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Original Article

Studying the Effect of Hormone Replacement Therapy on Tinnitus in Menopausal Women

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BRIEF TEXT

Background and Objective

It has been reported that women's peripheral and central auditory systems are more sensitive than those of men and undergo fluctuations during the menstrual cycle [1]. Estrogen may have neurostimulatory and neuroprotective effects on all auditory nerve fibers. Progesterone is also a 5-HT-lowering neurosteroid that has an indirect, balancing effect on auditory processing, thereby inhibiting the stimulatory effect of estrogen [2]. Hormones may play a role in the pathogenesis of pathological conditions of the auditory system, including hyperacusis, tinnitus, Meniere's disease, and auditory dysfunction in premenstrual syndrome [3]. Also, a negative correlation has been observed between circulating steroid levels and the severity of tinnitus associated with dysfunction of the hypothalamic-pituitary-adrenal axis. In contrast, hormone therapy in postmenopausal women has been shown to reduce the risk of tinnitus [4]. This study aimed to determine the effect of hormone replacement therapy (HRT) on tinnitus in menopausal women.

Materials and Methods

This randomized clinical trial was conducted in 2024-2025. The research sample consisted of postmenopausal women with moderate-to-severe tinnitus. Data collection tools included a demographic questionnaire, the Tinnitus Handicap Inventory (THI), the Visual Analog Scale (VAS), Tinnitus Matching Test (TMT), and general audiological assessments, including the pure-tone test, speech perception threshold, word-in-noise test, and tinnitus matching test [5]. The samples in this study were selected via convenience sampling, but allocation to the intervention and control groups was randomized (triple-blind study); 18 in the intervention group and 17 in the control group were included in the analysis. The intervention group received 0.625 mg of conjugated estrogen and 2.5 mg of medroxyprogesterone daily for three months [6]. The control group received a placebo tablet that was packaged in a similar shape and appearance to estrogen… [7] … [8] … [9].

Results

Before treatment, there was no difference in the tinnitus loudness scores based on the THI between the two groups (P = 0.32). After

treatment, the means of both groups also improved (P = 0.00). However, the means in the intervention group improved significantly and were lower than the other group (P = 0.02). However, in the intervention group, the mean difference before and after treatment in tinnitus loudness scores based on the THI was significant compared to the control group (P = 0.00) (Table 1). Based on TMT, there was no difference in tinnitus loudness scores between the two groups before treatment (P = 0.13). The tinnitus loudness scores of the both groups were reduced compared to before treatment based on TMT (P< 0.05). After treatment, the mean TMT score in the intervention group improved more and was lower than in the control group (P = 0.00). The difference in mean tinnitus loudness scores before and after treatment was not significant between the two groups based on TMT (P = 0.42) (Table 2). No significant between-group differences were observed in tinnitus pitch before (P= 0.68) or after treatment (P= 0.91), though the intervention group showed a significant increase in pitch (P < 0.001; Table 3). Similarly, while both groups showed significant improvement in VAS loudness scores post-treatment (P < 0.001), no significant between-group differences were observed at baseline (P = 0.83), post-treatment (P= 0.66), or in the mean change between groups (P= 0.64; Table 4).

Discussion

The main finding of this study was that, in postmenopausal women, HRT may be beneficial for tinnitus; while THI showed significant differences before and after treatment between groups, other assessments (VAS, TMT) showed inconsistent or non-significant changes. In fact, subjective improvement in THI had no consistent effect on loudness measures and increased tolerance for tinnitus annoyance. Therefore, we cannot make a general conclusion that combined HRT improved our patients' tinnitus. Our second finding was that both the intervention and control groups showed improvements in HRT, TMT, and VAS assessments, reflecting the placebo effect and the natural variability of tinnitus. This highlights the importance of between-group comparisons, as the THI score improved significantly after the intervention, and the difference between pre- and post-intervention means was greater than with placebo. Also, the tinnitus loudness score based on the TMT showed a significant decrease after the intervention compared with placebo treatment.

Our third and fourth findings were an increase in pitch frequency after the intervention and an increase in the effectiveness of HRT in patients with shorter tinnitus duration, respectively. Both of these observations were exploratory, and we do not have a specific explanation for them.

Our fifth finding was based on a significant improvement in the THI score after the intervention. Since this questionnaire assesses several dimensions of patients' quality of life, including sleep status, concentration, and emotional state [7], the improvement in our patients' THI scores indicated a positive effect of HRT on their overall quality of life. However, in our study, the analyses were exploratory, which could increase the risk of false-positive findings, especially given multiple outcomes, a small sample size, and no adjustment for multiple comparisons.

