Research Article

Study of audiovisual reaction time in premenstrual and postmenstrual phase of menstrual cycle in normal young females

Bhakti Dabir*, P K Kalwale

Department of Physiology, Goverment Medical College, Aurangabad, 431001, Maharashtra, INDIA.
Email: bhaktidabir007@gmail.com

Abstract

The measurement of reaction time has been used to evaluate the processing speed of central nervous system and coordination between sensory and motor system. Neurophysiologic studies have shown that the brain regions involved in affective state as well as cognition are widely affected by ovarian steroids. Present study was carried out to determine if there is any alteration in audiovisual reaction time during premenstrual period compared to postmenstrual period in young females. The study was conducted on thirty healthy, regularly menstruating female medical students who were in the age group of 18-22 years to evaluate the influence of premenstrual phase compared to postmenstrual phase on auditory reaction time (ART) and visual reaction time (VRT) by using a reaction time instrument which is supplied by Medicaid systems RTM 604(Chandigarh-India). Premenstrual phase was taken as 1 to 7 days prior to onset of next menstruation and postmenstrual phase as 5th to 10th day of menstrual cycle. The mean visual reaction time in seconds was found to be 0.5743 ± 0.0529 during premenstrual phase whereas it was 0.5477 ± 0.0510 during postmenstrual phase and the difference was statistically significant. The mean auditory reaction time in seconds was found to be 0.4597 ± 0.0425 during premenstrual phase whereas it was 0.4363 ± 0.0441 during postmenstrual phase and the difference was statistically significant. It was concluded that reaction time was more during the premenstrual phase as compared to the postmenstrual phase.

Keywords: Reaction time, Menstrual cycle, Ovarian steroids.

***Address for Correspondence:**
Dr. Bhakti Dabir, Department of Physiology, Govt. Medical College, Aurangabad, 431001, Maharashtra, INDIA.
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INTRODUCTION

Menstrual cycle refers to cyclic changes that occur in ovary and endometrial tissue under the influence of hormones during active reproductive years in females, leading to recurrent monthly bleeding per vaginum. About 24 hours before the end of menstrual cycle, estrogen and progesterone levels decline leading to menstrual bleeding. This is followed by proliferative or postmenstrual phase which is under influence of estrogen and then the secretory or premenstrual phase under the influence of estrogen and progesterone.[1] Large segment of female population experience certain behavioral and neurological symptoms like depression, tension, poor judgment, nervous irritability, emotional instability, headache, decreased concentration during premenstrual phase.[1,2] Reaction time is interval between the application of stimulus and the appearance of an appropriate voluntary response by a subject. It involves stimulus processing, decision making and response programming. Reaction time has been found to be altered by number of factors both physiological and pharmacological.[3,4] Processing speed and motor speed appear to be dependent on cerebral dopaminergic system and basic neuroscience studies have shown that estrogen influences dopamine release in nigrostrial pathway.[5,6] Reaction time is index of processing capabilities of central nervous system and coordination of sensory and motor systems.[2,7] Present study was carried out to determine if there is any

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difference in audiovisual reaction time during premenstrual period compared to postmenstrual period in young females.

MATERIAL AND METHODS

The study was conducted in the Department of Physiology, Government Medical College at Aurangabad (MS). Premenstrual phase was taken as 1 to 7 days prior to onset of next menstruation and postmenstrual phase as 5^{th} to 10^{th} day of menstrual cycle. All subjects were asked to have adequate sleep at night and to refrain from any medications throughout the period of study. Subjects with history of irregular menstrual cycle, pregnancy, lactation or use of contraceptive in past 1 year were excluded from the study. Subjects with history of audiovisual disturbances, psychiatric illness or sleep disorders, any trauma or addictions were also excluded from the study. The study protocol was explained and informed consent was obtained from all the volunteers. After taking consent personal, medical and menstrual history of subjects was noted and audiovisual reaction time was measured during the premenstrual period (i.e.1 to7 days prior to onset of next menstruation) and postmenstrual period (5^{th} to 10^{th} day of menstrual cycle). ART and the VRT were measured in a quiet separate room with the subject sitting comfortably on a chair. The ART and VRT were measured by using a reaction time instrument which was supplied by Medicaid Systems RTM-604 (Chandigarh, India). The data was analyzed by paired t test and p value <0.05 was taken as significant.

RESULTS

Table 1: Baseline characteristics

Parameter	Value in study group
Weight (Kg.)	52.32 ± 5.67
Height (cm.)	155.14 ± 4.65

Table 2: Comparison of reaction time

Parameter	Premenstrual period	Postmenstrual period	p value
VRT (Sec.)	0.5743 ± 0.0529	0.5477 ± 0.0510	<0.0001(S)
ART (Sec.)	0.4597 ± 0.0425	0.4363 ± 0.0441	<0.0001(S)

ART-Auditory reaction time, VRT-visual reaction time, S-Significant

DISCUSSION

The present study shows the prolongation of both ART and VRT during premenstrual phase as compared to those during postmenstrual phase. Retention of water and sodium due to variation in sex steroid levels during menstrual cycle might influence the process of axonal conduction time and availability of neurotransmitter at synapses in auditory pathways. Change in either of these two processes cause conduction time to vary during the menstrual cycle [1, 2, 8]. Neurophysiologic studies have shown that the brain regions involved in affective state as well as cognition are widely affected by ovarian steroids [9, 10]. Progesterone acts at the level of plasma membrane of selected cells to inhibit the activation of adenylcyclase. Progesterone is metabolized by extra-adrenal 21-hydroxylation to deoxycorticosterone which acts by way of mineralocorticosteroid receptor [2]. Another metabolite formed by reduction of progesterone acts in the brain as an anesthetic / anxiolytic agent by binding to gamma amino butyric acid ($GABA_A$) receptor. GABA is an inhibitory neurotransmitter, an endogenously produced anxiolytic like compound. These metabolites are formed in women during premenstrual phase when progesterone excretion is high. GABA favors influx of chloride ions into the cells. Increased chloride entry into brain cells serves to hyperpolarize the membrane and thereby inhibits neural transmission. This neural transmission inhibition affects sensory-motor association and processing capability of central nervous system [2]. So, this prolongation of reaction time during the premenstrual phase could be attributed to modulation in neurotransmitter involved due to hormonal fluctuations affecting sensory-motor association and processing capability of central nervous system [2, 8]. Limitations of study include the small sample size and study design. Further research with larger sample size and with robust study design needs to be done to further understand the difference in reaction time during various phases of menstrual cycle.

CONCLUSION

It was concluded that reaction time was more during the premenstrual phase as compared to the postmenstrual phase.

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