Research Article

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STUDY OF VISUAL ONLINE REACTION TIME IN DIFFERENT PHASES OF MENSTRUAL CYCLE IN HEALTHY FEMALES

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ABSTRACT

Aims and objectives: The present study was designed to study the influence of various phases of menstrual cycle on visual online reaction time.

Material and Methods: Fifty females in the age group of 18-25 years were recruited for the study. Visual reaction time test was taken online. Statistical Analysis: Results were analysed by ANOVA with SPSS version 17.0 using paired 't' test.

Results: showed that there was significant prolongation of reaction time ($p<0.05$) in luteal phase as compared to follicular and menstrual phase.

Conclusions: Variation in visual reaction time could be due to the fluctuating levels the female sex hormones across the menstrual cycle.

Key Words: Follicular phase, Luteal phase, Online reaction time

INTRODUCTION

The biological activity of the menstrual cycle is created by the coordination among hypothalamic, hypophyseal and ovarian hormones.[1].

The established hypothalamic, hypophyseal and ovarian axis and its cyclical hormonal changes during the three phases of normal menstrual cycle are as follows.[2].

Follicular phase: is mainly a phase of oestrogen, influenced by follicular stimulating hormone.

Luteal phase: primarily a phase of progesterone influenced both by follicular stimulating hormone and luteinizing hormone.

Menstrual cycle: the cervical bleeding phase, due to the withdrawal of hormonal effect on endometrium. The fluctuations in hormonal levels affect not only the female reproductive tract but also many other tissues of the body.

Various studies have shown that female sex hormones modulate auditory, visual and taste threshold, latency and amplitude.[3] Behavioural and neurological symptoms like decreased concentration, nervous, irritability, emotional instability, poor judgement, tension and depression are seen in women during premenstrual phase.[4] This may be due to due to effect of gonadal hormones on neural functions.[5]

Reaction time is the measure of how fast a person responds to a particular type of stimuli. It can be defined as the time interval between the application of a stimulus and an appropriate voluntary response from the subject. It measures the ability to process information and judges the ability to concentrate and coordinate.[6]

Flow of information in an organism can be depicted in this way: [7,8,9]

Stimulus	Receptors	Integrators	Effectors	Response
Stimulus	Sensory neuron	Spinal cord or Brain	Motor neuron	Response

Various studies have shown that ovarian steroids influence dopamine release in the nigrostriatal pathway.[10,11] Estradiol has widespread effects throughout the brain regions involved in affective state as well as cognition.[12,13]

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Online visual reaction times during various phases of menstrual cycle studies have not been studied in other researchers. As menstrual cycle is associated with fluctuating levels of ovarian hormones, this study was designed to study the visual online reaction time across different phases of menstrual cycle.

MATERIAL & METHODS

The present study was a cross-sectional study, conducted in Department of Physiology, Santosh Medical College, Ghaziabad. Ethical approval was taken from the research committee of the Institution before starting the study.

One hundred apparently healthy female volunteers in the age group of 18-25 years with history of regular menstrual cycle were studied in follicular, luteal and menstrual phases of menstrual cycle. Mensrual history including age of menarche, regularity of cycles, history of dysmenorrohea, history of premenstrual symptoms like irritability, headache were collected. Female subjects with age >above 25years, history of irregular menstrual cycles, use of contraceptive pills, use of psychotropic drugs (sedatives, hypnotics and tranquilizers), antihistaminics, antiepleptics, and smokers or consuming alcohol were excluded from the study. Females with history of psychiatric illness or recent psychological trauma or sleep disorders were also excluded from the study. Informed consent was taken from all the subjects.

Height was measured using a standard stadiometer with the subject standing in erect posture. The readings were taken to the nearest 0.1cm.

Weight was recorded in kgs using a calibrated weighing machine (Avery) scale with a capacity of 120 kg and a sensitivity of 0.05 kg.

BMI (body mass index) was calculated as the weight in kilograms divided by the square of the height in meters [weight(kg)/height(m^2)] .[14]

Online Reaction Time Test: Visual reaction time test was taken online.[15].It consists of a traffic light signal of red, yellow and green. The subject is instructed to click on a button to begin when ready, to wait for the stoplight to turn green, and click the button when it turns green quickly! The average of five responses in seconds is taken as a reading.

