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# The Effect of Vibroacoustic Stimulation and Music on Fetal Movement

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***Abstract***

***Introduction***

Fetal movement started at the 7th weeks of pregnancy and by the end of pregnancy will gradually be perfect and harmonious. Near-term fetuses can discriminate acoustic features, such as frequencies and spectra, and process complex auditory streams. In this study, we aimed to evaluate fatal movement in response to music and vibration stimulation.

***Materials and Methods***

This study was a clinical trial that was conducted in two groups and two-steps. Participants were pregnant women (primigravida) who have referring to the Shahid Beheshti Hospital in Isfahan during 2013 to receive routine prenatal care. The 64 pregnant women (32-36 weeks) were randomly assigned to the groups of Vibroacoustic stimulation (n= 32) and Music (n=32). They were stimulated immediately after the first non stress test and before the second test. The researchers' evaluated and analyzed possible changes in non-stress test results using SPSS software version 20.

***Results***

Mean age of the subjects in vibroacoustic group and in music group were (25.5±2.6) (24.9±4.4) respectively. Paired t-test showed there was no relationship between the average number of acceleration of the fetal heart rate before and after the intervention ($P>0.05$). On the other hand, there was a significant correlation between the average number of fetal movements in the music group before and after the intervention ($P<0.05$).

***Conclusion***

Mothers listen to music has led to increase their perception of fetal movements and increased number of fetal movements. So perhaps the music can use for the evaluation of fetal movement in high-risk mothers or mothers who complain of decreased fetal movements. As a result, the music may be used as a tool for assessment of fetal well-being.

***Key Words*:** Non stress test, Music, Vibroacoustic stimulation, Fetal movement.

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## Introduction

Passive and non- stimulated fetal movements are started from 7th weeks of pregnancy and would be completed and evolved by the end of pregnancy gradually (1). From week 20 to 30 of pregnancy, general movements of fetus are organized and periods of activity–relaxation are emerged in the fetus (2). In the third quarter, development of fetal movement continues almost until 36$^{th}$ weeks of pregnancy; at this time, behavioral condition has stabilized in most of normal embryos(3).

Fetal hearing response is started in the sixteenth week of pregnancy, two months sooner than other sensations of fetus (4). The anatomical structure of ear is evolved in twenty-fourth weeks of embryonic development; this means that the fetus shows behavioral- hearing response 8 weeks sooner the ears structure are completed. These findings suggest the complexity of hearing (5). Human hearing is evolved gradually over the last three months of pregnancy. Fetus detects acoustic characteristics such as sounds frequency and processes complex hearing progress in the near-term (6).

Kafali (7) examined the impact of maternal anxiety and music on fetal movements and fetal heart rate in non-stress situation in Turkey. His findings showed that baseline fetal heart rate and number of fetal movements was higher significantly in the music group compared to control group. Meanwhile, fetal heart acceleration rate was greater in the music group compared to control group.

Zimmer et al. (8) conducted a study in Haifa region in occupied Palestine. In this study, fetal activities in form of respiratory movements and body movements was examined using real time ultrasound in three periods of 25 minutes sequentially. The courses include:

- Control course (without music);
- Chromatic classical or pop music course;
- Classical or pop music based on mother's interest.

The results indicate an increase in the number and duration of fetal movements, reducing the time duration and number of breathing during music playback compared to the control period. Interestingly, playing the mother's favorite song has led to an increase in the duration of fetal movement obviously. The results of Valiani and Pirhadi (9) in Isfahan showed that acceleration of the fetal heart rate didn't have significant difference before and after the intervention of Vibroacoustic stimulation and music. Given the above studies, the researcher intended to examine the number of fetal movements in response to Vibro-acoustic stimulation and music and compared two groups together. Obviously, to increase accuracy in the assessment, growth of fetal heart should be examined.

## Materials and Methods

The present study is a randomized clinical trial (RCT code: IRCT2012092310913N1). This study was conducted by two groups in two steps. The environment of this study was center of gynecology and obstetrics of Shahid Beheshti Hospital in Isfahan, Centeral of Iran. The study population included pregnant women (first pregnancy) aged 35-18 year- old who visited in the center to receive regular prenatal care. Sampling in this study was simple random. Researcher invited all pregnant women who referred to Shahid Behesti center to survey their situation. Then, qualified women were selected by completing a check list (including the criteria for inclusion). After signing the consent and complete personal information in the questionnaire by the research, they were randomly divided into two vibroacoustic simulation and music groups. Data of this research was

qualitative (nominal - ordinal) and quantitative (discrete - continuous). Data was gathered using a two-part questionnaire. The first part of questionnaire consist of demographic characteristics and the second part as specific questionnaire contains 10 questions relating to the information related to fetal heart strips. In this research, 64 pregnant women who had the inclusion criteria for the study were selected.

