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THE EFFECT OF BINAURAL BEATS ON PREGNANT WOMEN PRIMIGRAVIDA 3RD TRIMESTER TO REDUCE PAIN IN THE 1ST STAGE OF LABOR PROCESS

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ABSTRACT

Keywords:
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Third-trimester primigravida mothers typically experience anxiety. Serotonin, norepinephrine, and GABA are the three primary neurotransmitters responsible for anxiety. Labor pain may be impacted by anxiety. Relaxation music can help with anxiety. Binaural beats are a sort of relaxation music that are thought to be an inexpensive, safe, and side-effect-free approach to ease anxiety and pain in patients, according to various studies. The aim of this study was to ascertain how binaural beats affected anxiety and pain during the early stages of labor. The HRS-A questionnaire was used in a quasi-experimental study with a control group for the pretest and posttest. The participants in this study are 36 primigravida moms who are 36 weeks along. The participants were then split into four groups: control, alpha, beta, and gamma. Two weeks prior to delivery, the intervention was conducted by listening to 20 minutes of the group's preferred genre of music or binaural beats. The labor pain scale was calculated using the Verbal Descriptor Scale. The collected data will be examined with Paired-Sample T-Test, One-Way ANOVA, and Regression Linear tests in SPSS. The result of alpha and beta groups, when the anxiety scale affects the pain scale of the initial stage of labor, there is a considerable drop in the anxiety scale. Binaural beats' alpha and beta waves hence effectively lower the initial stage of labor's pain scale.

ABSTRAK

Kata Kunci:
binaural beats,
kecemasan,
nyeri persalinan,
primigravida

Ibu primigravida trimester ketiga biasanya mengalami kecemasan. Serotonin, norepinefrin, dan GABA adalah tiga neurotransmitter utama yang bertanggung jawab atas kecemasan. Nyeri persalinan dapat dipengaruhi oleh kecemasan. Musik relaksasi dapat membantu mengatasi kecemasan. Binaural beats adalah sejenis musik relaksasi yang dianggap sebagai pendekatan yang murah, aman, dan bebas efek samping untuk meringankan kecemasan dan rasa sakit pada pasien, menurut berbagai penelitian. Tujuan dari penelitian ini adalah untuk memastikan bagaimana binaural beats memengaruhi kecemasan dan rasa nyeri selama tahap awal persalinan. Kuesioner HRS-A digunakan dalam penelitian kuasi-eksperimental dengan kelompok kontrol untuk pretest dan posttest. Responden dalam penelitian ini adalah 36 ibu primigravida yang memiliki usia kehamilan 36 minggu. Para responden kemudian dibagi menjadi empat kelompok: kontrol, alpha, beta, dan gamma. Dua minggu sebelum persalinan, intervensi dilakukan dengan mendengarkan 20 menit sesuai dengan musik masing-masing kelompok atau binaural beats. Skala nyeri persalinan dihitung dengan menggunakan Verbal Descriptor Scale. Data yang terkumpul akan diperiksa dengan uji Paired-Sample T-Test, One-Way ANOVA, dan Regresi Linear di SPSS. Hasil pada kelompok alpha dan beta, skala kecemasan mempengaruhi skala nyeri pada kala 1 persalinan, dan terjadi penurunan yang cukup besar pada skala kecemasan. Gelombang alpha dan beta pada binaural beats secara efektif menurunkan skala nyeri kala 1 persalinan.

INTRODUCTION

Pregnancy is a happy moment and also causes stress for women. Stress during pregnancy arises because there are many changes in pregnant women ranging from hormonal changes to physical changes. This stress scale can also be caused by pregnant women imagining a painful birth process. Pregnant women will respond to their stress with feelings of anxiety (1). Feelings of anxiety in pregnant women are often found, especially in primigravida mothers, and increase when the pregnancy reaches the third trimester.

Many primigravida pregnant women experience anxiety disorders because the mothers have never had the experience of giving birth before. A study stated that of 16 respondents, who were third trimester primigravida mothers, there were 62.5% or 10 respondents experiencing severe anxiety (2). Another study also showed that 52.5% of pregnant women experienced anxiety during the third trimester and 66.2% of them were primigravida mothers (3). This is similar to research that shows a significant correlation between gravidity in the third trimester and the level of anxiety of pregnant women (4). The research stated that it was known that of the 50 respondents, 20 of them were primigravida mothers who experienced moderate anxiety.

