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Assessment and comparison of blood pressure and heart rate in females with and without pre-menstrual syndrome during various stages of menstrual cycle

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ABSTRACT

Premenstrual syndrome (PMS) is a group of physical, emotional and psychological symptoms experienced by at least 85% of the women in the reproductive age group. The symptoms start a few days after ovulation and continue till menstrual flow occurs after which it ceases. It is a major difficulty experienced by females, given its monthly occurrence. The aim of this study is to determine variations if any in heart rate and blood pressure of females during various stages of menstrual cycle. The study population, consisting of fifty first MBBS students in the age group of 17-20 years, was divided into PMS and non-PMS groups with the help of a symptom tracker that was filled by the candidates over a period of two months. During these two months, the blood pressure and heart rate of each subject was recorded on the 2nd, 12th and 22nd days corresponding to the menstrual, post-menstrual and pre-menstrual phases. Statistical analysis was done for the data obtained using one way ANOVA. It was found that the systolic blood pressure and heart rate showed significant variations in the PMS group. The systolic blood pressure (SBP) was found to be lowest during the menstrual phase (101.9 ± 0.79) which then steeply rose to 117.8 ± 0.99 during the pre-menstrual phase. It was also seen that the menstrual phase SBP of PMS subjects was lower than that of the Non-PMS subjects (111.64 ± 0.96). The heart rate also showed similar variations. From this study, it was concluded that pre-menstrual syndrome can affect systemic parameters such as blood pressure and heart rate.

Keywords: Menstrual cycle, Pre-menstrual syndrome, blood pressure, heart rate

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INTRODUCTION

The menstrual cycle is the group of cyclical changes which occur in the female reproductive system that prepares the uterus for implantation. The chief hormones controlling the cycle are pituitary hormones- follicle stimulating hormone (FSH) and luteinizing hormone (LH), and ovarian hormones- estrogen and progesterone. Each cycle can be divided into three phases based on events taking place in the ovary or in the uterus. These are the follicular phase, ovulatory phase and the luteal phase with respect to the changes in ovary, and menstrual phase, proliferative phase and secretory phase with respect to changes in the uterus. Ovarian hormone estrogen remains dominant till ovulation after which progesterone takes over this role. Due to the changeover in the dominant hormone and various other effects of these steroids, many changes are observed in the entire female body during the cycle. This study focuses on one of the complications of the menstrual cycle, premenstrual syndrome and its effect on blood pressure and heart rate, if any. Premenstrual syndrome refers to the physical, emotional and psychological symptoms experienced by at least 85% of pre-menopausal women before the onset of menstruation. The symptoms start a few days after ovulation and continue till menstrual flow occurs after which it ceases. Some of the common symptoms of PMS are irritability, mood swings, headaches, joint or muscle pain, trouble with memory and concentration, changed sleep patterns. It was reported that around 3-8% of women suffer from pre-menstrual dysphoric disorder (PMDD)[1,2], an extreme form of PMS in which thoughts of suicide is prevalent. Thus PMS greatly reduces the work efficiency, affects a person psychologically and emotionally, thereby interfering in one's social life. This gets evidence from the fact that in earlier days, PMS was virtually an unknown disorder whereas now, because of increased levels of stress, pollution etc. which affect a person both physically and psychologically, more and more women claim to suffer from PMS. Tamaki Matsumoto et al[3], in their study reported that decrease in functioning of Autonomic Nervous System (ANS) in females with PMS during the late luteal phase. Some theories suggest that fluctuating levels of serotonin and altered sensitivity to estrogen and progesterone may also be one of the underlying causes of this disorder. Changes in the normal level of sex hormones and hormonal imbalances can also trigger the symptoms. All types of sex steroids and related hormones influence the normal functioning of the cardiovascular system[4]. Many studies have indicated that estrogen has a blood pressure lowering affect[5-9]. The proof comes from the fact that the incidence of hypertension is higher in post-menopausal women when there is a drastic reduction in the level of the hormone. Progesterone on the other hand does not have any direct effect on blood pressure, but it can enhance the blood pressure lowering effects of estrogen as shown by various other studies. However, artificially synthesized progesterone,

found in contraceptives, has an androgenic effect and is found to elevate blood pressures. Female sex hormones are thus known to have significant impact on cardiovascular regulatory mechanisms. Hence imbalances in the level of these hormones and/or altered sensitivity may lead to changes in blood pressure and heart rate. There will also be significant changes in the blood pressure and heart rate since these are directly under the control of the ANS. In the present study, blood pressure and heart rates of females with PMS are compared with those of normal females to find out if significant changes or patterns can be observed.