Researchers have reported that combined HRT, or coadministration of estrogen and progesterone, can reduce tinnitus-related disability and mean THI scores after treatment, and is an effective method for improving tinnitus in patients [1, 2, 10, 11]. However, we could not

conclude that combined HRT was effective in improving tinnitus in our patients. It has been reported that HRT, whether as estrogen monotherapy or as a combination of estrogen and progesterone, increases prolactin secretion and protects bones by affecting calcium metabolism [12]. Combined HRT may have adverse effects due to the presence of progestin, which can harm the peripheral and central auditory systems [13]. In our study, there were no reports of complications from combined HRT up to six months after drug administration, and the degree and pattern of hearing loss in our patients did not change before and after the study. However, we observed a finding for which we had no specific explanation: an increase in the pitch frequency of the tinnitus sound…[14]…[15]…[16].

It has also been reported that women who have undergone estrogen monotherapy have a significant reduction in breast cancer incidence and mortality [17]. Therefore, patients should be clearly informed that estrogen monotherapy has fewer side effects than combined HRT, so that they can make an informed decision when considering HRT [18].

Conclusion

In postmenopausal women, HRT may have potential benefits in reducing tinnitus-related disability. While other measures of tinnitus (visual analog scale, tinnitus matching test) are inconsistent or not significant, we cannot conclude that HRT is an effective intervention for the treatment of tinnitus.

REFERENCES

1. Emami SF, farahani F, mortazavi S. Studying of distortion product of otoacoustic emissions in menopausal women. *Indian J Otolaryngol Head Neck Surg*. 2023;**75**(1):88–92. PMID: 37206831 DOI: 10.1007/s12070-022-03210-1
2. Sajadian M. et al. Auditory-verbal memory function of women during the menstruation and ovulation periods. *Aud Vestib Res*. 2021;**30**(4):294-299. DOI: 10.18502/avr.v30i4.7449
3. Chrbolka P, Palúch Z, Hill M, Alušík Š. Circulating steroids negatively correlate with tinnitus. *Steroids*. 2017;**123**:37-42. PMID: 28450069 DOI: 10.1016/j.steroids.2017.04.004
4. Chen H-C, Chung C-H, Chen VC, Wang Y-C, Chien W-C. Hormone replacement therapy decreases the risk of tinnitus in menopausal women: a nation wide study. *Oncotarget*. 2018;**9**(28):19807. PMID: 29731984 DOI: 10.18632/oncotarget.24452
5. Emami SF, Shariatpanahi E, Gohari N, et al. Aging and speech-in-noise perception. *Indian J Otolaryngol Head Neck Surg*. 2023;**75**(3)1579-85. PMID: 37636642 DOI: 10.1007/s12070-023-03689-2
6. Liu P, Wei R, Zhu Z, Li H, Guo L, Miao Y, et al. Hormone replacement therapy in perimenopausal women with chronic tinnitus. *Lin Chuang er bi yan hou tou Jing wai ke za zhi J Clin Otorhinolaryngol Head Neck Surg*. 2021;**35**(9):812-7. PMID: 34628834 DOI: 10.13201/j.issn.2096-7993.2021.09.009
7. Mahmoudian S, Shahmiri E, Rouzbahani M, Jafari Z, Reza Keyhani M, Rahimi F, et al. Persian language version of the Tinnitus Handicap Inventory: translation, standardization, validity and reliability. *Int Tinnitus J*. 2011;**16**(2). PMID: 22249867
8. Jafari Z, Toufan R, Aghamollaei M, Malayeri S, Rahimzadeh S, Esmaili M. Characteristics and effects of tinnitus among workers exposed to occupational noise. *Iran Occupational Health*. 2014;**11**(1). Link
9. Jalali MM, Soleimani R, Fallahi M, Aghajanpour M, Elahi M. Psychometric Properties of the Persian Version of the Tinnitus Handicap Inventory (THI-P). *Iran J Otorhinolaryngol*. 2015;**27**(79):83–94. PMID: 25938079
10. Osman A, Țiereanu M-L. Hormonal and vascular contributions to tinnitus in pregnancy: a systematic review of literature. *ORL ro*. 2025(67). Link
11. Horner KC. The effect of sex hormones on bone metabolism of the otic capsule--an overview. *Hear Res*. 2009;**252**(1-2):56-60. PMID: 19121641 DOI: 10.1016/j.heares.2008.12.004
12. Guimaraes P, Frisina ST, Mapes F, Tadros SF, Frisina DR, Frisina RD. Progestin negatively affects hearing in aged women. *Proc Natl Acad Sci U S A*. 2006;**103**(38):14246-9. PMID: 16959884 DOI: 10.1073/pnas.0606891103
13. Stenberg AE, Wang H, Fish J 3rd, Schrott-Fischer A, Sahlin L, Hultcrantz M. Estrogen receptors in the normal adult and developing human inner ear and in Turner's syndrome. *Hear Res*. 2001;**157**(1-2):87-92. PMID: 11470188 DOI: 10.1016/s0378-5955(01)00280-5