During pregnancy, there is a decrease in serotonin, an increase in *gamma-aminobutyric acid* (GABA), an increase in norepinephrine and an increase in epinephrine (5). These neurotransmitters respectively cause anxiety, increase the risk of depression, increase heart rate, stimulate psychological stress, and cause mood swings (leading to negative mood). The resulting psychological and physiological conditions will stimulate pain by reducing the pain threshold value, thereby increasing sensitivity to pain. The pain threshold value decreases when you are in a state of anxiety, depression and discomfort (6,7).

The birthing process consists of four stages. The mother will experience pain caused by stretching of the uterus and stretching of the cervix during the first stage of labor (8). The uterus stretches, causing pinching of the nerve endings which causes uterine inertia. These complications are factors that cause the second stage to last a long time, apart from the lack of strength to push due to lack of energy (9). Based on one study, 37% of maternal deaths occurred due to the second stage which lasted a long time (9,10). The treatment method related to this is often by providing food or drink to increase the mother's energy during the second stage. However, this method is considered less than optimal, because often the mother does not have the desire to eat and drink (11). The stretching of the uterus and cervix caused in the first stage can increase the potential for uterine inertia to occur in the second stage, which lasts longer. The author states that there is a need for innovative interventions related to reducing first stage pain in order to reduce maternal and infant mortality rates to realize the achievement of Sustainable Development Goals (SDGs) number 3, namely healthy and prosperous lives, especially in maternal and child health.

Relaxation music can significantly reduce emotional recall and trauma (12). Relaxation methods for reducing anxiety in the medical field are very diverse, one of which is the use of binaural beats. Binaural beats are based on the use of the difference between two sound waves of fixed intensity, and heard through different ears (13). Delta waves (0.1-4 Hz), theta waves (4-8 Hz), alpha waves (8-13 Hz), beta waves (13-30 Hz), and gamma waves (30-100 Hz) are binaural waves beats. Several previous studies stated that binaural beats can reduce anxiety and reduce pain. A research result states that listening to binaural beats for 20 minutes has better results in reducing the anxiety scale (14,15).

Binaural beats is considered a cheap, safe and side effect-free method for alleviating anxiety and pain in patients (13). Binaural beats have the potential to be a good method for reducing anxiety and pain. However, so far there has been no specific research regarding the effect of binaural beats on the anxiety scale of third trimester primigravida mothers and the pain scale during labor. Therefore, research regarding the effect of giving binaural beats on the anxiety scale experienced by primigravida pregnant women in the third trimester, the pain scale in the first stage of labor, and the differences in influence between the types of alpha, beta and gamma waves on binaural beats needs to be carried out. The results of this research can be used as a solution to

reduce the anxiety experienced by primigravida mothers and/or in the third trimester which will have the impact of minimizing pain in the first stage during the birthing process.

METHODS

This research used a quasi-experimental design which carried out a pretest and posttest on the experimental and control groups. This research was carried out in the city of Surabaya and Sidoarjo Regency, by getting 52 initial respondents, who were then divided into four groups, namely the experimental group (alpha, beta, and gamma) and the control group which differed in the type of audio intervention. Several respondents dropped out at the end of the research, because they did not routinely carry out audio therapy intervention activities (binaural beats and audio control group) during the research period. There were 16 respondents who dropped out (four people from each group), so that the number of research respondents who could be analyzed was 36 people (nine people from each group).

The use of alpha, beta and gamma waves is based on indications during labor, namely in a conscious condition. The purposive sampling technique used was to take every respondent who met the research criteria and the respondents were present at the time of the research with the inclusion criteria, namely if you are pregnant for the first time (primigravida), in the third trimester or equivalent to a minimum gestational age of 36 weeks, and are willing to become respondents by agreement on the informed consent sheet provided before the research begins.

The anxiety level of pregnant women respondents was measured using the Hamilton Rating Scale for Anxiety (HRS-A) questionnaire given to respondents. The HRS-A questionnaire has 14 parameters with answer options using a 0-4 Likert scale (0=none; 1=mild; 2=none; 3=severe; and 4=very severe). The results of each parameter are summed and averaged. The final score is categorized into four categories, namely a scale of 0-<13=no anxiety; 13-19=mild anxiety; 20-26=moderate anxiety; 27-40=severe anxiety; The HRS-A questionnaire was distributed twice before the intervention

and after the intervention (after delivery). Data regarding the first stage of labor pain scale was collected by distributing the Verbal Descriptor Scale (VDS) questionnaire to respondents after delivery. The VDS questionnaire has a scale of 0-10 (0=no pain; 1-3=mild pain; 4-6=moderate pain; 7-9=controlled severe pain; and 10=uncontrolled severe pain).

