

Effect of music therapy on germinal period and auditory memory in babies

Seyedeh Narjes Zamani¹, Mohammadi Korush^{2,*}

¹Department of Psychology, Bandar Abbas Branch, Islamic Azad University, Bandar Abbas, Iran

²Asistants Professor, Hormozgan University, Bandar Abbas, Iran

Abstract: The aim of present study is to explore effect of music on auditory memory in babies. Methodology: by using cluster sampling in a semi experimental plan, 40 individuals were selected of all pregnant women in Bushehr and randomly divided in two groups of evidence and experiment. Mothers in experiment group were requested to play a specified piece of music for babies twice a day, in the mornings and afternoons at a certain time for five minutes, in the last eight weeks of pregnancy. Then heartbeat and respiration of babies were measured five days after birth two times by stethoscope, first time was 30 minutes before playing music and second time was during playing music. Descriptive and deductive statistics including analysis of one-way variation were applied to examine data. Findings: results illustrated that in processes after examination, average scores of respiration and heartbeat in experiment group were significantly higher than evidence group. Conclusion: auditory stimulus (music) in germinal period affect in a positive manner on babies' memory and cause to learn.

Key words: Music; Auditory memory; Germinal period; Auditory stimulus

1. Introduction

One of the important periods in human being lifetime is the germinal period (Pourrahimi, 2007). A germ grows based on a significant pattern and the first eight weeks are the most vital time in germ growth in which germs' organs and tissues developed from three cellular layers (Ectoderm, Mesoderm, and Endoderm) that are made in this period. Nervous system and the sense organs (ear, eye, nose, mouth) are originated in Ectoderm layer (Sadler and Longman, 2012). Various areas of brain grow in different speed and at first the sense organs develop independent of other areas in brain which will be connected to them later. In the 25th week of germinal period, central nervous system and the peripheral sense organs would be connected and after one week sensational learning starts seriously and then the growth in brain will be influenced by sensational stimulus (Parncutt, 2006).

One of the important sense organs is ear. Hearing growth in the germ and baby needs to develop structural organs in ear which grow at the first 20 weeks of pregnancy. And evolution of nervous part of hearing system occurs after the first 20 weeks of pregnancy and hearing system works after a period of time, about 25th week of pregnancy. Cochlea is of the same criteria in adults after 20 weeks of pregnancy (Stephanie and Stanley, 2003), hearing system needs outer hearing stimulus to grow and develop (Geriven and Brown, 2008), inside of the mother's womb, the germ is able to recognize easily the sonic energy with low frequency (lower than 500

hertz) which is produced from the surface but maybe can't recognize the sonic energy with high frequency (higher than 500 hertz), (Gerhardt and Abrams, 1996).

In mother womb, the germ can react against different and loud noises and distinguish mother's voice from other voices (Rice, Forouqan Translation, 2012) after 30-35 weeks of germinal period (Stanley, 2007). But at the end of pregnancy the germ is able to listen to the voices come from outer environment (Kasuga and Herada, 2001).

Researchers illustrated that at the end of pregnancy the germ can distinguish highest and lowest tone of voices from inside and outside mother's body (Kisilevsky and Davies, 2007). The germ's hearing ability can be measured by variations in heart beats and its motions to make a response to a voice (Parnkot, 2006). In another study James, Spencer and Stepsis (2002) reported that being exposed to music at pregnancy period causes changes in germ behavior (changes in heart beat). Kim et al. (2006) explore the effect of music in pregnancy on spatial memory, spatial topology or recording memory and to remind places and understand the relationship between separated singular stimulus (Carlson, 1999), and to prevent mongolism and disorder in spatial learning skill for infants. Increase or decline in the germ's heart beat in order to make a response to a voice starts after 20th week of germinal period (it occurs after 26th week in many cases). Variations of germ's heart beat or motions in response to music are common after 32 -38 weeks (Parnkot, 2006). Also the change can be happened after birth (Behrman et al., 2010).

