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Original article :

Effect of Different Phases of Menstrual Cycle on Cardio-Respiratory Efficiency in Normal, Overweight and Obese Female Undergraduate Students: An Original Research

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ABSTRACT

Background: Obesity is a major health issue in many countries and may start at any stage of life. Hence we aim to compare women of different weights at specific dates of menstruation on cardio-pulmonary efficiency.

Methods: We conducted an observational study among the 90 female undergraduate students who were divided equally as normal, obese, and overweight based on the body mass index. Later the Cardio-respiratory competence was evaluated among them on the 2nd, 7th, and 22nd day of menstruation. The statistical analysis was performed, and the significant value was considered as $p<0.05$.

Results: We observed that there was a significant variation in the various stages of menstruation for the efficiency in the physical exercise. There was a significant difference between the overweight and the normal groups. Among the regular group, significant variation was seen in strength at luteal and follicular stages than in other groups. Among the obese PEFR was lower than the other groups.

Conclusion: We observed that among the obese and overweight, there was a decrease in the Fitness capacity.

Keywords: Obesity, Menstruation, Cardio-Respiratory Competence

INTRODUCTION

Sex hormones in women are known to influence the body weight, the mood of the person, the various activities of the person. Many young women participate in various strenuous physical activities; the influence of hormones may play a role in the activity.[1-5] Cardiorespiratory function must be effective to achieve physical exercise as it requires efficient blood supply and oxygen. One of the major problems the people are facing is obesity, seen commonly among the various types of economies of the nations. Many diseases are related to obesity, one being irregular menstruation, cardiac problems. Contradicting studies about the variations in the cardio-respiratory efficacy during the dates of the menstruation is given. These are also on the rise in the younger age females.[6-10] Higher weight is usually associated with lower cardiac function and is usually more seen in men. Hence we aim to compare women of different weights at specific dates of menstruation on cardio-pulmonary efficiency.

MATERIALS AND METHODS

We conducted a clinical observational study after taking the ethics clearance and the patient's consent. We included 90 healthy female subjects between the age groups 18-25. We selected the subjects with no gynecological medical conditions. We excluded those participants with medical conditions like PCODS, infections, irregular menstrual cycles, dysmennorhea, cardio-respiratory diseases. The participants were equally divided based on the BMI into three groups as Normal, Obese, Overweight. Their menstrual dates were noted, and the physical fitness was recorded at menstrual phase -2nd, follicular phase -7^{th,} and luteal phase -22nd day. The height and the weight of the participants were recorded. The ages were also recorded. The blood pressure and the rate of the heartbeat were recorded. The cardiac efficiency test was checked by exercise on a bicycle ergometer. Exercise efficacy was measured as:

$$\text{Exercise efficiency (\%)} = \frac{\text{Duration of exercise (in seconds)}}{(\text{1st min} + \text{2nd min} + \text{3rd min})\ \text{pulse rate after exercise}} \times 100\%$$

Respiratory competence was tested by calculating the "Peak expiratory Flow rate, expiratory blast test, and respiratory endurance tests." The data was noted and analyzed for statistical variations. We considered any values that had a $p<0.05$ as significant.

RESULTS

The various demographic characteristics of the subjects were compared, and there was no significant difference between the groups. **Figure 1** We observed that the overall exercise efficiency significantly varied for the menstrual phases, with statistically significant in the average and overweight groups. **Figure 2** We observed that the overweight and obese subjects showed lower scores on the blast test compared to the average weighted subjects. **Figure 3** No significant variation was seen among three groups for blast test at menstruation, follicular stage, and luteal stage of menstruation. Significant variation was seen in the endurance test in the luteal and the follicular of the normal group, and no variation among the other two. **Figure 4** We also observed that among the obese individuals, significantly low PEFR compared to lower weight groups.

