Muscular Performance during different phases of Menstrual cycle

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Abstract

Background: 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.

Objective: To study muscular performance by doing hand grip strength (strength of upper limb muscles) and time to fatigue during sustained submaximal isometric handgrip strength exercise during the different phases of menstrual cycle

Materials and Methods: A cross sectional study was conducted in 50 females medical students with regular menstrual cycle of age group between 19-25 years. Muscular performance was assessed by maximum voluntary contraction and time for the onset of fatigue at 30% maximum voluntary contraction, which were recorded using hand grip strength dynamometer by using Power lab 8/30 series with dual Bioamplifier (AD Instruments Australia, Model No.ML870).

Results: There is no significant change in maximum voluntary contraction in terms of handgrip strength during different phase of menstrual cycle, though there is slight increase in Secretory phase comparing to Proliferative phase and menstrual phase. The time to fatigue at 30% of MVC (maximum voluntary contraction) is more in secretory phase, but slight statistically significant change is observed between proliferative phase and menstrual phase.

Conclusion: Though there is slight changes in values, as these are not statistically significant, regularly menstruating female athletes do not need to adjust their menstrual phase to maximize the performance.

Keywords: Hormones; Menstrual cycle; Muscular performance; Time to fatigue

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Introduction

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.[1,2] Certain physiological parameters such as athletic performance could change along with the phases of menstrual cycle.[3] Fluctuating levels of sex steroids across normal menstrual cycle affect sensory- motor association of an individual.[4] Muscular performance can be assessed in terms of maximum voluntary contraction and time for fatigue. Maximum voluntary contraction is assessed by the hand grip strength. 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] It was observed that, there is significant increase in handgrip strength at mid-cycle compared with both the follicular and luteal phases. Associated with the increase in strength, there was a significant slowing of relaxation time and increase in fatiguability at mid cycle. Muscle fatigue was slower in during luteal phase comparing to the follicular phase.[5] In another study, it was observed that, the fluctuations in female reproductive hormone concentrations throughout the menstrual cycle do not affect muscle contractile characteristics, such as Maximal isometric handgrip strength and fatiguability.[6] It is reported that, there is a slight decrease in aerobic capacity during the luteal phase.[8] As there are controversies related to the effect of fluctuating hormones on muscular performance like fatiguability and strength, so we have taken this study to know the muscular performance in terms of hand grip strength (strength of upper limb muscles) and time for fatigue during sustained submaximal isometric handgrip strength exercise during different phases of menstrual cycle.

Material and Methods

Cross – Sectional and Descriptive study was conducted in the Department of Physiology, Navodaya Medical College, Raichur, after obtaining Ethical clearance certificate from the Institutional research ethical committee (Human) during the period May to September 2013. Fifty (50) female medical students in the age group of 19-25 years with regular menstrual cycle were recruited for the study. History of irregular menstrual cycle, present history of fever, history suggestive of neurological abnormalities, any limb deformities, history of systemic diseases like diabetes mellitus, hypertension and history suggestive of muscular weakness were excluded from the study. Written infirmed consent was taken from each

participant. All the individuals were examined for vital parameters and anthropometric parameters like height and weight were measured.

After selecting the subjects, appointment was scheduled in prior and they were advised to come to the lab, for recording during different phases of menstrual cycle like, menstrual phase, proliferative phase and secretory phase. Doubts raised by them before, during or after the tests were patiently addressed and ascertained. The subjects were assured. Muscular performance is 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.[6]

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 {maximum muscle contraction (strength)} was noted. Muscle strength was expressed in Newton and time to fatigue in seconds.[9]

Statistical analysis:

The results were expressed in terms of Mean±SD. The test of significance used was student "t" test (paired t-test) and a "p' value less than 0.05 was considered statistically significant. The data was analyzed by using SPSS 17.0 version statistical software. Microsoft Word and Excel have been used to generate graphs, tables etc.

Results

A Cross – Sectional and Descriptive study was undertaken in 50 regular menstruating women. All the women belonging to the age group 19 to 25 years with mean age 19.34±0.62 and have BMI 20.46±1.34 kg/m^2. All the subjects have 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.

Table 1: Comparing the MVC and TIME TO FATIGUE AT 30% of MVC between menstrual phase and proliferative phase

Parameter	Menstrual phase [Mean± SD]	Proliferative phase [Mean± SD]	't' value	'p' value	Significance
MVC (Hand Grip strength) in Newton	161.06± 50.78	161.07±46.38	0.005	>0.05	Non Significant
Time to fatigue at 30% MVC (Seconds)	201.66±88.93	209.72±82.51	2.15	<0.05	Significant

Table 2: Comparing the MVC and TIME TO FATIGUE AT 30% of MVC between menstrual phase and secretory phase

Parameter	Menstrual phase [Mean± SD]	Secretory phase [Mean± SD]	't' value	'p' value	Significance
MVC (Hand Grip strength) in Newton	161.06± 50.78	167.18±51.35	1.95	>0.05	NS
Time to fatigue at 30% MVC (Seconds)	201.66±88.93	212.80±100.80	1.65	>0.05	NS

NS—Non Significant

Table 4: Comparing the MVC and TIME TO FATIGUE AT 30% of MVC between proliferative phase and secretory phase

Parameter	Proliferative phase [Mean± SD]	Secretory phase [Mean± SD]	't' value	'p' value	Significance
MVC (Hand Grip strength) in Newton	161.07±46.38	167.18±51.35	1.71	>0.05	NS
Time to fatigue at 30% MVC (Seconds)	209.72±82.51	212.80±100.80	0.39	>0.05	NS

NS—Non Significant

Discussion

The female hormones, estrogen and progesterone, may have their implications for exercise performance during exercise. In our study, we have noticed that though the muscular performance in terms of maximum voluntary contraction is more during secretory phase comparing to proliferative phase and menstrual phase, but it is not significant statistically. Even the time to fatigue at 30% of MVC is more during secretory phase comparing to proliferative phase and menstrual phase, but there is no statistical significant difference except for proliferative phase and menstrual phase. The results of our study correlate with other studies done by X A K Janse de Jonge,[6] Gür,[9] and Lebrun,[7] where no changes have observed and it is contrary to the work done by Phillips,[10] Sarwar [5], Greeves,[11] who observed changes.

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. The literature suggests that estrogen may promote endurance performance by altering carbohydrate, fat and protein metabolism, with progesterone often appearing to act antagonistically.[6] 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,[12] under the influence of oestrogen and progesterone.[5] These may be the possibilities that contribute to the changes observed, but as observed changes are not significant statistically, so that the women should not alter her menstrual cycle for muscular performance.

Conclusion

In 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. As these findings are not statistically significant, there is no need for regularly menstruating female athletes to adjust their menstrual phase to maximize the performance.

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