* Corresponding Author.

Specialists believe that music in pregnancy plays a positive role in the germ's brain growth, improvement in learning place and time (Kim et al., 2006), also to establish the base of language inception and speech perception (Kisilevsky and Davies, 2007), language development and cognitive growth in baby (Honig, 2004), flourishing creativity and analyzing the deeper relationship between mother and baby (Federico and Whitwell, 1999). Increasing creative and gregarious skills in babies in order to make them a complete person as to self-confidence, will, to be sociable will come true in near future (Qasemzade, 2012). Fukui and Toyoshima reported the positive role of music to improve learning and memory. Other studies explore importance of music to rebuild nerve cells especially in neurotic disorders, to help contacting with people suffering from physical, mental and social disorders and to control pain (Lowis, 2011). Considering the subjects mentioned above and effect of music on brain growth in germinal period, memory and learning, and although the studies mostly were done on other species' infants, so few studies about effect of the intervention on human beings germ led to dealing with this issue. Hence, the main purpose of the study is to explore the effect of music therapy on auditory memory and learning in infants.

2. Methodology

Method: it is a semi-experimental method and pre-test, post-test plan and evidence group are applied. The independence variable is listening to music by mothers that is applied only in intervention group and its effect on scores obtained from post-test evaluated for patients in experimental group and were compared to evidence group.

Approach: the population consists of all pregnant women in Bandar Abbas in 2012. In the final sample, by using cluster sampling in two medical centers selected from 11 centers in Bandar Abbas, and based on entrée criteria (mother's ability and interest in cooperation with the study, to be in 32nd week of pregnancy, mother and germ health, no hearing defect in germ, having general and basic watchfulness in pregnancy period, no anxiety and stress) 54 individuals were selected and randomly were divided in two groups of experiment and evidence including 27 participants. Then the experiment group was under intervention that it was requested to mothers to play a selected piece of music by researchers for babies twice a day about five minutes at a certain time in the last eight weeks of pregnancy. Due to be ensured for having a correct process, participants were informed by phone or had meetings during these eight weeks (end of October till end of November, 2012). Finally after checking the babies thorough Apgar score and making sure about babies' health by their doctors and informing mothers, at the first five days of birth and in a desirable and quite place, babies' heart beat and respiration were measured by stethoscope twice a day, first 30 minutes before playing the music and

the second time during playing the music. The measuring process was done in both groups. But at the end of the study 10 participants were released because of (no cooperation to continue the study, turning pregnancy to dangerous pregnancy (abortion risk, bleeding, Preeclampsia), premature childbirth (earlier than 38th week) and also later that it happens after 38th week, a normal childbirth). Accordingly four mothers, two mothers from each group, were released and the final numbers of mothers in each group were 25 to study the results. Descriptive and deductive statistics such as covariance analysis and SPSS software were applied to analyze the data.

3. Measurement

Piece of music: the selected piece of music in the study had a simple and gentle rhythm, emotional melody, smooth song separated from the tone and even more stronger, no intensive changes in beats (about 60-80 beats per minutes like adults heart beat), calm and had no exciting time for 5 minutes duration that was used in Namdar and Azimzadeh study (1992) and its consistency was approved.

Stethoscope: it is a tool which can reinforce internal and weak voices of different parts of body and putting head on chest or abdomen is not needed. It is applied to listen (examine) heart, lung and sometimes abdomen.

Chronometer: it is a tool (clock) to measure a range of time. Chronometer calculates the time since it is active and going till it will be stopped.

Apgar scale: it is a test taken one minute after the childbirth and the second time is taken five minutes after childbirth. The scores range from 1 to ten. Score 10 represents the healthiest status. The test evaluates factors such as respiration, heartbeat, muscular power, nerves reflexes, skin color (rice, 1992).

