

How Does Listening to “Fetal Heartbeats” Affect the Feelings of Pregnant Women?

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ABSTRACT

OBJECTIVES: This study was conducted to evaluate the impact of listening to fetal heartbeats (FHBs) on the feelings of normal and high-risk pregnancies (HRPs), and to learn the colors and geometrical figures representing their feelings.

STUDY DESIGN: This retrospective cohort study consisted of 291 pregnant women who applied for a non-stress test (NST). Participants were divided into two groups; 1: Normal pregnancies (Group1) and 2: HRPs (Group2). Demographic variables, feelings in response to listening to FHBs (negative, neutral, positive), grade mark (0-10) of feelings, color (warm, neutral, cold), and figure (simple, complex) preferences were retrospectively evaluated.

RESULTS: Of the 291 women, 172 (59.1%) Group 1 participants were compared to 119 (40.9%) Group 2 participants. Group 1 and Group 2 had similar feelings ($p>0.05$), however, the rate of negative feelings was higher in Group 2 (11.6% vs. 20.2%). Higher marks were observed in Group 2 with happiness and peace/relaxation after listening to FHBs. Fear was the lowest mark in women with positive/neutral feelings in both groups. Women in Group 1 preferred warm colors regardless of their feelings. Women in Group 2 who have positive feelings chose warm colors, whereas women who felt neutral or negative more commonly chose cold (55.5%) and neutral (41.7%) colors ($p=0.017$). Independent of feelings, simple figures were predominately preferred ($p=0.04$).

CONCLUSION: NST is more than a perinatal surveillance method and listening to FHBs has a positive impact on the feelings of pregnancies. Warm colors were commonly related to positive feelings. Simple figures were preferred regardless of feelings.

Keywords: Colors; Fetal surveillance; Feelings, Figures; Non-stress test; Pregnancy

Gynecol Obstet Reprod Med 2024;30(2):101-106

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Submitted for Publication: 08.06.2024 Revised for Publication: 09.07.2024

Accepted for Publication: 02.08.2024 Online Published: 05.08.2024

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| QR Code | Access this article online |
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| | DOI:10.21613/GORM.2023.1521 |



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Introduction

Pregnancy is a physiological condition expected to result in a fairy tale but may end up in a nightmare. Poor obstetric history, maternal risk factors, obstetrical complications, the mental and emotional capacity of the individual, and previous labor/birth experiences may all influence the feelings of a pregnant woman (1). Providing a better psychological atmosphere for a pregnant woman is one of the goals of antenatal care programs. Any implementation that may improve maternal feelings is advisable and should be encouraged, especially in high-risk pregnancies (HRPs).

A successful antenatal care program necessitates comprehensive follow-up programs and surveillance methodologies to have a satisfactory pregnancy outcome. Risk/problem assessment is one of the main targets of the follow-up protocols (2). Perinatal surveillance is necessary, especially for HRPs after the 24th gestational week to achieve better perinatal mor-

How to cite this article: Beksac MS, Unal C, Yalaniz B, Cagan M, Tanacan A, Fadiluglu E, Donmez HG. How Does Listening to “Fetal Heartbeats” Affect the Feelings of Pregnant Women? *Gynecol Obstet Reprod Med.* 2024;30(2):101-106

bidity and mortality rates (3). Non-stress test (NST) after the 28th gestational week is one of the widely used methodologies within the framework of perinatal surveillance programs (4). NST is used to evaluate fetal well-being and its application is also critical not to have medical and legal problems (5). We believe that NST is more than a perinatal surveillance methodology and listening to fetal heartbeats (FHBs) may also have a positive or negative impact on the feelings of the pregnant woman. On the other hand, maternal feelings also influence fetal physiology (6,7). Thus, NST provides a kind of maternal-fetal communication, and it may ensure maternal relief or provoke negative feelings. At this point, it is critical to know the patients with negative feelings in response to listening to FHBs to arrange better psychological support or treatment not to have antenatal care difficulties.

It has been reported that environmental stimulants such as colors and geometrical structures of objects may affect the feelings of people (8). We believe that the compliance of patients' sense of aesthetics and environmental conditions may influence their feelings during NST. Decorations of the rooms, the colors of the walls, the presence of paintings, and other artistic tools are all crucial in affecting the feelings of patients (9). Thus, knowing the colors and the geometrical figures that were brought to mind while listening to FHBs may be important in constructing better hospital settings.

In this study, we aimed to demonstrate the impact of listening to FHBs on the feelings of normal and high-risk pregnant women and to learn the colors and the geometrical figures representing their feelings.

