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RESEARCH ARTICLE

Effect of premenstrual stress on reaction time of 18-20 years age group

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ABSTRACT

Background: The premenstrual syndrome is a recurrent, variable cluster of trouble some ill-defined symptoms and signs that develop during the 10 days before the onset of menses and subside when menstruation occurs. There are studies in literature about the effect of psychological stress affecting audio visual reaction time (VRT). There are very few studies in literature about reaction time and premenstrual stress. **Aims and Objectives:** The purpose of this study was to find out whether the premenstrual phase has any effect on human reaction time when compared with that of postmenstrual phase. **Materials and Methods:** This study had been conducted in 100 healthy female volunteers in between 18 and 20 years age group. In this study, we had studied the time taken between applications of visual stimulus and auditory stimulus and response obtained and comparison of the response in female volunteer during premenstrual phase and postmenstrual phase. Subjects were presented with two types of stimuli; visual stimuli and auditory stimuli. Paired and unpaired *t*-test was used at appropriate places as a statistical test. The $P < 0.05$ was considered significant. **Result:** A significant increase in weight and prolongation in auditory reaction time and VRT were observed during the premenstrual phase. **Conclusion:** Increase in reaction time during premenstrual phase could be attributed to fluid and salt retention due to ovarian steroids leading to decrease in the processing capability of central nervous system and leads to prolongation of reaction time period.

KEY WORDS: Reaction Time; Premenstrual Stress; Visual Reaction Time; Auditory Reaction Time

INTRODUCTION

Unlike in men, the endocrine profile of female hormones is cyclical during their sexual cycles. It is necessary to enquire into the role of such cyclical endocrine profile in maintaining psychic and physical harmony to extract optimum work.[1] The premenstrual syndrome (PMS) is a recurrent, variable cluster of troublesome ill-defined symptoms and signs that develop during the 10 days before the onset of menses and subside when menstruation occurs. Certain behavioral and neurological symptoms, *viz.,* headache, malaise, nervous irritability, emotional instability, decreased ability to concentrate, decrease in skin resistance, and increased blood pressure have been reported during the premenstrual phase and are associated with salt and water retention.[2]

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Reaction time is crucial for our everyday lives and requires intact sensory skills, cognitive processing, and motor performance. Reaction time measurement is an indirect index of processing capability of the central nervous system and simple means of determining sensory motor association and performance of an individual.[2] Reaction time has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures.[3] There are various factors influencing human reaction time. Among them one of the factors is stress. There are studies in literature about the effect of psychological stress affecting audio visual

reaction time. There are very few studies in literature about reaction time and premenstrual stress.

Hence, the aim of this study was to see, whether the state of premenstrual tension affects the sensory function and sensory motor association and processing capability of the central nervous system. The human reaction time measurement had been made from the volunteers subjected to visual stimuli and auditory stimuli.

MATERIALS AND METHODS

A cross-sectional study was conducted on the female medical students of Index Medical College Hospital and Research Centre, Indore. The study protocol was approved by Institutional Ethics Committee. Informed written consent of volunteer students was obtained before the procedure. 100 female medical students fulfilling inclusion criteria were included. Female students between 18 and 20 years with normal sensory and motor examination on the basis of physical examination were included in this study. Students having skeletal muscle diseases (i.e., Myasthenia gravis, periodic paralysis, and polymyositis) or having neural diseases (i.e., poliomyelitis and polyneuropathy) were excluded from the study. Students were also checked for acuity of vision (by Snellen's test and Jaeger's test); color perception (by Ishihara's chart); normal auditory function (by Rinne's test and Weber's test). Students with abnormality/is in these tests were also excluded from the study.

Their detailed menstrual history was noted, and the premenstrual and postmenstrual phases were calculated as follows: Premenstrual phase - 1 to 7 days before onset of next menstruation. Postmenstrual phase - 5th to 10th day of the menstrual cycle. Their weight in kilograms, auditory reaction times (ART), VRT were measured both during premenstrual and postmenstrual phases.[2] The apparatus used in this study was audio-visual reaction timer. Proper consent of volunteer students was obtained before the procedure. Each individual was explained about the test, and sufficient trials were given for proper understanding. All the subjects were subjected to the tests in the quiet/secluded room. The reaction time was noted during morning hours (10 am - 12 pm). The examiner randomly presents either the visual or auditory signal to the student. The student immediately responds by pressing an appropriate corresponding switch on her side. The time duration between the application of stimulus by examiner and registering the response from the student was taken as reaction time.

