STUDY OF AUDITORY REACTION TIME DURING FOLLICULAR AND LUTEAL PHASE OF MENSTRUAL CYCLE

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Abstracts: **Background:** Reaction time is an indirect index of evaluating the processing speed of central nervous system and a simple mean of determining the sensory-motor performance. Female sex hormones not only affect the female reproductive organs but also central nervous system. Present study was aim to determine whether follicular and luteal phase affect the auditory reaction time. **Method:** The study was conducted on 50 healthy adult female with regular menstrual cycle, between the age group of 26-40 years. Simple and Choice Auditory reaction time were measured during follicular and luteal phases**.** The result was statistically analysed by graph Pad Instat Statistical software (demo version). P<0.05 was taken as significant. **Result:** Simple and Choice auditory reaction time both were longer during luteal phase as compared to follicular phase of menstrual cycle. **Interpretation and conclusion:** Prolonged auditory reaction time during luteal phase could be due to modification of auditory processing which in turn could be due to alteration of neural transmission.

Key Words: Auditory reaction time, Follicular phase, Luteal phase, menstrual cycle.

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Introduction:

Reaction time has been defined as the time interval between the application of the stimulus and an appropriate voluntary response by the subject[1]. It provide an indirect index of processing capability of CNS and a simple means of determining ones sensory-motor performance[2]. A significant reduction in the response time indicates an improved sensorimotor performance and/or enhanced processing ability of the CNS, whereas a prolonged response time indicates a deterioration of processing capability of the CNS or poor sensorimotor performance or a combination of both[3].

Reaction time is found to be altered by a number of factors both physiological and pharmacological[4,5]. Menstruation is a physiological process in which there is cyclical bleeding per vaginum in females during reproductive age .This is due to cyclical production of estrogens and progesterone by ovaries with associated changes in endometrium of uterus. In proliferative phase of menstrual cycle estrogen level is high and in secretory phase, progesterone

level is high as compared to estrogens. Proliferative phase of endometrial cycle corresponds to follicular phase of ovarian cycle and secretory phase corresponds to luteal phase of ovarian cycle[6]. Gonadal hormones not only influence the reproductive functions, but they also display neuroactive effects[7].

The present paper is aims to understand the effect of follicular and luteal phase of menstrual cycle on auditory reaction.

Material and Methods:

The study was carried out in Department of Physiology, Government Medical College, Bhavnagar . The study was conducted on 50 healthy female subjects between the age group of 26-40 years and having regular menstrual cycle of 27-35 days for at least past 6 months. Subjects were selected on the basis of inclusion and exclusion criteria. Subjects >40 years, history of irregular menstrual cycle, taking contraceptive pills, anti-histaminic, antiepileptic, psychotropic drugs (sedative, Transquilizers, hypnotics), alchohol and smokers were excluded from this study. Subjects having psychiatric disorders, endocrinological disorders, epilepsy, sleep disorders, pathology or injury to the upper limb, hearing disorders and athletes were also excluded from this study. The approval of Institutional Review Board of Government Medical College, Bhavnagar and written consent from the female subjects was obtained.

Name, age, address and basic vitals of all the subjects were noted. History of tea and coffee was also taken. The tests were carried out in a secluded room around 10 o'clock in the morning. The reading were taken in the sitting position. After 15 minutes of rest , the Auditory Reaction time was measured by " Multiple Choice Apparatus 635 mp (Reaction Time Apparatus)", Inco company product (Ambala).The procedure was explained to the subjects. All the subjects were well informed with type of stimuli (Bell) and they were instructed to press the response key by the index finger of their dominant hand. After rehearsal, 3 reading were taken. The lowest reading was taken as the value for Auditory Reaction Time. Both simple and choice Auditory Reaction Time were taken. The Auditory Reaction Time was recorded during follicular (9-12th days) and luteal phase (19-22nd days) of menstrual cycle.

The results were manifested as Mean ± SD and the data were analysed by graph Pad Instat, statistical software (demo version). P value < 0.05 was taken as significant.

Result:

In the present study, Auditory Reaction Time of 50 healthy subjects was recorded. Table I compare simple Auditory Reaction Time and Table II compare choice Auditory Reaction time during follicular and luteal phase of menstrual cycle.

