ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 07 | July - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FLUCTUATION IN HEARING THRESHOLDS RELATED TO THE PRE-MENSTRUAL AND POST-MENSTRUAL PERIODS

Audiology

Sneha S Raj* Audiologist, Rajiv Gandhi Institute Of Speech & Hearing, Meeliyat P.O., Thrikaripur, Kasaragod- 671310 Kerala. *Corresponding Author

Dr. Binoy Shany M S Professor (Audiology), Marthoma College Of Special Education, Institute Of Speech & Hearing, Badiadka, P.O. Perdala, Kasaragod-671551, Kerala.

ABSTRACT

Inner ear homeostasis and auditory functioning are impacted by the variations in hormone concentrations during the various menstrual cycle phases. Hormone fluctuations alter hearing thresholds by influencing higher sections of auditory processing. (Hampson, 1990). **Method:** To identify the hearing threshold variation during the pre-menstrual and postmenstrual period, 40 healthy female subjects in the age group of 18-25 years with regular menstrual cycles were enrolled for the study. **Result:** In the current study from the results obtained the mean score indicates that the hearing thresholds of both conventional pure tone audiometry and extended high frequency audiometry are poorer in all frequencies during the premenstrual period and were better in the postmenstrual period. **Conclusion:** It is evident that there is a relationship between the fluctuations of hormones during the various phases of the menstrual cycle and hearing sensitivity because the mean hearing thresholds are better during the postmenstrual period, when estrogen levels are higher, and they are comparatively lower during the premenstrual period.

KEYWORDS

INTRODUCTION

The first menstruation during puberty marks the beginning of the menstrual cycle, which is a sequence of changes in a sexually mature female. One of the elements influencing audition is hormonal fluctuations during the menstrual cycle. The inner ear's homeostasis and auditory sensory processing are impacted by variations in the levels of estrogen and progesterone across the various stages of the menstrual cycle (Al-Mana et al., 2008; Hederstierna et al., 2007). Less progesterone is produced in the second half of the menstrual cycle during perimenopause because of fluctuations in hormone levels brought on by decreased ovulation. Periods may be irregular, missing, or accompanied by severe clotting or bleeding. The shift in the estrogen to progesterone ratio causes symptoms. Therefore, the symptoms are caused by an imbalance in these hormones.

The premenstrual phase has a higher auditory reaction time than the postmenstrual phase. It is well recognized that hormones affect the homeostasis of the labyrinthine fluid. According to Ishii, Nishino, and Herrerias (2009), it results in hearing and balance problems. By monitoring spontaneous otoacoustic emission, Haggerty, Lusted, and Morton (1993) asserted that outer hair cells are responsive to hormonal and metabolic changes. In his research, Cox (1980) found that hearing thresholds were at their lowest during the menstrual phase and at their highest during the post-menstrual period. This is because the menstrual phase is when estrogen and progesterone levels are at their lowest.

Because of its excitatory and protective effects on the central nervous system, estrogen may make the auditory system more sensitive during periods of peak circulation. Accordingly, less sensitive auditory function may result from decreased hormone levels during the premenstrual phase. Similar to the findings reported in other sensorimotor and cognitive functions, a hormone fluctuation impacts higher areas of auditory processing, resulting in alterations in auditory thresholds (Hampson, 1990).

Existing research indicates that the existence of cochlear receptors for both estrogen and progesterone contributes to differences in the hearing threshold. As a result, inner ear homeostasis and auditory functioning are impacted by variations in these hormone concentrations throughout the menstrual cycle. The Indian population's premenstrual and postmenstrual hearing threshold fluctuation has not received much attention. In order to evaluate the auditory variance in the premenstrual and postmenstrual periods, this study was created.

METHOD

The study aims to investigate the variation in hearing thresholds in women during the menstrual cycle at the premenstrual and postmenstrual periods.

Test Procedure:

To identify the hearing threshold variation during the pre-menstrual and postmenstrual period, 40 healthy female subjects in the age group of 18-25 years with regular menstrual cycles were enrolled for the study. The subjects were oriented about the calculation of pre- and post-menstrual phases. The first day of bleeding is considered the first day of the cycle. The postmenstrual phase was considered as the 7th to 10th day of the menstrual cycle. The pre-menstrual phase was considered as the 21st to 25th day of the menstrual cycle.

1. Preselection Procedure:

Before the audiological tests, an otoscopic examination, screening audiometry, an interview on the audiological history (each participant was asked to complete case history to assess otologic health) and menstrual cycle were carried out (each participant completed a questionnaire on the regularity of the menstrual cycle) Thorough menstrual history including nature, regularity, the total duration of the cycle, days of menstrual flow, were sought from each participant.