Material and Method

This retrospective cohort study was conducted among 291 pregnant women who applied for NST during the antenatal care program who had been admitted to a pre-pregnancy counseling program for women with poor obstetric history between 2016 and 2019 at the Perinatology Outpatient Clinic. The questionnaire was retrospectively evaluated by the expert (Table I). In the first step, demographic characteristics and clinical findings of the patients (maternal age, gravidity, parity, number of miscarriages, and education status of pregnant women) were analyzed and the patients were divided into two groups; Group 1: Normal pregnancies and Group 2: HRP.

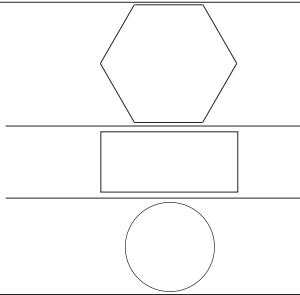
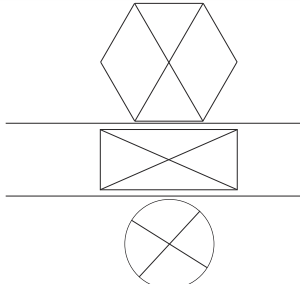

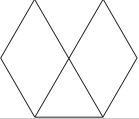


HRP was defined as patients with "poor obstetric history" (POH), obstetrical complications (early pregnancy bleeding, fetal growth restriction, preterm contractions, preeclampsia, etc.), and maternal risk factors for obstetric complications (metabolic, immunological, inflammatory, etc.). The data were retrieved from the electronic database of the Division of Perinatology.

Group 1 (normal) and Group 2 (HRP) were compared in terms of maternal age, gravidity, parity, the number of previ-

ous miscarriages, educational status (illiterate, primary school, secondary school, high school, university), and gestational week at NST application.

In the second step of the retrospective study, the recorded descriptions of pregnant women's "feelings/emotions" in response to listening to fetal heartbeats (FHBs) at the end of the non-stress test (NST) were analyzed. The emotions had been categorized as happiness, peace/relaxation, excitement, lack of negative feelings, anxiety/concerns, and fear. Each emotion had been graded on a scale from 0 to 10 for further evaluation, with 0 representing the weakest and 10 representing the strongest intensity. Additionally, the patients selected a color and a geometrical figure from related scales to represent the feelings that were brought to their minds while listening to FHBs (Table I).

Table I: Description and classification of feelings, colors, and figures.

| Classification of study groups according to patients' feelings | |
|--|--|
| Positive feeling group | Happiness Peace/relaxation, Excitement |
| Neutral feeling group | Lack of negative feelings |
| Negative feeling group | Anxiety/concerns Fear |
| Classification of preferred colors | |
| Warm colors | Yellow Red Orange Pink |
| Neutral colors | White Black Gray |
| Cold colors | Blue Green Purple Brown |
| Classification of preferred figures | |
| Simple |   |
| Complex |     |

Colors were grouped as warm, cold, and neutral while the figures were divided into two as simple and complex (10). Yellow, red, orange, and pink were defined as warm colors, while blue, green, purple, and brown were cold colors. On the other hand, white, black, and gray were neutral colors. The simple figures specified in the questionnaire were a rectangle, hexagon, and circle. The complex figures were rectangles, hexagons, and circles with an "X" mark on them representing failure and negativism (Table I).

NST was applied in a separate room starting at the 28th gestational week according to standard protocol. The questionnaire, which was created from scratch due to the absence of a standard, known set of features associated with the patient's feelings, was completed under the supervision of a nurse.

Statistical analyses were performed with the Statistical Package for the Social Sciences v22 (SPSS.22, IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Data were evaluated for normality of distribution by visual and analytic analysis. Due to the lack of normal distribution of cases, median values together with range were used. Categorical variables were compared using the Chi-square test and Fisher's exact. Pair-wise comparisons were performed by Mann Whitney U test or chi-square test according to the characteristics of the data in case of statistically significant differences between the groups. Bonferroni correction was applied to pairwise comparisons. A p-value of <0.05 was considered statistically significant. This study was approved by the institutional ethics committee and implemented according to the Declaration of Helsinki (GO19-1064).

Results

Demographic and clinical characteristics of the normal (Group 1) and high-risk (Group 2) pregnancies are shown in Table II. Maternal age, gravidity, and the number of previous

miscarriages were significantly higher in Group 2 compared to Group 1 (p values were 0.004, <0.001, and <0.001, respectively), while gestational week at NST application was significantly lower in Group 2 (p<0.001).

The distribution of feelings, color choices, and figure preferences of normal and high-risk pregnancies are shown in Table III. Group 1 and Group 2 had similar feelings (p>0.05), however, the rate of negative feelings was higher in Group 2 (11.6% vs. 20.2%). Higher grade marks were observed in Group 2 with happiness and peace/relaxation after listening to fetal heartbeats. Fear was the lowest grade mark in women with positive/neutral feelings in both groups. Women in Group 1 preferred warm colors regardless of their feelings. Women in Group 2 who have positive feelings chose warm colors, whereas women who felt neutral or negative more commonly chose cold (55.5%) and neutral (41.7%) colors (p=0.017). Independent of their feelings, all women predominately preferred simple figures (p=0.04).

