycle, paired t test was carried out. The level of statistical significance was $p<0.05$.

## RESULTS

All the subjects in the age group 20-30 years with mean age 24.34±4.62years had BMI 21.46±1.14 kg/m2. All the subjects had vital parameters within range. The mean recorded value of Maximum Voluntary Contraction (MVC) and Time for Fatigue at 30% of Maximum Voluntary Contraction during the different phases of menstrual cycle are represented in tables-1, 2 and 3.

**Table-1: Comparison of MVC (Hand grip strength) and Time to fatigue at 30% MVC between menstrual and proliferative phase**

| Parameter | Menstrual phase | | Proliferative phase | | p value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| MVC (Hand grip strength) in Newton | 154.8 | 22.079 | 156.1 | 17.672 | 0.56 |
| Time to fatigue at 30% MVC (Seconds) | 193.9 | 24.305 | 205.4 | 20.01 | 0.047* |

MVC - Maximum Voluntary Contraction

N = 56, *$P$<0.05 significant, ***$P$<0.005 highly significant difference

**Table-2: Comparison of MVC (Hand grip strength) and Time to fatigue at 30% MVC between menstrual and secretory phase**

| Parameter | Menstrual phase | | Secretory phase | | p value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| MVC (Hand grip strength) in Newton | 154.8 | 22.079 | 160.7 | 19.579 | 0.022* |
| Time to fatigue at 30% MVC (Seconds) | 193.9 | 24.305 | 206.7 | 17.461 | 0.02* |

MVC - Maximum Voluntary Contraction

N = 56, *$P$<0.05 significant, ***$P$<0.005 highly significant difference

**Table-3: Comparison of MVC (Hand grip strength) and Time to fatigue at 30% MVC between proliferative and secretory phase**

| Parameter | Proliferative phase | | Secretory phase | | p value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| MVC (Hand grip strength) in Newton | 156.1 | 17.672 | 160.7 | 19.579 | 0.003*** |
| Time to fatigue at 30% MVC (Seconds) | 205.4 | 20.01 | 206.7 | 17.461 | 0.66 |

MVC - Maximum Voluntary Contraction

N = 56, *$P$<0.05 significant, ***$P$<0.005 highly significant difference

MVC was significantly ($p<0.05$) better in secretory phase (160.7±19.579) compared to menstrual (154.8±22.079) and proliferative phase (156.1±17.672). But there was no significant ($p>0.05$) difference found between menstrual and proliferative phase.

Time to fatigue at 30% MVC was higher during secretory phase (206.7±17.461) than menstrual (193.9±24.305) and proliferative phase (205.4±20.01). Time to fatigue was significantly higher during secretory and proliferative than menstrual phase ($p<0.05$). But there was no significant ($p>0.05$) difference found between secretory and proliferative phase, though it was high during secretory phase.

## DISCUSSION

In present study we found that Maximum voluntary contraction was higher during secretory phase than proliferative and menstrual phase. And time to fatigue at 30% MVC was also found to be higher during secretory and proliferative phase compared to menstrual phase. So, overall muscle performance capability was found to be better during secretory phase of menstrual cycle.

Although a number of studies have found exercise performance - and in particular, endurance performance - to vary between menstrual phases, there is an equal number of such studies reporting no differences. In a study done by X A K Janse de Jonge, fluctuations in female reproductive hormone concentrations throughout the menstrual cycle do not affect muscle contractile characteristics [13]. In another study done by Lebrun, investigations using estradiol and progesterone levels as a confirmatory index of ovulation did not find significant differences across the cycle in either maximal or submaximal exercise responses, although a slight decrease in aerobic capacity during the luteal phase was reported [15].

There was a significant increase in MVC (about 10%) during the follicular phase of the menstrual cycle when estrogen levels are rising [16]. which is contrary to the results of present study.

The literature suggests that estrogen may promote endurance performance by altering carbohydrate, fat and protein metabolism, with progesterone often appearing to act antagonistically. Estrogen promotes glucose availability and uptake into type I muscle fibers providing the fuel of choice during short duration exercise and increases free fatty acid availability and oxidative capacity in exercise, favoring endurance performance. During the luteal phase the muscle may be warmer, coincident with the rise in basal body temperature brought about by progesterone. This, in turn, may increase the blood supply to the muscle which could reduce fatigue. Glycogen storage is also known to change during the cycle, with muscle and liver stores being greater during the luteal phase [17], under the influence of estrogen and progesterone [5].

Study also showed decreased performance during menstrual phase which can be attributed to psychic and physiologic factors [18]. Fluid retention in muscular compartment causes pain and discomfort and decreases contractility of muscles which is a physiologic factor [19]. In our Indian society social stigma attached to menstruating women can also be considered as a factor to decrease the performance during menstrual phase, as was found in the present study.

Estimation of female sex hormones during different phases and its correlation to muscle performance may reveal more facts.

The results of this study should help understand the pattern of muscle/work performance changes due to the differences between the phases of the menstrual cycle, and for administrators to promote health education in the workplace from the viewpoint of occupational safety and enable development of strategies that will assist the workers, especially women to handle both physical and psychological stress, in more efficient manner. The strategies could be

- Self-compassion training
- Rules by the law makers and administration for favorable working environment to women
- Counseling personnel at work place
- Early detection of adverse effects of cyclical stress on working women and framing adequate measures to prevent further worsening and complications.

## CONCLUSION

The present study was undertaken to gain fundamental knowledge for the purpose of managing women's occupational health and safety, by assessing muscle performance capability during different phases of menstrual cycle among garment workers.

To conclude, during secretory phase MVC (maximum voluntary contraction) and time to fatigue at 30% of MVC is more may be due to increased blood flow to the muscle and glycogen storage under the influence of estrogen and progesterone.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding publication of this paper.

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