The intervention is carried out for 20 minutes per day, at least two weeks before the Expected Birth Day or *Hari Perkiraan Lahir* (HPL). This is based on research which states that relaxation memories from binaural beats can be formed at least one week after listening to them regularly. One week later, intervention continues to be implemented to maintain the neurotransmitter pathway. This is related to the average decline in HPL with a standard deviation of 2.28 ± 11.57 days. A research result states that listening to binaural beats for 20 minutes has better results in reducing the anxiety scale.

Levene Test was used as a homogeneity test and the Shapiro-Wilk test as a normality test in the analysis prerequisite tests. In addition, inferential and descriptive analyzes were also carried out. This research uses *Statistical Program for Social Science* (SPSS) 18.0 software to produce descriptive and inferential analysis. Inferential analysis using Paired-Sample T Test, *One-Way Analysis of Variance* (ANOVA), and linear regression tests were used in inferential analysis. HRS-A pretest and posttest anxiety scores will be compared using the Paired-Sample T Test. Testing variations in the pain and anxiety scores of each group used One-Way ANOVA. The linear regression test was used to determine the effect of anxiety scores on the pain scale for the first stage of labor.

RESULT

The results of descriptive analysis from Table 2 show that each group experienced a decrease in the average anxiety scale with the highest decrease, namely the alpha group of 12.639. The results of this descriptive analysis can be interpreted to mean that alpha wave type binaural beats can reduce anxiety. Meanwhile, the first stage pain scale with the lowest average was in the beta group with an average of 5.00.

The Paired-Sample T Test in this research analysis was used to determine the decrease in the anxiety scale for each group. This test was used because the results of normality testing and homogeneity testing of research data showed that the data were normal and homogeneous. The results of the normality test using Shapiro Wilk showed that all the data obtained were normally distributed with sig>0.05. The results of the homogeneity test on the data obtained using the Levene test with the results of the anxiety scale before the intervention were not homogeneous, whereas the anxiety scale after the intervention and the pain scale for the first stage of labor were homogeneous, that the pain scale for the first stage experienced by pregnant women had a different perception of pain..

The results of the homogeneity test on the data obtained using the Levene test showed that the anxiety level results before the intervention were not homogeneous. Meanwhile, the level of anxiety after the intervention and the level of pain in the first stage of labor were homogeneous.

Table 1. Results of Descriptive Analysis of Anxiety Scale Data Before Intervention, Anxiety After Intervention, and Pain Scale in the First Stage of Labor

	Respondent Group	n	Mean	elementary school	Minimum	Maximum
Anxiety Scale Before Intervention	*Alpha*	9	20,556	5,659	13.00	30.00
	Beta	9	22,333	6,633	8.00	31.00
	Gamma	9	23,333	3,428	17.00	27.00
	Control	9	19,667	10,897	6.00	39.00
Post-Intervention Anxiety Scale	*Alpha*	9	7,917	5,838	1.00	17.75
	Beta	9	15,294	7,123	6.13	27.13
	Gamma	9	22,501	13,949	9.00	50.75
	Control	9	22,389	12,162	8.00	46.50
Pain Scale for First Stage of Labor	*Alpha*	9	5,889	3,018	1.00	10.00
	Beta	9	5,000	2,236	2.00	8.00
	Gamma	9	6,000	3,162	1.00	10.00
	Control	9	6,778	2,539	2.00	10.00

Based on the results of Table 2, it can be seen that the significance value in the alpha and beta groups is smaller than the 0.05 significance level. The results of the hypothesis test can be interpreted, namely that there is a decrease in anxiety levels in the alpha and beta groups. Meanwhile, the significance value for gamma and control is greater than the 0.05 significance level

The results of the hypothesis test can be interpreted, namely that there is no decrease in anxiety levels in the gamma and control groups. The conclusion from this interpretation is that there is an influence of alpha and beta wave binaural beats on reducing the level of anxiety experienced by third trimester primigravida female respondents.