2. Conventional Pure-tone audiometry (250 Hz to 8 kHz) and extended high-frequency audiometry (9 kHz to 16 kHz):

The hearing status of the subjects within the frequencies of 250 Hz to 8000 Hz was assessed using a Piano Inventis dual-channel clinical pure tone audiometer. Air conduction thresholds were obtained using the modified Hughson and Westlake procedure (Carhart and Jerger, 1959) in 1dB steps. The hearing threshold of the subjects within the frequencies of 9 KHz to 16 KHz was also assessed using a Piano Inventis dual-channel clinical audiometer. Air conduction thresholds were obtained using the modified Hughson and Westlake procedure (Carhart and Jerger, 1959) in 1dB steps.

The test results in the premenstrual and postmenstrual phases were compared to identify the hearing threshold variation in both phases. The collected data were subjected to analysis using SPSS version 27.0. The mean and standard deviation were obtained for each frequency in conventional pure tone audiometry and extended high-frequency audiometry during the premenstrual and postmenstrual period. Paired t-test was carried out to find the significant difference between the hearing threshold at each frequency during the premenstrual and postmenstrual period.

RESULT

The obtained results are explained in the following sections.

1. Conventional pure tone audiometry during the premenstrual and postmenstrual period.

Table 1: Indicates The Mean And Standard Deviation Of Hearing Threshold At Various Frequencies In The Right Ear.

Frequencies	N	Premenstrual		Post menstrualt-value		t-value	p-value
		Mean	SD	Mean	SD		
250Hz	40	3.95	3.559	3.53	3.762	1.560	.127

500Hz	40	5.88	3.172	4.75	3.557	5.626	.000
1kHz	40	6.10	2.416	5.10	2.725	4.074	.000
2kHz	40	5.08	3.562	4.30	3.268	2.443	.019
4kHz	40	3.43	4.437	2.95	4.230	1.361	.181
8kHz	40	1.88	4.931	.28	4.894	3.535	.001

From Table 1, the p-value indicates that the mean hearing threshold variation obtained was significant except at 250 Hz and 4 kHz. The mean hearing threshold at various frequencies shows that during the postmenstrual period, the hearing threshold was better when compared to the premenstrual period.

Table 2 indicates the mean and standard deviation of hearing threshold at various frequencies in the Left ear.

Frequencies	Premenstrual		Post menstrual		t-value	p-value
	Mean	Standard deviation	Mean	Standard deviation		
250Hz	2.65	5.142	1.93	4.687	3.019	.004
500Hz	5.38	3.477	4.95	3.105	1.497	.143
1kHz	5.58	3.876	4.70	3.421	4.242	.000
2kHz	3.80	3.639	2.93	3.885	3.050	.004
4kHz	2.53	5.883	1.48	5.059	2.014	.051
8kHz	2.15	4.715	-.20	4.473	6.419	.000

From Table 2, the p-value indicates that the mean hearing threshold variation obtained was significant except at 500 Hz. The mean hearing thresholds show that during the postmenstrual period, the hearing thresholds are better when compared to the premenstrual period.

The results obtained from conventional pure tone audiometry, from table 1 of the right ear and table 2 of the left ear, it is evident that the mean value of hearing thresholds is better in the postmenstrual period when compared to the premenstrual period. Also, the p-value indicates that there is a significant difference in hearing thresholds except at 250 Hz and 4 kHz in the right ear and 500 Hz in the left ear during the premenstrual and postmenstrual period.

2. Extended high-frequency audiometry during the premenstrual and postmenstrual period.

Table 3 Indicates The Mean And Standard Deviation Of Hearing Threshold At Various Frequencies In The Right Ear.

Frequencies	Premenstrual		Post menstrual		t-value	p-value
	Mean	Standard deviation	Mean	Standard deviation		
9KHz	2.05	6.413	-1.35	7.116	8.240	.000
10KHz	2.73	8.470	.33	8.229	5.838	.000
11.2kHz	5.95	5.267	2.23	5.554	10.456	.000
12.5 kHz	3.73	7.473	-.20	7.923	11.108	.000
14kHz	11.25	13.285	8.48	12.049	2.751	.009
16kHz	26.68	6.889	21.55	6.706	9.255	.000

From Table 3, the results indicate that there is a difference in mean hearing threshold in each frequency during the premenstrual and postmenstrual period, indicated by the p-value.

Table 4 Indicates The Mean And Standard Deviation Of Hearing Threshold At Various Frequencies In The Left Ear.

Frequencies	Premenstrual		Post menstrual		t-value	p-value
	Mean	Standard deviation	Mean	Standard Deviation		
9kHz	2.68	5.993	-.08	5.717	10.575	.000
10kHz	1.73	6.030	-1.55	5.430	5.203	.000
11.2kHz	2.00	6.813	-1.05	6.349	7.252	.000
12.5 kHz	3.90	5.790	-.43	5.505	13.731	.000
14kHz	13.00	14.994	8.25	13.720	5.742	.000
16kHz	28.40	6.698	24.30	6.545	22.994	.000

Table 4 shows that the p-value shows a highly significant difference in mean hearing thresholds at all frequencies tested during the premenstrual and postmenstrual periods.