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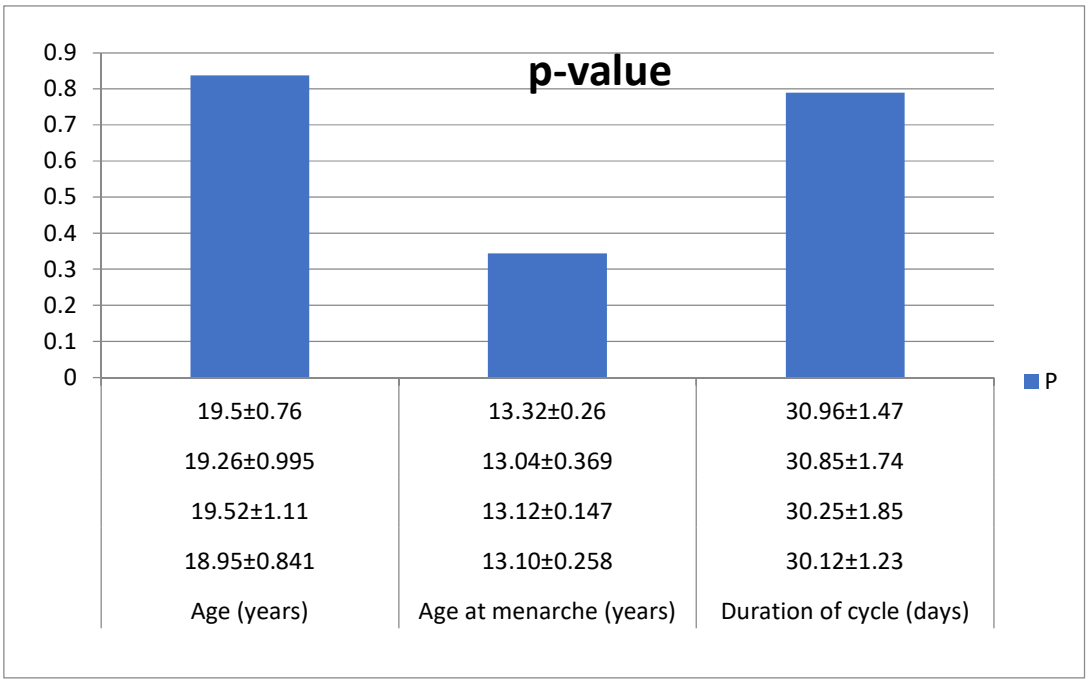