MATERIALS AND METHOD

Before commencing the study, consent letters were obtained from the students for their participation in the study. Subjects with menstrual irregularities, polycystic ovarian syndrome and history of uterine or other types of ovarian abnormalities were excluded from the study. Only eumenorrheic candidates with cycle between 25-35 days were selected as subjects. Since the study involves human subjects, an ethical committee approval was also obtained, prior to the commencement of the study.

A PMS symptom tracker was given to the subjects, who were asked to fill it for two consecutive months during which the study was carried out. The symptoms have been classified into two groups-physical and mood & behavioural. Physical symptoms include headache, cramps, joint or muscle pain, backache etc. Mood and behavioural changes include anxiety, depression; crying spells, change in sleep pattern and appetite and so on[10]. A subject who experiences at least three symptoms in each of the group is classified as suffering from PMS. If not, then the subject belongs to the non-PMS group. In this way the study population, which consisted of 50 students was divided into PMS and non-PMS groups. Simultaneously the blood pressures and heart rates were recorded for each of the subjects during pre-menstrual phase-day 22, menstrual phase-day 2 and post-menstrual phase-day 12.

Measurement of blood pressure

Blood pressure was measured with the help of BP apparatus (Crown High Definition LCD BP monitor). Recording was done each day between 4 pm and 5 pm to maintain uniformity. The subjects were asked to rest completely for 5 minutes after which blood pressure was measured from the right arm in sitting posture.

Measurement of Heart rate

Heart rate was measured manually. The data thus obtained has been evaluated and compared.

RESULTS AND DISCUSSION

Statistical analysis was done for the data obtained using one way ANOVA with p value less than 0.05 was considered as statistically significant.

For PMS group, the systolic blood pressure on the 2nd day, on the 12th day and on the 22nd day was found to be 101.2 ± 0.79, 109.5 ± 0.61 and 117.8 ± 0.99 respectively. The diastolic blood pressures on the 2nd, 12th and 22nd day was found to be 74.36 ± 0.45, 73.68 ±0.44 and 75.92 ± 0.68 respectively. The heart rates on the corresponding days are 70.6 ± 0.88 79.9 ± 0.89 and 87.94 ± 0.94. The p-values of all the measured entities was found out to be significant ($p < 0.05$)

For the non-PMS group, the systolic blood pressure on the 2nd, 12th and 22nd day was found to be 111.64 ± 0.96, 111.12 ± 0.79 and 112.48 ± 0.93 respectively. The values of diastolic blood pressures on the corresponding days are 70.88 ± 0.75, 71.96 ± 0.64 and 72.72 ± 0.68. The heart rates are found to be 80.96 ± 1.03, 80.22 ± 0.98 and 77.04 ± 1.13.

Table 1: Systolic, diastolic blood pressure and heart rate of PMS and Non PMS group

	PMS (n=25)			NON PMS (n=25)		
	2nd day	12th day	22nd day	2nd day	12th day	22nd day
Systolic BP	101.2±0.79	109.5±0.61	117.8±0.99	111.64±0.96	111.12±0.79	112.48±0.93
Diastolic BP	74.36±0.45	73.68±0.44	75.92±0.68	70.88±0.75	71.96±0.69	72.72±0.68
Heart rate	70.6 ± 0.88	79.9±0.89	87.94±0.94	80.96±1.03	80.22±0.98	77.04±1.13