4. Results

According to data obtained from demographic Table, at the beginning of the study all samples in evidence and experiment group were in 30th week of pregnancy, there were no defect in germ growth, mother and germ were under control in this period, they were completely healthy and stress or anxiety was not observed, all mothers were under cesarean surgery in 38th week of pregnancy and Apgar score was 9 out of 10 for babies.

According to Table 1, demographic results show that 10 participants that is 20% of experiment group were in 25-21 age group, 5 participants or 16% of the group were in 30-26 age group, 5 participants or 10% of the group were in 35-31 age group and 2 participants or 4% of the group were in 40-36 age group, in evidence group 6 participants that is 12% of the group were in 25-21, 9 participants or 18% of the group were in 30-26 age group, and finally 5 participants that is 10% of the group were between 40-36 years old.

Table 1: Demography specifications based on groups

Group		Variable	
Evidence	experiment		
6(%12)	10(%20)	21-25	Age
9(%18)	8(%16)	26-30	
5(%10)	5(%10)	31-35	
5(%10)	2(%4)	36-40	
7(%14)	6(%12)	Not graduated from high school	Education
8(%16)	10(%20)	Junior and senior college diploma	
6(%12)	6(%12)	BA,BS	
4(%18)	3(%6)	MA,MS	

The Results of education show that 6 participants (12%) were not graduated from high school in experiment group, 10 participants(20%) had junior and senior college diploma, 6 participants(12%) had BA/S and 3(6%) participants of the group had MA/S or upper degree. also in evidence group 7(14%)

participants were not graduated from high school , 8 (16%) participants had junior and senior college diploma, 6(12%) participants of the group had BA/S and 4(8%) participants had MA/S or upper degree.

Table 2: Mean and standard deviation of respiration and heartbeats in babies for both groups

quantity	Standard deviation	Mean	Group	Variables
25	2/2	18/56	experiment	respiration
25	3/2	16/04	Evidence	
25	3/2	19/3	experiment	heartbeat
25	3/6	15/8	Evidence	

Considering the purpose of the study, the data elicited from the Table 3 represented that in experiment group ,mean and standard deviation rate(M:18/56,SD:2/2) for respiration in babies were more than babies in evidence

group(M:16/04,SD:3/2). Also in experiment group mean and standard deviation rate (M: 19/3, SD: 3/2) for heart beat in babies were more than babies in evidence group (M: 15/8, SD: 3/6).

Table 3: Results of covariance analysis for effect of music on babies' auditory memory in post-test

Indexes						Subjects
Statistical power	P	F	Squares mean	Degree of freedom(2)	Degree of freedom(1)	
0/67	0/04	4/01	158.420	48	1	Heart beat
0/95	0/02	5/31	79.380	48	1	Respiration

As to the effect of music on respiration and heart beat in babies, the purpose of the study , which is represented by covariance analysis (Table 3), a significant difference was observed in both groups for the rate of respiration mean in babies(F(1,48)=4/01,P<0/02). Also the significant effect of music on heart beat was observed in babies both groups (F (1, 48) =79/380, P<0/02).

5. Discussion

The study aimed to explore the effect of music therapy in germinal period on babies' auditory memory. Therefore mothers were asked for listening to music in the last two months of pregnancy. Eventually the group (experiment) was compared to evidence group that did not obtain any intervention, based on heart beat and respiration. And results illustrated listening to music positively effects on auditory memory in babies and lead to learning. The results were similar to Aria and et.al (2012), James, Spencer and Stepsis (2002) and Kim and et.al (2006). Also they were as the same as Mang et al.

(2009) that believed music causes improvement in learning and memory. Also the study confirmed that at the end of pregnancy the germ can listen to the voices come from out of mother's body (Nishio et al., 2001; Kislivesky and Daivis, 2007).