Table 2. Test Results of Differences in Anxiety Scores Before and After Using Binaural Beats in the Alpha, Beta, Gamma and Control Groups

Respondent Group	n	Mean	Elementary School	t	Significance Value (p<0.05)	Information
Alpha (before and after intervention)	9	12,639	4,664	8.130	0.000	Significant
Beta (before and after intervention)	9	7,039	7,963	2.652	0.029	Significant
Gamma (before and after intervention)	9	0.832	11,765	0.212	0.837	Not significant
Control (before and after intervention)	9	-2,722	13,780	-0.593	0.570	Not significant

Tests for differences in average anxiety scores after the intervention were carried out on third trimester primigravida mother respondents analyzed using One-Way ANOVA. The significance value of the One-Way ANOVA results for the anxiety value variable after the binaural beats intervention was smaller than the 0.05 significance level (F=4.066, p value = 0.015), so H0 was rejected. The results of this analysis can be interpreted to mean that there are differences in the average anxiety scores after the binaural beats intervention in primigravida mothers in the alpha, beta, gamma and control groups. Least Significance Difference (LSD) analysis was used to see the differences between groups (Table 3) with the results that there were no differences in the average anxiety scores after the binaural beats intervention in the alpha and beta groups and in the gamma and control groups, and there were differences in the alpha and control groups. Gamma and alpha groups with controls are marked with the notations a and b, as markers of differences between groups.

Table 3. LSD Analysis of Differences in Mean Anxiety Scale After Intervention for Each Group

Respondent Group	Average Value
Alpha	5.00a
Beta	5.50a
Gamma	9.88b
Control	11.81b

Tests for differences in the average pain scale in the first stage in primigravida mothers were analyzed using One-Way ANOVA. It was found that the One-Way ANOVA significance value for the pain scale value variable was greater than the 0.05 significance level, so H1 was rejected. So the results of the hypothesis test can be interpreted to mean that there is no difference in average pain in the first stage of labor between the alpha, beta, gamma and control groups. It can be seen from the average (mean) level of pain in the first stage of labor as measured using the VDS questionnaire that is not much different. The average level of pain in the first stage of labor in the alpha group was 5.889; beta group of 5.000; gamma group of 6.000; and the control group was 6.778. Based on these average figures, it shows that the level of pain in the first stage of labor is almost the same,

namely moderate pain based on the pain categorization on the verbal descriptor scale questionnaire, thus the hypothesis is rejected.

Another result obtained by the researchers was the result of measuring the duration of labor of primigravida mothers, with the assumption that the duration of labor will certainly influence the level of labor pain in the first stage with its impact in the second stage. The results showed that the significance value of the One-Way ANOVA results was for the variable duration of labor after intervention, namely 0.022m which is smaller than the significance level used, namely 0.05, so that H0 is rejected, with an F value of 3.733. The test results can be interpreted to mean that there is an average difference in the duration of labor between the respondent groups.

Supported by the results of the LSD follow-up test, there was no difference in the duration of labor between the alpha and beta groups and the gamma group and the control group (there was a difference in the group with notation [a] and notation [b]). From these results it can be stated that alpha and beta waves have a shorter duration of labor, so they can reduce fatigue during labor, which has an impact on reducing the risk of maternal and fetal death.

Table 4. LSD Analysis of Differences in Mean Duration of Labor for Each Group

Respondent Group	Average Value
Alpha	7.92[a]
Beta	15.29[a]
Gamma	22.50[b]
Control	22.39[b]

Table 5. Test Results of the Effect of Anxiety in Primigravida Mothers in the Third Trimester on the Pain Scale in the First Stage of Childbirth

	Regression Coefficients	Q	Significance Value (p<0.05)
(constant)	4.473	5.824	0.000
Anxiety levels after binaural beats intervention	0.085	2.265	0.030

The test of the influence of anxiety in third trimester primigravida mothers on pain in the first stage of labor was analyzed using the linear regression test. Based on the results of Table 5, it is known that the significance value of the anxiety level variable after the binaural beats intervention on the pain scale for the first stage of labor shows a value of 0.030, which means Ha is accepted or had an influence on anxiety in third trimester primigravida mothers regarding pain in the first stage of labor. The magnitude of the influence of anxiety in third trimester primigravida mothers on pain in the first stage of labor can be predicted using the formula "Pain scale = 4.473 + 0.085* anxiety value," which means that the assumed pain scale value is the sum of the constant value of 4.473 and the product of the coefficient of 0.085 with the number anxiety after intervention. Linear regression analysis also shows that anxiety in primigravida mothers has a 10.6% effect on pain in the first stage of labor.