Statistical Analysis: Results were analysed by ANOVA with SPSS version 17.0 using paired 't' test and expressed as Mean ± SD. P value < 0.05 was considered as significant.

RESULTS

Table 1 : Mean ± SD of the anthropometric variables

Variables	Mean±SD
Age(yrs)	20.72±1.20
BMI(kg/m^2)	21.67± 0.97

Table 2: Statistical analysis of online visual reaction test during different phases of the menstrual cycle.

Parameters	Menstrual phase(MP)	Follicular phase(FP)	Luteal phase(LP)
Online Reaction Time (sec)	0.42±0.12	0.53±0.11	0.65±0.14
p value	MP vs FP <0.05	FP vs LP <0.05	LP vs MP <0.05

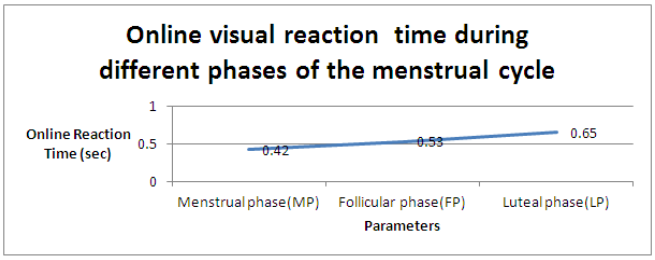

Figure 1: Line graph showing the visual reaction time in different phases of the menstrual cycle

DISCUSSION

Our study results have shown that there is prolongation of online visual reaction time in luteal phase [mainly progesterone] as compared to the follicular phase [mainly oestrogen]. Delayed reaction time in the luteal phase may be due to female sex hormones [mainly progesterone] that cause salt and water retention thus affecting the axonal conduction. Altered axonal conduction influences the availability of neurotransmitter at synapses in signal processing pathway that causes slow conduction of the impulse and hence prolonged reaction time[16].

Kaneda *et. al.* have also showed that increased latency of visual evoked potentials may be due to high progesterone levels during the luteal phase[17].

Various studies have showed that effects of estrogen on brain are antagonistic to that of progesterone therefore explaining less reaction time in follicular phase as compared to luteal phase[18,19,20,21]. Progestrone may also decrease the sensitivity of neurons and blunts the estrogen potentiated GABA (Gamma-Amino Butyric Acid) release[22,23].Moreover, estrogen has been shown to be neuroprotective[24].

It has been shown by many authors that female sex hormones act at the receptor level on the hippocampus and hypothalamus that alters the excitability of the neurons across different phases of the menstrual cycle[25,26]. Limitation of our study is that we have not measured hormonal levels of estrogen and progesterone in the serum during various phases of menstrual phases. These also have not been statistically correlated with reaction times.

CONCLUSIONS

Variation in visual reaction time could be due to the fluctuating levels the female sex hormones across the menstrual cycle. The prolongation of reaction time in menstrual phase correlates well with the mood swings associated with premenstrual syndrome. Tasks requiring short reaction times like emergencies situations in speeding while driving, air force postings on the war front may be avoided in this phase, as these are prolonged during the phase.