14. Smeti I, Assou S, Savary E, Masmoudi S, Zine A. Transcriptomic analysis of the developing and adult mouse cochlear sensory epithelia. *PLoS* One. 2012;**7**(8): e42987. PMID: 22900075 DOI: 10.1371/journal.pone.0042987
15. Chen H-C, Chung C-H, Chen VC, Wang Y-C, Chien W-C. Hormone replacement therapy decreases the risk of tinnitus in menopausal women: a nation wide study. *Oncotarget*. 2018;**9**(28):19807. PMID: 29731984 DOI: 10.18632/oncotarget.24452
16. Manyonda I, Sinai Talaulikar V, Pirhadi R, Ward J, Banerjee D, Onwude J. Could Perimenopausal Estrogen Prevent Breast Cancer? Exploring the Differential Effects of Estrogen-Only Versus Combined Hormone Replacement Therapy. *J Clin Med Res*. 2022;**14**(1):1-7. PMID: 35211211 DOI: 10.14740/jocmr4646
17. Stenberg AE, Simonoska R, Stygar D, Sahlin L, Hultcrantz M. Effect of estrogen and antiestrogens on the estrogen receptor content in the cochlea of ovariectomized rats. *Hear Res*. 2003;**182**(1-2):19-23. PMID: 12948597 DOI: 10.1016/s0378-5955(03)00136-9
18. Price K, Zhu X, Guimaraes PF, Vasilyeva ON, Frisina RD. Hormone replacement therapy diminishes hearing in peri-menopausal mice. *Hear Res*. 2009;**252**(1-2):29-36. PMID: 19269311 DOI: 10.1016/j.heares.2009.02.010

Table 1. Mean and Standard Deviation of Disability Due to Tinnitus in the Studied Samples Based on the Tinnitus Handicap Inventory (THI)

Scale THI	Group		*P* Value*
	Intervention (Mean ± SD)	Control (Mean ± SD)	
Before treatment	56.70 ± 0.48	52.11 ± 76.32	0.32
After treatment	25.10 ± 0.20	36.80 ± 12.13	0.03
Difference in means before and after treatment	-31.10 ± 0.63	-13.10 ± 64.07	0.00
P-value**	0.00	0.00	-

*Mann-Whitney test **Wilcoxon test

Table 2. Mean and Standard Deviation of Tinnitus Loudness Scores in the Studied Samples Based on the Tinnitus Matching Test (TMT) Before and After Treatment

TMT scale	Group		*P* Value*
	Intervention (Mean ± SD)	Control (Mean ± SD)	
Before treatment	5.10 ± 94.83	6.20 ± 88.02	0.13
After treatment	2.00 ± 66.97	3.10 ± 39.10	0.00
Difference in means before and after treatment	-3.10 ± 33.64	-2.10 ± 94.87	0.42
P value**	0.00	0.00	-

*Mann-Whitney test **Wilcoxon test

Table 3. Mean and Standard Deviation of Tinnitus Pitch in the Studied Samples Based on the Tinnitus Matching Test (TMT) Before and After Treatment

TMT Scale	Group		*P* Value*
	Intervention (Mean ± SD)	Control (Mean ± SD)	
Before treatment	3866.26 ± 11.25	4176.22 ± 47.40	0.68
After treatment	4194.25 ± 44.47	4176.22 ± 47.41	0.90
Mean tinnitus pitch differences	333.47 ± 98.98	0 ± 0	0.10
P value**	0.00	-	

*Mann-Whitney test **Wilcoxon test

Table 4. Mean and Standard Deviation of Tinnitus Loudness Scores in the Studied Samples Based on the Visual Analog Scale (VAS) Before and After Treatment

VAS Scale	Group		P Value*
	Intervention (Mean ± SD)	Control (Mean ± SD)	
Before treatment	7.10 ± 83.20	7.10 ± 73.35	0.83
After treatment	3.39 ± 44.47	3.00 ± 52.72	0.67
Difference in means before and after treatment	-4.10 ± 44.58	-4.10 ± 18.51	0.64
P value**	0.00	0.00	-

*Mann-Whitney test **Wilcoxon test