DISCUSSION

The occurrence of psychological changes during pregnancy will cause complications and have an impact on the health of the mother and fetus, and even have an impact on postpartum depression. Providing

an introduction to pregnancy stress management is very

important in reducing the potential negative effects on the physical and psychological health of mothers and babies in the postpartum period (16), by relaxing using music or audio media *binaural beats.*

Binaural beats is auditory music that is produced by stimulating different frequencies (the magnitude of the wave frequency in audio binaural beats that enters the right ear is different from that that enters the left ear) and separately in each ear to stimulate the brain. Binaural beats alpha, beta and gamma waves can target the *Limbic Hypothalamus Pituitary Adrenal Axis* (LHPA), which will be stimulated and cause the release of the hormone *Corticotropin-Releasing Hormone* (CRH). This can increase the secretion of the hormone cortisol from the adrenal cortex and also activate adrenergic activity from the *Locus Ceruleus* (LC) which is where norepinephrine is produced (17). Norepinephrine and other neurotransmitters are homeostatic so that it will decrease stress and anxiety management in pregnant women in the third trimester, especially primigravida mothers; this is positively correlated with preventing vasoconstriction. The majority of blood flow is obstructed in cases of mothers with high anxiety, so giving birth without obstruction to blood flow will minimize pain in the mother giving birth.

The results of this study also found that there was no significant difference in average pain in the first stage of labor between the group using binaural beats and the control group. There is no difference in the average pain in the first stage of labor because the scale of pain measurement for each individual is not the same, so a definite measurement is needed of the labor pain felt (not subjective) by pregnant women in labor. This research produced findings that there was significance in the duration of labor in the alpha and beta wave groups. The size of the duration of labor during the delivery process will determine a mother's level of fatigue, which will then influence the continuation of labor.

The results of this study prove that anxiety in third trimester primigravida mothers influences the pain scale in the first stage of labor. The higher the level of anxiety experienced by primigravida mothers in the third trimester, the higher the pain scale in the first stage of labor. Vice versa, so it is necessary to balance the anxiety that can occur in primigravida mothers in the third trimester before the birth period, with the aim of reducing the scale of pain that will be felt in the first stage of labor. These results still need to be studied further because they have a constant value that has a fairly large influence on the pain scale in the first stage of labor, apart from the level of anxiety in primigravida mothers. Pregnant women will be influenced by external variables which can also cause pain in the first stage of labor, such as demographic factors and social and environmental factors for primigravida pregnant women.

There was a significant reduction in anxiety levels in the alpha and beta groups, where the anxiety level had an influence on the pain scale in the first stage of labor, so that alpha and beta wave binaural beats had a good influence on reducing the pain scale in the first stage of labor.

CONCLUSIONS AND SUGGESTIONS

Conclusion

It has been proven that anxiety in third trimester primigravida mothers has an influence on the pain scale in the first stage of labor, so emotional management is needed that can minimize anxiety, one of which is using audio binaural beats. Audio binaural beats alpha and beta waves have an influence on reducing anxiety levels, as well as having an influence on the pain scale of the first stage of labor. Binaural beats alpha and beta waves have a good influence on reducing the pain scale in the first stage of labor.

Suggestion

Based on the results of this research, it can be recommended that alpha and beta wave binaural beats can be used as a relaxation method for pregnant women to reduce anxiety, which will have an impact on reducing first stage pain with a shorter duration of labor. The results of this research can then be utilized by health workers who provide services to pregnant women, such as Independent Midwife Practices (PMB), Community Health Centers, Mother and Child Hospitals.

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REFERENCES

1. Devi NS, Shinde P, Shaikh G, Khole S. Level of Anxiety Towards Childbirth among Primigravida and Multigravida Mothers. Int J Appl Res. 2018;4(5):221–224. Available from: https://www.academia.edu/download/88051444/4-5-18-620.pdf

2. Afiyah RK. Effectiveness of Endorphin Massage Against Anxiety the Face of Labor on Mother Primigravida in the Region of Clinics Jagir Surabaya. In: Proceeding of Surabaya International Health Conference. Surabaya: UNUSA; 2017. p. 317–324. Available from: https://conferences.unusa.ac.id/index.php/SIHC17/article/download/298/46/382

3. Wardani HW, Agustina R, Damayanti EAF. Tingkat Kecemasan dengan Kualitas Tidur Ibu Hamil Primigravida Trimester III. J Dunia Keperawatan. 2018;6(1):1–10. Available from: https://jdk.ulm.ac.id/index.php/jdk/article/view/423