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REFERENCES

1. Cooke WH, Ludwig DA, Hogg PS, Eckburg DL, Convertino VA. Does the menstrual cycle influence the sensitivity of vagally mediated baroreflexes. Clin Sci 2002;102: 639-644
2. Williams. Pregnancy planning and antepartum management, Text Book of Obstetrics. 2006,22nd edition,226.
3. Vogel W, Broverman DM, Klaiber EL. EEG responses in regularly menstruating women and in amennorrheic women treated with ovarian hormones. Science. 1971;172:388.
4. Pawar BL, Kulkarni MA, Syeda A, Somwanshi ND, Chaudhari SP. Effect of premenstrual stress on cardiovascular system and central nervous system. J Obstet Gynecol India. 2006;56(2):156–58.
5. Walpurger V, Pietrowsky R, Kirschbaum C, Wolf OT. Effect of the menstrual cycle on auditory event related potentials. Hormones and Behavior. 2004;46:600
6. Nene AS, Pazare PA. A study of auditory reaction time in different phases of the normal menstrual cycle. Indian J Physiol Pharmacol. 2010;54(4):386–90.
7. Formulate and test hypotheses regarding reaction times. Biology 104. A online PDF literature form Radford University.www.radford.edu/jkel/reaction.
8. Robert JK. A Literature Review of Reaction Time, 2005. Available from: http://www.biae.clemson.edu/bpc/bp/Lab/110/reaction.htm#Arousal. [Accessed 2005 Mar 17].
9. Marieb Elaine N. Exercise 22 Human reflex physiology. Activity 9: testing reaction time for basic and acquired reflexes. Human Anatomy and Physiology Laboratory Manual (Cat Version). 7 th ed. San Francisco, California: Benjamin Cummings; 2003. p. 232-3.
10. Mc Ewen B. Estrogen action throughout brain. Recent Prog Hormon Res 2002; 57: 357-384.
11. Mc Dermott JL. Effects of estrogen on dopamine release from corpus straitum of young and aged female rats. Brain Res 1993; 606:118-125.
12. Asso D. The relationship between menstrual cycle changes in nervous system activity and psychological behaviour and physical variables.Biol Psychol 1986;23: 53-64.
13. Asso D, Braier JR. Changes with menstrual cycle in psychophysiological and self report measures of activation. Biol Psychol 1982; 15: 95-107.
14. Everett RB, Worley RJ, MacDonald PC and Gant NF. Modification of vascular responsiveness to Angiotensinogen II in pregnant women by intravenously infused 5 alpha dihydroprogestrone. Am J Obstet Gynaecol 1978;131:352-357.
15. The Online Reaction Time Test (http://getourwebsitehere.com/jswb/rttest01.html.)
16. Das S, Gandhi A, Mondal S. Effect of premenstrual stress on audiovisual reaction time and audiogram. Indian J Physiol Pharmacol 1997;41:67-70.
17. Kaneda Y, Ikuta T, Nakayama H, Kagawa K, Furuta N. Visual evoked potential and electroencephalogram of healthy females during the menstrual cycle. J Med Invest. 1997;44:41–46.
18. Kawakami M, Sawyer CH. Effects of sex hormones and antifertility steroids in brain thresholds in the rabbit. Endocrinology. 1967;80:857–871.
19. Kluck N, O'Connor S, Hesselbrock V, Tasman A, Maier D, Bauer L. Variation in evoked potential measures over the menstrual cycle: a pilot study. Prog Neuropsychopharmacol Biol Psychiatry. 1992;16:901–911.
20. Vingerling JR, Dielemans I, Witteman JC, Hofman A, Grobbee DE, de Jong PT. Macular degeneration and early menopause: a case-control study. BMJ. 1995;310:1570–1571.
21. Párducz A, Perez J, Garcia-Segura LM. Estradiol induces plasticity of gabaergic synapses in the hypothalamus. Neuroscience. 1993;53:395–401.
22. Yadav A, Tandon OP, Vaney N. Auditory evoked responses during different phases of menstrual cycle. Ind J Physiol Pharmacol 2002; 46: 449-456.
23. Yadav A, Tandon OP, Vaney N. Long Latency auditory evoked responses in ovulatory and anovulatory menstrual cycle. Ind J Physiol Pharmacol 2003; 47: 179-184.
24. Behl C, Widmann M, Trapp T, Holsboer F. 17-beta estradiol protects neurons from oxidative stress-induced cell death in vitro. Biochem Biophys Res Commun. 1995;216:473–482.
25. McEwen BS, Davis PG, Parsons B, Pfaff DW. The brain as target for steroid hormone action. Ann Rev Neurosci. 1979; 2: 65-73.
26. Curtis DR, Game CJA, Johnston GAR, McCulloch RM. Central effects of β-(p chlorophenyl)-γ-aminobutyric.Brain RES. 1974; 70: 493-99.