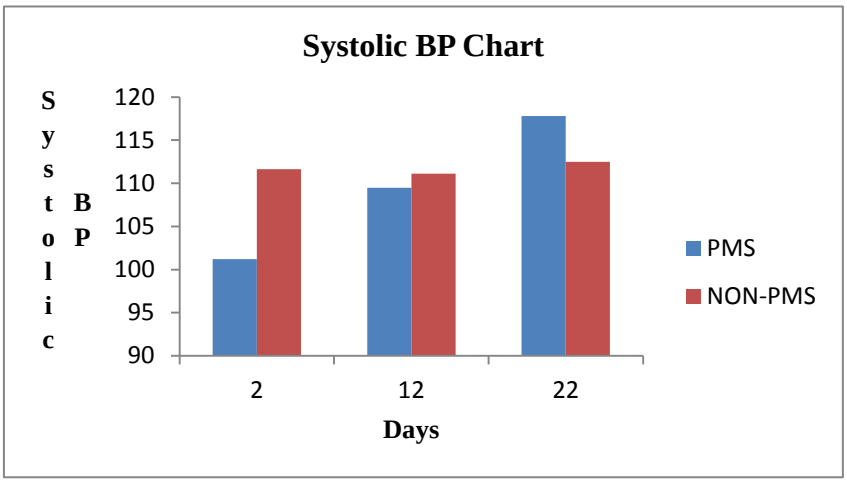

Figure 1: Systolic blood pressure chart of PMS and NON-PMS

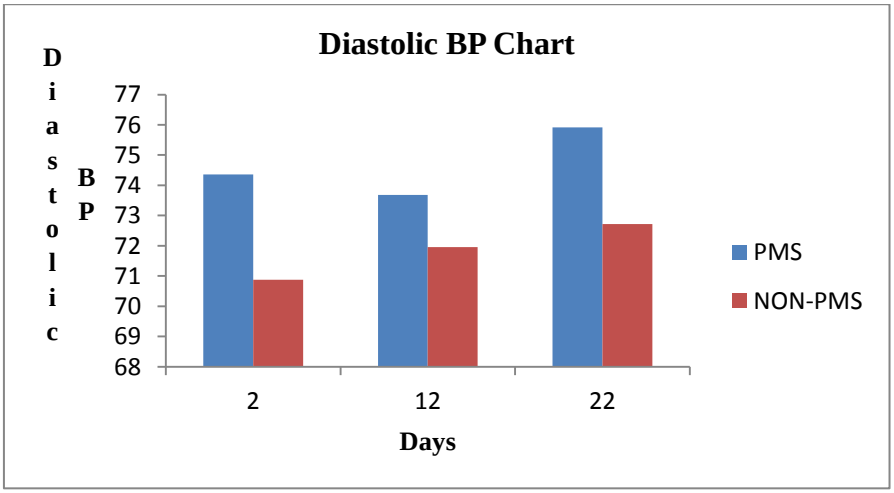

Figure 2: Diastolic blood pressure chart of PMS and NON-PMS

In this study, it has been found out that SBP shows variations during menstrual phase (day 2), postmenstrual phase (day 12) and pre-menstrual phase (day 22) for the PMS group. It was found to be highest during the premenstrual phase and lowest during the menstrual phase which is in correlation with the study carried out by Okeahialem et al[11] but contradictory to the findings of Stamatelopoulos et al[12]. Also, a steady increase in SBP has been noticed. For the non-PMS group, no such variations are observed. SBP is almost uniform throughout the cycle as observed by McFetridge and Sherwood[13].

The DBP values are found to be nearly uniform for both groups throughout which is in agreement with the studies carried out by Moran et al[14]. No significant variations are noticed, however, the average DBP values are slightly higher for PMS group on each of the days. For the PMS group, significant variation is noticed in the heart rates. It peaks in the premenstrual phase and then steadily falls to its lowest value during the menstrual phase, as observed in a study reported by Palmero and Choliz[15]. No such variation is observed in the non-PMS group. The heart rate was maintained near uniformity.

The changes observed in the PMS group with respect to blood pressure and heart rate may be due to increased levels of androgenic hormones as they cause higher blood pressures and heart rates. If serum analysis was carried out, it would have indicated the exact levels of various hormones. This could reveal whether or not there exists a relationship between PMS and androgenic hormones. These changes could have also been caused due to depressed activity of the autonomic nervous system (ANS) or due to imbalances or altered sensitivity to the various sex hormones.

Variations due to temperature and other factors were not taken into account while analysing the results.

CONCLUSION

From this study, it can be concluded that the systolic blood pressure shows a steep rise among females with PMS starting from the menstrual phase and that they also tend to have relatively lower values of SBP in the menstrual phase as compared to the non-PMS group females.

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