4. Septiani FH, Zakiyah Z, Mustikowati T. Hubungan Graviditas Trimester III dengan Tingkat Kecemasan Ibu Hamil dalam Menghadapi Tanda-Tanda Persalinan. J Kesehat. 2020;9(2):147–152. Available from: http://jurnal.lib-akperngestiwaluyo.ac.id/ojs/index.php/jkanwvol82019/article/view/108

5. Husaini FY. Hubungan antara Tingkat Kecemasan dengan Insomnia pada Mahasiswa Angkatan 2019 Fakultas Kedokteran Universitas Hasanuddin. [Makassar]: *Skripsi*. Universitas Hasanuddin; 2020. Available from: http://repository.unhas.ac.id/id/eprint/2097/

6. Rafika R. Efektivitas Prenatal Yoga terhadap Pengurangan Keluhan Fisik pada Ibu Hamil Trimester III. J Kesehat. 2018;9(1):86–92. Available from: http://dx.doi.org/10.26630/jk.v9i1.763

7. Widodo WDP, Zainal R, Saleh I. Hubungan Antara Jenis Kelamin dengan Ambang Batas Nyeri dan Toleransi Nyeri pada Mahasiswa Fakultas Kedokteran Universitas Sriwijaya Angkatan 2017. [Palembang]: *Thesis*. Universitas Sriwijaya; 2020. Available from: https://repository.unsri.ac.id/39583/

8. Juniartati E, Widyawati MN. Literature Review : Penerapan Counter Pressure untuk Mengurangi Nyeri Persalinan Kala I. J Kebidanan. 2018;8(2):112–119. Available from: https://doi.org/10.31983/jkb.v8i2.3740

9. Martini S, Dewi RK. Hubungan Keikutsertaan Senam Hamil terhadap Lama Persalinan Kala II. Shine Cahaya Dunia Kebidanan Univ An Nuur. 2020;5(1):30–39. Available from: https://ejournal.annurpurwodadi.ac.id/index.php/TSCBid/article/view/199

10. Sinambela DP, Hateriah S. Analisis Perbedaan Posisi Meneran Miring Kiri dan Setengah Duduk pada Ibu Bersalin dengan Lama Kala II di RSUD Dr. H. Moch Anshari Saleh Banjarmasin. Proceeding Sari Mulia Univ Midwifery Natl Semin. 2019;1(1):39–46. Available from: https://doi.org/10.33859/psmumns.v0i1.22

11. Difarissa RR. Hubungan Tingkat Kecemasan dan Lama Partus Kala I Fase Aktif pada Primigravida di Pontianak. J Mhs PSPD FK Univ Tanjungpura. 2016;2(3): 532–552. Available from: https://jurnal.untan.ac.id/index.php/jfk/article/view/20019

12. Rickard NS, Wong WW, Velik L. Relaxing Music Counters Heightened Consolidation of Emotional Memory.

Neurobiol Learn Mem. 2012;97(2):220–228. Available from: https://doi.org/10.1016/j.nlm.2011.12.005

13. Menziletoglu D, Guler AY, Cayır T, Isik BK. Binaural Beats or 432 Hz Music? Which Method is More Effective for Reducing Preoperative Dental Anxiety? Med Oral Patol Oral Cir Bucal. 2021;26(1):e97–e101. Available from: https://doi.org/10.4317%2Fmedoral.24051

14. McConnell PA, Froeliger B, Garland EL, Ives JC, Sforzo GA. Auditory Driving of the Autonomic Nervous System: Listening to Theta-Frequency Binaural Beats Post-Exercise Increases Parasympathetic Activation and Sympathetic Withdrawal. Front Psychol. 2014;5:1–10. Available from: https://psycnet.apa.org/doi/10.3389/fpsyg.2014.01248

15. Petrovich O. The Effects of Binaural Beats on Emotion and Cognition. [St. Petersburg, Florida]: University of South Florida St. Petersburg; 2018. Available from: https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=1170&context=masterstheses

16. Pinar SE, Daglar G, Aksoy OD. The Effect of Stress Management Training on Perceived Stress, Anxiety and Hopelessness Levels of Women with High-Risk Pregnancy. J Obstet Gynaecol (Lahore) [Internet]. 2022;42(1):17–22. Available from: https://doi.org/10.1080/01443615.2020.1867970

17. Mardjan H. Pengaruh Kecemasan pada Kehamilan Primipara Remaja. Abrori, editor. Pontianak: AG Litera; 2016. 124 p.