DISCUSSION

The physician aims to provide the complete well-being of their patients both physically and psychologically. Here comes the importance of maternal-fetal communication to overwhelm the negative feelings of the mother in terms of fetal well-being. The ambiance and harmony of the obstetrics services should be optimal for obtaining favorable results. NST is not only a dedicated test to evaluate fetal well-being, but also it may be considered a bridge for trust between the mother and fetus (6). Furthermore, it may relieve physicians who are also anxious about the status of the fetus. Thus, any effort to improve the mood of pregnant women will be beneficial to achieve a better perinatal outcome, especially in high-risk pregnancies.

Listening to FHBs is very attractive for a pregnant woman because it is the confirmation of the livelihood of the baby. It

Table II: Demographic and clinical characteristics of the normal (Group 1) and high-risk (Group 2) pregnancy groups.

| | Normal pregnancy group (Group 1) (n=172) | High-risk pregnancy group (Group 2) (n=119) | p |
|---|---|--|------------------|
| Maternal age (years) (median, IQR)^a | 28 (8) | 30 (7) | 0.004 |
| Gravidity^a | 2 (2) | 3 (2) | <0.001 |
| Parity^a | 0 (1) | 1 (1) | 0.280 |
| Number of previous miscarriages^a | 0 (0) | 1 (2) | <0.001 |
| Educational status (n,%)^b | | | |
| <i>Illiterate</i> | 1 (0.5%) | 0 (0%) | |
| <i>Primary school</i> | 33 (19.1%) | 19 (16%) | |
| <i>Secondary school</i> | 20 (11.6%) | 14 (11.7%) | 0.840 |
| <i>High school</i> | 57 (33.1%) | 39 (32.7%) | |
| <i>University</i> | 61 (35.4%) | 47 (39.4%) | |
| Gw at NST application^a | 37 (3) | 33 (6) | <0.001 |

IQR: Inter-quartile range, Gw: Gestational week, a: Statistical analysis was performed by Mann-Whitney U test, b: Statistical analysis was performed by Chi-square test.

Table III: Distribution of the grades of feelings, color choices, and figure preferences of normal and high-risk pregnancies.

| Feeling Groups n (%) | Normal Pregnancy Group (Group 1) (n= 172) | | | High-risk Pregnancy Group (Group 2) (n=119) | | | p |
|--|--|--------------|--------------|--|--------------|--------------|--------------|
| | positive | neutral | negative | positive | neutral | negative | |
| | 120 (69.8) | 32 (18.6) | 20 (11.6) | 77 (64.7) | 18 (15.1) | 24 (20.2) | 0.125 |
| Grade of feelings (0 to 10) (median, IQR) | | | | | | | |
| Happiness | 8 (3) | 8 (5) | 6 (5) | 10 (3) | 7 (5) | 6.5 (3) | |
| Peace/relaxation | 8 (3) | 7 (3) | 5 (6) | 10 (3) | 7 (4) | 6 (3) | |
| Excitement | 8 (5) | 5 (5) | 8 (3) | 7 (5) | 4 (5) | 7 (4) | |
| Lack of negative feelings | 5 (2) | 6 (3) | 4 (2) | 5 (3) | 6 (4) | 5 (3) | |
| Anxiety/concerns | 4 (5) | 3 (5) | 8 (5) | 5 (5) | 3 (5) | 9 (2) | |
| Fear | 2 (6) | 2 (3) | 6.5 (4) | 3 (3) | 2 (5) | 7 (4) | |
| Color preferences (n, %)^b | | | | | | | |
| Warm colors | 53 (44.2) | 15 (46.9) | 13 (65) | 35 (45.5) | 3 (16.7) | 8 (33.3) | |
| Neutral colors | 28 (23.3) | 3 (9.4) | 6 (30) | 18 (23.4) | 5 (27.8) | 10 (41.7) | 0.017 |
| Cold colors | 39 (32.5) | 14 (43.7) | 1 (5) | 24 (31.1) | 10 (55.5) | 6 (25) | |
| Figure preferences (n, %)^b | | | | | | | |
| Simple figure | 101 (84.1) | 29 (90.6) | 15 (75) | 67 (87) | 14 (77.8) | 15 (62.5) | |
| Complex figure | 19 (15.8) | 3 (9.4) | 5 (25) | 10 (13) | 4 (22.2) | 9 (37.5) | 0.04 |

IQR: Inter-quartile range, b: Statistical analysis was performed by Chi-square test.