Table: 1 Comparison of Simple auditory reaction time (Min.) during different phases of menstrual cycle

Phases of menstrual cycle	Mean	±SD	T value	P value
Follicular phase	0.213	0.0408		
Luteal phase	0.232	0.0507	2.069	<0.05

Table:2 : Comparison of Choice auditory reaction time (Min.) during different phases of menstrual cycle

Phases of menstrual cycle	Mean	±SD	T value	P value
Follicular phase	0.353	0.0633		
Luteal phase	0.38	0.0634	2.114	< 0.05

Discussion:

Reaction time (RT) is the correct and timely response to the stimulus. It is brought about by reflex mechanisms involving peripheral and central mechanisms. Reaction time is an indirect index of processing capabilities of the central nervous system. It involves stimulus processing, decision making and response programming[8].

Reaction time is a simple, non-invasive and widely used method to check sensory-motor coordination and processing speed of central nervous system (CNS). However several factors affects it like gender, age, activity status of the person.

The sex hormones, especially estrogen and progesterone secreted from the ovaries, vary in their level during different phases of menstrual cycle. The menstrual phase is characterized by low levels of both these hormones and as we progress through the follicular phase, estrogen level rises rapidly to reach the peak just before ovulation, with progesterone levels continuing to remain low. Whereas during the luteal phase, the levels of both estrogen and progesterone rises, thus in the mid luteal phase, both the hormones are high. Hence during the normal menstrual cycle, there are two peaks of estrogen secretion, an "ovulation peak," which occurs near the end of the follicular phase and a "luteal peak." Progesterone reaches a peak about 4-7 days before menstruation[9].

Mean simple auditory reaction time during follicular phase is 0.213 **±** 0.0408 min. and during luteal phase is 0.232 **±** 0.0507 min. (table-I) . The table shows that simple auditory reaction time increase during the luteal phase as compared to the follicular phase. This increase in simple auditory reaction time during luteal phase is statistically significant (p< 0.05).

Mean choice auditory reaction time during follicular phase is 0.353 **±** 0.0633 min. and during luteal phase is 0.38 **±** 0.0634 min. (table-II) . The table shows that choice auditory reaction time increase during the luteal phase as compare to the follicular phase. This increase in choice auditory reaction time during luteal phase is statistically significant (p< 0.05).

Similar findings were reported by S. Das et al[10], Sunil Kumar et al [11], Pawar BL. et al[12]and Bhakti Dabir et al[13]. They found increased auditory reaction time during luteal phase (premenstrual phase) as compared to follicular phase (postmenstrual phase). But according to Veena C N et al[14] and Christina Sudheer et al[3] study auditory reaction time was highest during the mid proliferative phase (follicular phase) and lowest during the premenstrual phase (luteal phase) of menstrual cycle.

Neurophysiological studies have shown that brain region involved in affective state as well as in cognition are widely affected by ovarian hormones estrogen and progesterone[15]. Study of Smith et al showed that systemic or local application of progesterone significantly enhanced inhibitory responses of purkinje cells of cerebellum to GABA and suppressed glutamate excitation [16]. Transmagnetic stimulation studies also showed more cortical inhibition in luteal phase of menstrual cycle which is dominated by progesterone[17].

Bruce and Russel 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[18] .

Reduction metabolites of progesterone acts in the brain as an anasthetic / anxiolytic agent by binding to gamma amino butyric acid (GABA) receptor. GABA A is a inhibitory neurotransmitter, an endogenously produced anxiolytic like compound. These metabolites are formed in women during premenstrual phase when progesterone excretion is high. Apparently the confirmation changes of GABA receptor after anxiolytic steroid binding increase the affinity of GABA A for this receptor. GABA favours 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 sensorimotor association and processing capability of central nervous system[19] .

Different theories mentioned above help us to understand delay in reaction time during luteal phase.

Conclusion:

From this study we conclude that auditory reaction time is prolonged in luteal phase as compared to follicular phase which may be due to fluctuation of female sex hormones during menstrual cycle, as Progesterone may alter the auditory processing by affecting the neural transmission.

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