FIG 1

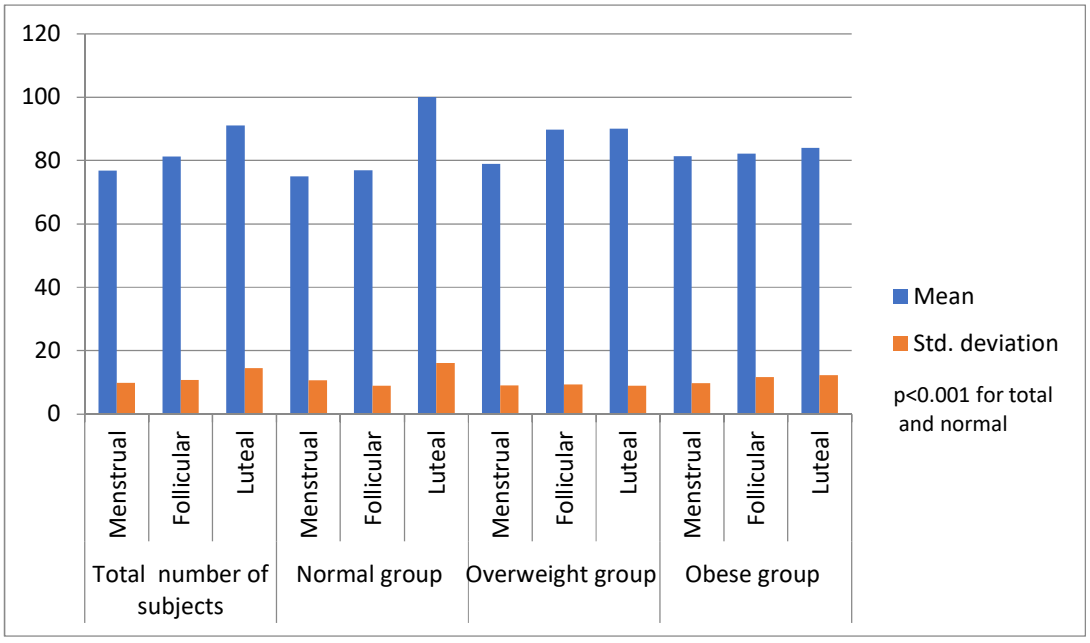

FIG 2

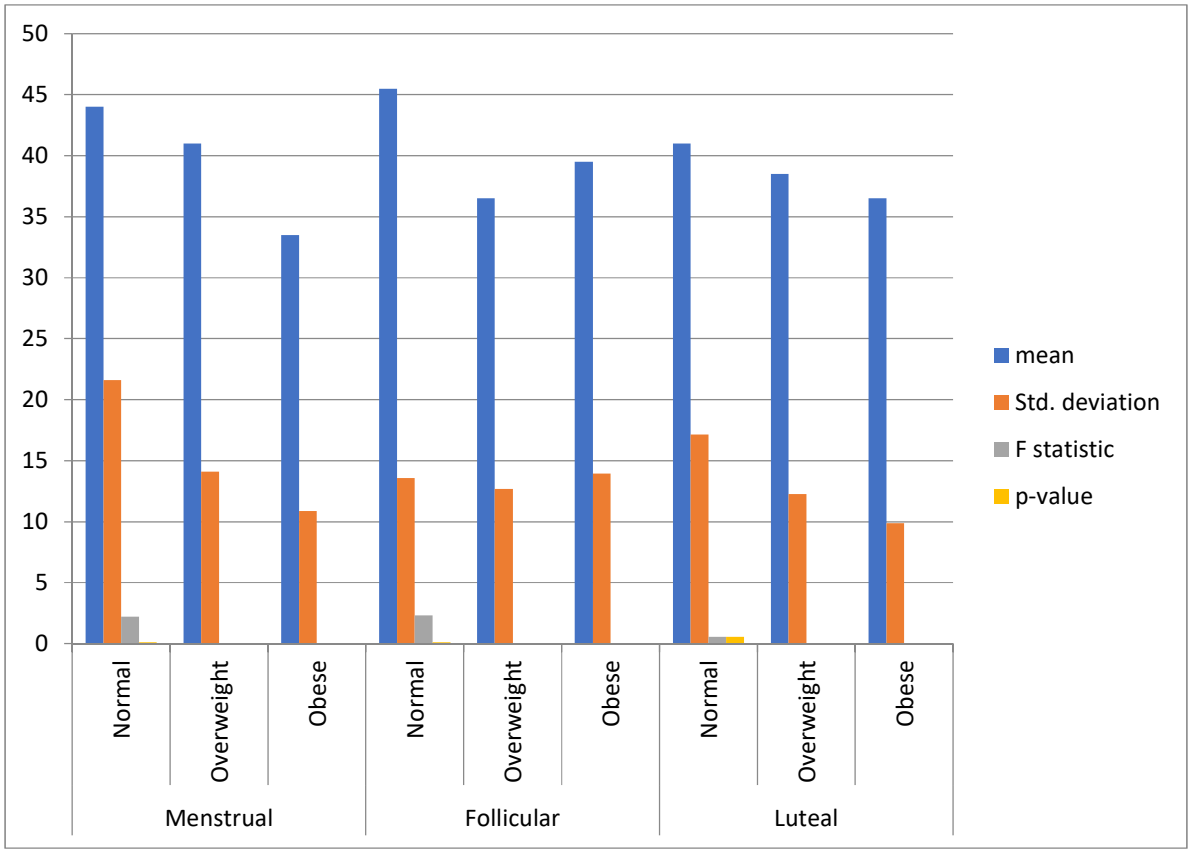
50
45
40
35
30
25
20
15
10
5
0
Normal
Overweight
Obese
Normal
Overweight
Obese
Normal
Overweight
Obese
Menstrual
Follicular
Luteal
mean
Std. deviation
F statistic
p-value