Inclusion criteria were:

- 35-18 years old;
- First pregnancy;
- Gestational age of 36 to 32 weeks of pregnancy;
- Singleton pregnancy without a history of infertility and use of assisted reproductive techniques;
- Having a history of regular visit to health centers - medical or private clinics to receive prenatal care;
- Absence of any disease or disorder during pregnancy;
- Lack of smoking or tobacco;
- Not taking any medication;
- Taking a meal about 2 hours before fetal non-stress test;
- Having at least 50 minutes of free time.

Technique of available numbers in the envelope was used to allocate samples into two groups randomly. In this way, the mothers were asked to pick one of a sealed envelope containing two intervention groups. Number 1 belonged to the vibroacoustic simulation group and number 2 belonged to music group.

After determining the sample group, the researcher conducted fetal non-stress test on them. Before starting the test, the investigator will ensure that all the subjects have taken a meal 2-4 hours prior to sampling. Also, their bladder should be depleted to avoid get up from bed and walking during the test. Before any intervention, fetal non-stress test was done on all subjects for 20 minutes in the left lateral position and data was registered.

After snapping the first non-stress test, to avoid fatigue mother asked him to sit on the bed for 5 minutes and drink a glass of cool water. After a short break of mother, asked her to sleep again on her left side, then the researcher conducted Leopold maneuver (touching parts of the fetus from the womb) and identified the position of the fetus in the mothers (to assimilate effect for skin irritation womb), then the researcher put the probe device on the mothers stomach and conducted the intervention by identifying the appropriate location of fetal heart and recording fetal monitoring device (10).

Intervention was done the way that in the vibroacoustic simulation, the researcher put a 128 C diapason on the mother stomach skin directly in the midline below the navel and made a vibration for three seconds by diapason hammer. This action could be repeated up to 3 times, each time for 3 seconds. Respond to this stimulation is natural when the acceleration number of heart in the fetus will be at least 15 pants in a minute for 15 seconds within 15 seconds after simulation along with long-term movements on the fetus (11). Second fetal non-stress test (NST) in vibroacoustic stimulation lasted 20 minutes.

In the Music group, after mother relaxation, the music of nature played for mother through a headphone while heart was recording. It should be noted that music in all groups was the same. Music playback continued for the mother of all for 20 minutes during second round of non-stress test.

In the event of any sudden disruption in the health of the mother or fetus, in case of any registration or other non-stress test result that there was doubt about the identification and interpretation and or the unwillingness of subjects to continue to cooperate, the subjects were excluded from

the study. The researcher entered the collected data from non-stress test questionnaire including acceleration number of heart rate of the fetus, the number of fetal movements and their personal data to the computer using SPSS software version 20 and analyzed them by descriptive and analytical statistics (mean, standard deviation, frequency, one way ANOVA test, paired t-test) was used to analyze the data. Researcher considered the amount of P-Value <0.05 for results of all statistical tests significantly.

## Results

Research findings related to the personal information of participants are presented in (Tables 1, 2). As shown in (Table.1), the average age of mothers participating in the intervention group did not show statistically significant.

**Table 1**: The Average age of participants

| Group | Age | | | |
|---|---|---|---|---|
| | Max | Min | Mean | SD* |
| Vibroacoustic simulation | 32 | 21 | 25.5 | 2.6 |
| Music | 34 | 19 | 24.9 | 4.4 |
| Variance – analysis test | F= 0.44; P=0.64 | | | |

*Standard deviation.

**Table 2**: Education Level of population

| Levels of Education | Music | Vibroacoustic simulation |
|---|---|---|
| | Number (%) | Number (%) |
| Primary | 3 (9.4) | 0 (0) |
| Secondary | 5 (15.6) | 9 (28.1) |
| Diploma | 18 (56.2) | 15 (46.9) |
| > diploma | 6 (18.8) | 8 (25) |
| Total | 32 (100) | 32 (100) |
| Kruskal-Wallis test | P value=0.72 | |

According to the information, these two groups in the study had no significant differences in terms of level of education.