The apparatus is designed to measure reaction time for four stimuli: Two sound stimuli and two light stimuli. Two response alternatives are provided by two response keys. The chronoscope was built into count the reaction time. Subjects were instructed to press the response button by the right index finger already on it to stop the clock as soon as she will see the visual stimuli from digital display reaction time was noted. Subjects were instructed to press the response button by the right index finger already on it to stop the clock as soon as she will hear the auditory stimuli from digital display reaction time was noted. Three readings of each stimulus taken and the lowest reading were taken as the reaction time reading. A comparison were made between - (i) VRT during premenstrual phase (stress) to postmenstrual phase and (ii) ART during premenstrual phase (stress) to postmenstrual phase.

Statistical Analysis

To test whether there was any significant difference in between males and females with reference to the study variables between the study groups, paired and unpaired *t*-test was used at appropriate places as a statistical test. The $P < 0.05$ was considered significant.

RESULTS

Visual and auditory human reaction time was studied in 100 female medical students of Index Medical College Hospital and Research Centre, Indore who formed the study group. The range of age of volunteer student was from 18 to 20 years. The results were tabulated and statistically analyzed. To test whether there was any significant difference in females with reference to the study variables between the study groups, paired and unpaired *t*-test was used at appropriate places as a statistical test.

According to Table 1, weight of volunteers during premenstrual phase was 52.360 ± 2.290 and during postmenstrual phase was 51.540 ± 2.422; the difference between two was found statistically significant (P = 0.0147). The VRT during premenstrual phase was 260.46 ± 9.91, and the VRT during postmenstrual phase was 234.44 ± 11.62. The difference between two was found statistically significant (P = 0.001). The ART during premenstrual phase was 239.00 ± 11.06, and the ART during postmenstrual phase was 210.80 ± 12.41. The difference between two was found statistically significant (P = 0.001).

Table 1: Data with statistical analysis of weight, ART, and VRT (n=100)

Parameters	Premenstrual phase	Postmenstrual phase	*P* value
Weight in kg	52.360±2.290	51.540±2.422	0.0147*
ART (in milliseconds)	239.00±11.06	210.80±12.41	0.0001*
VRT (in milliseconds)	260.46±9.91	234.44±11.62	0.0001*

Data presented are mean±SD, *P<0.05: Significant, ART: Auditory reaction time, VRT: Visual reaction time

DISCUSSION

In this study, a significant increase in weight gain was observed during the premenstrual phase. The literature is replete with reports of patients suffering from severe premenstrual fluid accumulation sometimes even up to 10 Ibs in weight gain.[4] The degree of premenstrual weight gain is reported to correlate with the degree of various premenstrual neurological symptomatology in many cases leading to poor attention and performance.

Symptoms due to pain, water retention, behavioral changes and skin disorders during premenstrual period PMS have been reported. As yet there is no biological marker that characterize the symptoms, so diagnosis of PMS, at present, is based on history and self-assessment questionnaire, such as memory observation questionnaires. The exact etiology of PMS whether distressing or not remain unknown.[5]

As is evident that headache in may be due to varying degree of cerebral edema, while somatic symptoms like stomach cramps in and low pelvic pain in could be due to fluid retention associated with irritable colon syndrome. The common symptoms of abdominal bloating in may be the result of gut hypotonia and gaseous distension caused by the luteal phase of progesterone. Decreased work efficiency in might be due to anemia and poor nutritional status of subjects. Carrie reported that women who experienced poorer general health reported more premenstrual symptom as well as more symptoms during pregnancy.[6] Increased burst of energy and activity in the premenstrual period could be emotional symptoms. Acne form eruption in may be due to aberrations in prostaglandin metabolism, premenstrual urticaria might be due to hypersensitivity to some specific substance which appeared in serum during the premenstrual period. Increased skin pigmentation in before menses could be due to increased release of melanocyte stimulating hormone. Greasy skin could be due to water retention. This work is a preliminary work and more work is needed to find out the cause of PMS and its treatment.

This may be the cause of prolongation of both auditory and VRT in this study, since reaction time indicates the minimum time taken by an individual to react to an external stimulus,[7] and is an indirect index of processing capability of central nervous system and sensory motor association.[8,9] Bruce and Russell[10] suggested that retention of water and sodium due to variation in sex steroid levels during menstrual cycles might influence the process of axonal conduction time and availability of neurotransmitter at synapses in the auditory pathways; changes in either of these two processes might cause conduction time to vary during menstrual cycle, whereas Broverman et al.[11] suggested that hearing sensitivity may be affected by estrogen secretion through its influence on acetylcholine which has been shown to be the neurotransmitter in auditory system.

CONCLUSION

Increase in reaction time during premenstrual phase could be attributed to fluid and salt retention due to ovarian steroids leading to decrease in the processing capability of the central nervous system and leads to prolongation of reaction time period.

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