The results obtained from extended high frequency audiometry, from table 3 of the right ear and table 4 of the left ear, it is clearly evident that the mean value of hearing thresholds is better in the postmenstrual period when compared to the premenstrual period. Also, the p-value indicates that there is a highly significant difference in hearing thresholds during the premenstrual and postmenstrual period.

DISCUSSION

In the current study from the results obtained the mean score indicates that the hearing thresholds of both conventional pure tone audiometry and extended high frequency audiometry are poorer in all frequencies during the premenstrual period and were better in the postmenstrual period. The results obtained from the present study agree with the study conducted by Perepa & Indurkar (2017), Peitiot & Parrot (1984), and Souza et al. (2017).

The fluctuation in hormones during the ovarian cycle may potentially lead to fluctuation in auditory function and other sensory processes. The auditory system may be more sensitive during the peak of oestrogen circulation because of its excitatory and protective effect in the central nervous system. The low levels of hormones during the premenstrual phase may relate to less sensitive auditory function. A fluctuation in these hormones affects higher areas of auditory processing and thus leads to changes in auditory thresholds (Perepa & Indurkar, 2017). Fluctuations in hormones during the menstrual cycle can cause various physical and psychological changes. The changes during the menstrual cycle cause certain variations in the hearing threshold. In the present study, the result reveals that the mean hearing thresholds vary during the premenstrual and postmenstrual period; the mean hearing thresholds were better in the postmenstrual period when compared to the premenstrual period in all frequencies ranging from 250 Hz to 16 kHz. The present study showed that there is a relationship between hormonal fluctuations and hearing thresholds, which was depicted by the changes in hearing thresholds observed during the phases of the menstrual cycle.

CONCLUSION

The menstrual cycle is a series of changes that occur in a sexually mature female, and it is marked by the first menstruation during the pubertal age. These changes are due to the fluctuations in hormones during the menstrual cycle. These hormonal changes that occur in a short time span lead to certain modifications all over the woman's body. Because of the cyclic nature of the female reproductive system and the influence of ovarian hormones on the auditory function in different phases of the menstrual cycle, the present study aimed to investigate the variation in hearing thresholds in women during the premenstrual and postmenstrual period

This study shows that there is a mean variation in hearing thresholds during the premenstrual and postmenstrual period. The mean hearing thresholds are better during the postmenstrual period, where there is a rise in estrogen, and it is comparatively poorer during the premenstrual period. The present study clearly shows that there is a relation between the fluctuations of hormones during different phases of the menstrual cycle and the hearing sensitivity.

REFERENCES

1. Cox, J. (1980). Hormonal Influence on Auditory Function. Ear and Hearing, 1(4), 219-222. doi: 10.1097/00003446-198007000-00008
2. Carhart R, & Jerger J (1959). Preferred method for clinical determination of pure-tone thresholds. J Speech Hear Disord, 24, 330–345.
3. Haggerty, H., Lusted, H., & Morton, S. (1993). Statistical quantification of 24-
4. Hour and monthly variabilities of spontaneous otoacoustic emission frequency in humans. Hearing Research, 70(1), 31-49. doi: 10.1016/0378- 5955(93)9
5. Hampson, E. (1990). Variations in sex-related cognitive abilities across the menstrual cycle. Brain and Cognition, 14(1), 26-43. doi: 10.1016/0278- 2626(90)90058-v
6. Ishii, C., Nishino, L., & Herrerias de Campos, C. (2009). Vestibular characterization in the menstrual cycle. Brazilian Journal of Otorhinolaryngology, 75(3), 375-380. doi: 10.1016/s1808-8694(15)30655-8
7. Peitiot, J.C. & Parrot, J. E. (1984). Effects of the ovarian and contraceptive cycles on absolute thresholds, auditory fatigue and recovery from temporary threshold shifts at 4 and 6 KHz. Audiology, 23, 581-598.
8. Perepa, L. & Indurkar, R. (2017). The effects of hormonal changes across menstrual cycle on high frequency auditory thresholds. Audiology Feature, Vol 26(3).
9. Souza, D., Luckwu, B., Andrade, W., Pessoa, L., Nascimento, J., & Rosa, M. (2017). Variation in the Hearing Threshold in Women during the Menstrual Cycle. International Archives of Otorhinolaryngology, 21(04), 323-328. doi: 10.1055/s-0037-1598601
10. Al-Mana D, Ceranic B, Djahanbakhch O & Luxon L M. (2008). Hormones and the auditory system: a review of physiology and pathophysiology. Neuroscience. 153(04):881–900. doi: 10.1016/j.neuroscience.2008.02.077.
11. Hederstierna C, Hultcrantz M, Collins A. & Rosenhall U. (2007). Hearing in women at menopause. Prevalence of hearing loss, audiometric configuration and relation to hormone replacement therapy. Acta Otolaryngol.127 (02):149–155. doi: 10.1080/0001 6480600794446.