Research findings indicate that the average number of acceleration of the fetal heart rate before the intervention in vibro-acoustic group was 2.7 ± 6.4. Also, minimum and maximum acceleration of fetal heart were 2 and 11 respectively.

In the music group, before the intervention, the average acceleration of the fetal heart rate was 3.5 ± 6.1. Also, minimum and maximum acceleration of fetal heart were 0 and 12 respectively.

After the intervention, in the vibro-acoustic group, the average acceleration of fetal heart was 2.8 ± 7. The minimum and maximum acceleration of fetal heart were 3 and 13 respectively.

In the music group, the average acceleration of fetal heart after intervention was 3.4 ± 6.8. Also, minimum and maximum acceleration of fetal heart were 2 and 15 respectively.

Paired t-test in vibroacoustic group showed no significant difference in the average acceleration of the fetal heart before and after the intervention (P = 0.32). This test the music group in revealed that no statistically significant difference was between the average acceleration of fetal heart rate before and after the intervention (P= 0.27).

Analysis of variance showed that the average acceleration of fetal heart rate in vibroacoustic simulation group and music group was not different before the intervention (P=0.33).

After the intervention, there was no significant difference between two groups in the average acceleration of the fetal heart rate (P=0.58).

**Table 3**: Average number of fetal movements before and after the intervention

| Number of fetal movement / Group | Before intervention | | After intervention | | P value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Vibroacoustic | 11.9 | 8.02 | 13.06 | 14.07 | 0.56 |
| Music | 12.16 | 12.4 | 16.94 | 14.7 | 0.03 |
| One ANOVA | F= 0.22 | | F=0.64 | | |
| | P=0.79 | | P=0.52 | | |

As noted in (Table 3), listening to music by mother caused to increase the number of fetal movements. So that the average number of fetal movements in the music group before and after the intervention were statistically significant (P = 0.03).

As noted in results, the number of acceleration of the fetal heart rate in both groups was not significant difference, but the number of fetal movements increased in music group. It should be noted, number of fetal movements was calculated based on mother's perception.

## Discussion

Results of current study showed there was no relationship between the average number of acceleration of the fetal heart rate before and after the intervention, but there was a significant correlation between the average number of fetal movements in the music group before and after the intervention.

Annunziata and colleagues in their study in 2012 stated that the number of acceleration of the fetal heart rate in both groups of low-risk mothers and high-risk mothers, after vibroacoustic simulation significantly increased. These researchers explained that an increase in the number of acceleration after vibroacoustic simulation can be due to a sudden change of fetus from sleep to active or weak waking position (12) and D'Eliaa in the results of their study in 2007 stated that all fetal parameters including number of acceleration was significantly increased as a result of vibro-acoustic simulation (13). According to Bartnicki and Dudenhausen reports, these simulations on fetus led to increase number of acceleration of heart rate by reducing variability of heart. Results of these studies are inconsistent to this study (14). Probably, this inconsistency is due to the difference in the results and conducting a study on low-risk fetuses. As shown in the current study, number of acceleration before intervention in tested fetuses was significantly high and simulating has not made a significant change in the number of acceleration. While in the doing this research in high-risk mothers or fetuses with abnormal heart rate pattern, probably better and more obvious impact of the above interventions will be observed.

Kafali and colleagues (7) reported in a study in 2011 that acceleration of heart rate of the fetus as well as the size of the acceleration was in the music group than the control group; also, they concluded that the number of fetal movements in response to music is significantly higher than the control group. Tan and colleagues (15) concluded that vibro-acoustic simulation can increase the number of fetal movements. Also Kisilevsky (16) claimed that using vibro-acoustic simulation create better understanding in the mothers of fetal movements. In this study, no significant change in the acceleration number of fetal heart rate has seen.

## Conclusion

Due to the increased number of fetal movements in response to music without increasing the acceleration number of fetal heart, it seems that listening to music can increase maternal understanding of fetal movements and increased movements of the fetus. For this reason, the music can be used to evaluate fetal movement in high-risk mothers or mothers who are not satisfied by their fetal movements. As a result, music may be used as a tool to evaluate high risk fetuses.

**Conflict of Interest:** None.

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