FIG 3

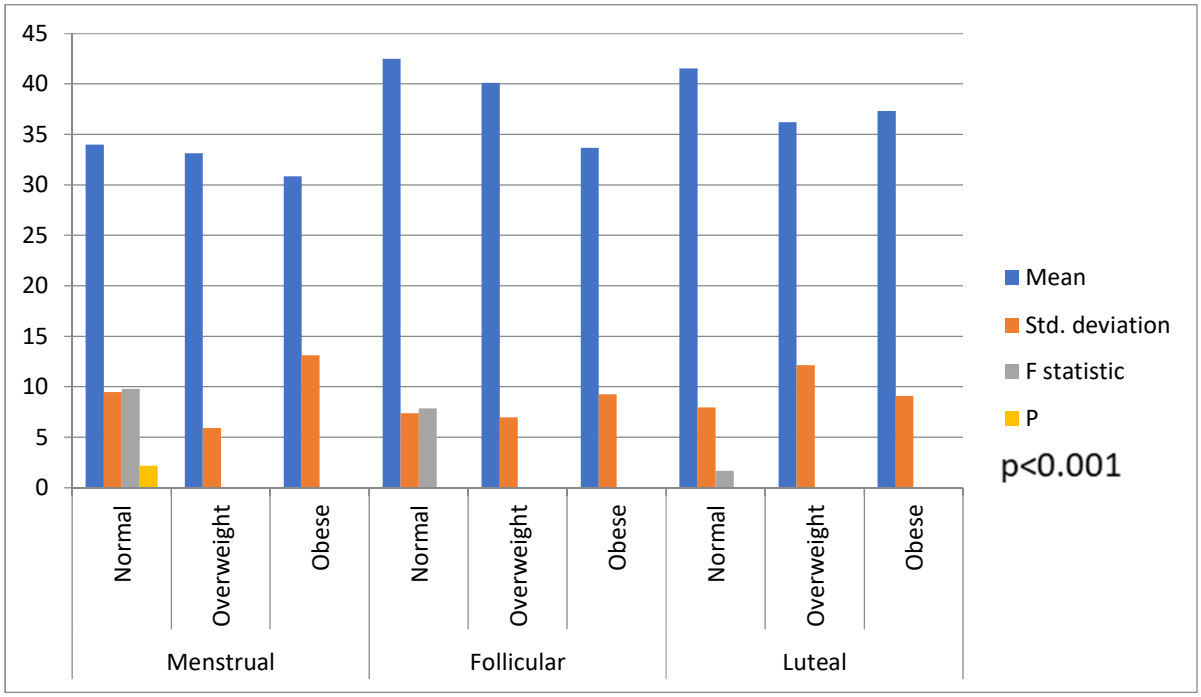

FIG 4

Menstruation is the most common of the biological rhythm that a woman had to endure. The cycle has follicular, ovulatory, and luteal stages.[11-13] These menstruation cycles are influenced by the hormones like estrogen and progesterone. Sex hormones influence the menstrual cycle and its stages. The follicular stage is categorized by the rise in the estrogen and progesterone levels even though in the ovulatory stage, a rise in the estrogen & reduction in progesterone is detected.[14-17] At the luteal stage, there is a stable rise in estrogen & progesterone. There are also other functions that are influenced by these hormones also. Previous studies have shown that these hormones influence substrate metabolism, psychological factors, cardiorespiratory function, and thermoregulation.[1,14,18] In our study, there was a significant variation in the exercise efficiency at the luteal phase among the overweight and the normal subjects. In the previous studies, it was seen that the exercise performance was under the influence of the estrogen/ progesterone ratio.[6] Previous research has shown that females can execute superior physical works at the luteal stage in menstruation as there is enhanced metabolism of fat. It is also seen that there is a greater breakdown of the fat. This may be favored by the higher estrogen/ progesterone ratio at the luteal phase that may lead to better exercise performance.[6] Previous research has shown women were comfortable exercising at the luteal stage.[2] We observed no significant variation in the blast test for the three stages. Largely overweight and obese subjects had a lower value for the blast test than normal subjects. At follicular and luteal stages in the average weighed, better endurance was seen than the other two groups. As stated in the previous studies, the changes in the pulmonary system of females can be attributed to the escalation in expiratory resistance in the follicular stage of menstruation.[1,2,6,21] Women may prevent the usage of glycogen and lower builds up of lactate in the muscle, and

consequently, may withstand a comparatively longer duration of exercise that may be of high intensity. Research has proved that women have an improved well-being level when performing any physical activity at the luteal stage.[19] The PEFR's lower values seen in the follicular and menstrual stages may be linked to decreased progesterone that impacts the bronchial tone positively. Contradictory studies are seen on pulmonary functions in various stages of menstruation. Progesterone prompts hyperventilation by mediating both the central medullary and peripheral receptors in the lungs. Various studies about the variations in pulmonary efficiency in the luteal stage of menstrual cycles, a rise in minute ventilation in the luteal stage as associated with menstrual and follicular stages. In the luteal stage, a raised progesterone level causes hyperventilation. The neural mechanism fundamental to the stimulation of respiration by progesterone is comparable to those mediating its reproductive properties. Among average and overweight subjects significant increase was seen at the luteal phase in PEFR but not in obese subjects. At the luteal stage, there may be an enhancement of estrogen and progesterone secretions, and that may lead to better cardiorespiratory endurance. In our study, a substantial rise in cardio-respiratory compliance was seen in average weighed women while a lower in both exercise and respiratory effectiveness was seen in obese and overweight females at various stages of menstruation. Previous research has shown that there was a rise in expiratory resistance in the follicular stage of the menstruation cycle that may be because of the changes in the pulmonary system of females. The respiratory response to progesterone is arbitrated at hypothalamic sites by an estrogen-dependent Progesterone Receptor intercede mechanism necessitating RNA and protein synthesis. The raised ventilation seen in the luteal stage is associated with higher progesterone that brings about an augmented inspiratory muscle endurance and bronchial smooth muscle relaxation.[19-22] Additionally, higher quantities of estrogen raise free fatty acid obtainability and oxidative capacity in physical activity, favoring endurance capacities.[16-20] Higher weight among women may cause higher cardiac output that may be a result of the increased total blood volume. This enhancement is necessary to meet the metabolic requirement of the increased weight. Therefore the cardiac workload is more among the obese that may be not related to the physical activity of the person.[6-15] Also, in the previous studies, the body mass index was shown to be inversely proportional to the physical fitness of the person.[20-22] We also observed in our study the same results. Among the obese and overweight undergraduate students, there is usually less ability for the endurance of the various active physical activities that might have contributed to finding no significant variation in the respiratory and exercise competence at various phases of the menstrual cycle in our study. The limitation of the study was another nutritional status was not considered, and also the hereditary, mental status was not assessed, which might have led to obesity. Further study with a larger population verifying our limitations is suggested.

CONCLUSION

From our study, we can propose that decreased fitness is associated with the phase of menstruation and also the weight of the women. Hence, we suggest a fitness regime and diet reduce these complications that may arise among women at a later age.

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