evokes various feelings related to the health of the fetus and gestational outcome. Interestingly, the rates of negative feelings were found to be 11.6% in normal pregnancies while these rates were 20.2% in HRP. The expected result may be that listening to the fetal heartbeat in HRP would increase maternal positive feelings. However, HRP consider the NST test as a fetal health indicator or individual exam. This can be interpreted as hearing fetal heartbeats during NST increases anxiety. Furthermore, some HRP may have negative feelings about NST due to poor obstetric history. Up to 10 to 15 percent of pregnancies are complicated by depression and anxiety disorders (11). Maternal risk factors, obstetrical complications, hormonal alterations, anxiety related to the well-being of the baby, lack of support from the family, and the burden of responsibility for a newborn are some of the main reasons behind these psychological disorders. Moreover, pregnant women with POH are at higher risk for stress and the antenatal follow-up protocols should be performed more attentively in these groups of patients (11). Intriguingly, HRP who feel positive after listening to the fetal heartbeats mostly choose 10 in the rating up to 0-10. This shows women who felt positive emotions after listening to the fetal heartbeats described it as a very strong feeling if they felt positive.

Color psychology is considered to be a very complex area of research (12,13). There is significant progress in research on color and psychological functioning, but much more theoretical and empirical work is needed (14). However, based on the effects of colors on psychology, we believe that colors can

be used to positively affect the emotions of pregnant women. Many studies have investigated the effects of colors on people (15-17). Color is thought to be much more than just aesthetics. Colors can contain important information and have a significant impact on people's effects, cognition, and behavior (18). The researchers also aim to obtain information about attention, perception, mutual communication, and the biology-culture interface through colors (18). The effect of colors was studied in certain patient groups to enable the optimization of inpatient and outpatient clinics, and the utilization of certain treatment modalities (19). It has also been reported that even the existence of any color instead of black and white figures may be effective in coping with stress. (20) Colors are classified into many types. A common classification is warm and cold colors, which were initially classified according to optical refraction (16,21). In this study, we tried to evaluate the relationship between colors/figures and feelings.

The relationship between color and psychological function was examined and the effect of red on performance was evaluated. Red is thought to be associated with performance impairment, as it evokes feelings of failure and avoidance (22). In another study on the interaction of mood and performance, researchers have shown that blue is a calming color and that red is a stimulating color that can interact with other environmental factors (17). In addition, a study evaluating emotional responses to colors confirmed the calming effect of green (21). In a study to describe the effect of colors on the recovery of patients after total hip or knee arthroplasty, rehabilitation in

standard and colored patient rooms was compared. The authors found that colors had a positive effect on patients' post-operative quality of life (23). In a study that tested the effects of coloring in healthcare, it was found that the stimulant effect of the color orange compared to white was greater than the effect of the green color in reducing stress (24).

In this study, all women in the normal pregnancy group mostly preferred warm colors (yellow, red, orange, and pink) independent of their feelings. HRPs who have positive feelings also chose warm colors, whereas women who felt neutral or negative more commonly chose cold (55.5%) and neutral (41.7%) colors. Therefore, we may suggest that the use of warm colors may be effective for patients to cope with stress even if they are in a negative mood.

We have also performed comparisons according to the figure selection of patients. We have used simple images for an applicable comparison and demonstrated that patients with negative feelings tend to choose complex figures as mentioned above. Thus, we may conclude that the simplicity of the environment may be chosen during NST. Simple figures may be used for the decoration of patient rooms due to the association between complex figures and negative feelings. Our findings may be used by architects in the design of hospital settings, especially NST rooms. Every patient wants to be treated in a peaceful environment. Decorating the hospital settings may be one of the key points to creating a healthy relationship between the patients and the physicians.

The limitation of this study is the relatively low number of patients. On the other hand, to the best of our knowledge this is the first study in the literature describing the impact of listening to fetal heartbeats (FHBs) on the feelings of normal and high-risk pregnant women, and to learn the colors and the geometrical figures representing their feelings.

Conclusion

In conclusion, warm colors, and the simplicity of the environment may have a calming effect on pregnancies. NST is more than a perinatal surveillance methodology and listening to FHBs is influential on the feelings of pregnancies.

Declarations

Ethics approval: This retrospective study was approved by the University Ethics Committee with reference number GO19-1064. All procedures were performed according to the Declaration of Helsinki.

Availability of data and materials: The data supporting this study is available through the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

Funding: None

Authors' Contributions: MSB contributed to the study concep-

tion and design. Data collection was performed by BY, CU, EF, MC, and AT. Statistical analysis was performed by CU, EF, and AT. The first draft was written by MSB, EF, and HGD. Critical reading was performed by HGD and MSB. All authors read and approved the final manuscript.

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