It can be mentioned to express the significant and positive effect that one of the important sense organs is ear. Hearing growth in germ and baby needs to develop structural organs of ear which is formed at the first 20 weeks of pregnancy. Evolution in nervous part of hearing system happens after 20 weeks of pregnancy period. Hearing system works after 25th week of pregnancy. Cochlea is of the same criteria in adults after 20 weeks of pregnancy (Stephanie and Standley, 2003). And auditory cortex in temporal lobe is important to design and develop hearing system. The 25th week of pregnancy till 5th and 6th months after birth is the most important time to develop nervous part of hearing system. This is the time that capillary cells of cochlea, auditory nerve axons, and nervous cells of auditory cortex in temporal lobe try to adjust receiving signals from

frequencies and particular intensities (Graven and Brown, 2008).

Because germ's ear growing will be completed before 32th week of pregnancy and nervous system in the germ has spent a vital period of growth and it is going to be completed, so timely stimulus in vital period of growth in an organ can lead to improvement. Hearing system needs outer auditory stimulus to grow and develop but it is dangerous for the hearing system growth in germ as much as adults that being in a noisy environment for a long time can be dangerous for their hearing system. Control of outer noise, to be exposed to meaningful noises like music and speech, supporting wake and sleep cycle, especially quick motion of eye during sleep are needed to develop a healthy auditory system (Graven and Brown, 2008).

Because intervention was on human beings germ in this study, it is similar to James, Spencer, Stepsis and Arias', but respiration and heart beat variations were used to determine learning process in this study. James, Spencer and Stepsis used only heart beats variations and Aria applied behavior evaluation scale in babies in their studies. Because of using animal samples and studying special memory, Kim and his coworkers' research is different from the study. They believed that exposing to noise and music in pregnancy period decrease mongolism and disorder in spatial learning ability for mice. The present study reports important results to support the effect of playing music on germ's memory in pregnancy period that its effect causes to increase learning in babies. The results can be used to increase knowledge in mothers, psychologists and medical centers which watch mothers in pregnancy period and prepare simple plans to reinforce memory and learning in babies since germinal time.

One of the most important limitations could be mentioned in this study was no proper cooperation of respondents in medical centers especially to gather data from medic files for pregnant women, difficulties to access the baby and measure its heart beat and respiration after birth, and no appropriate control on playing music process and mothers' cooperation with the study.

Also other researchers are recommended to use music with simple and gentle rhythm and emotional melodies, which have no intensive changes of beats and includes a smooth song and separated from the tone and even more stronger. And the germ should not be exposed to noise pollution.

References

- Arya, R., Chansoria, M., Konanki, R., Dileep, K., Tiwari. (2012). Maternal Music Exposure during Pregnancy Influences Neonatal Behaviour: An Open-Label Randomized Controlled Trial, *International Journal of Pediatrics*, 2012, 1-6.
- Behrman R, Kliegman R, Jenson H. (2010). *Nelson Textbook of Pediatrics*, Philadelphia: Saunders.
- Carlson, N. R. (1999). *Foundation of physiological psychology*. Allyn and Bacon.
- Federico G and Whitwell G. (1999). Music therapy and pregnancy. APPPAH VIII Conference, San Francisco, USA, 1-10.
- Fukui H and Toyoshima K. (2008). Music facilitate the neurogenesis, regeneration and repair of neurons, *Medical Hypotheses*, 71, 5, 765-769.
- Gerhardt K.J and Abrams R.M. (1996). Fetal hearing: Characterization of the stimulus and response, *Seminars in Perinatology*, 20, 1, 11-20.
- Graven S.N and Browne J. V. (2008). Auditory Development in the Fetus and Infant, *Newborn and Infant Nursing Reviews*, 8, 4, 187-193.
- Honig A. S. (2004). Communicating with babies through music, *Early Childhood Today*, 18, 5, 24.
- James D.K, Spencer C.J and Stepsis B. W. (2002). Fetal learning: a prospective randomized controlled study, *Ultrasound Obstet Gynecol*, 20, 431-438.
- Kim H, Lee M. H, Chang H. K, Lee T. H, Lee H.H, Shina M. S, Won R, Shin H.S and Kim C.J. (2006). Influence of prenatal noise and music on the spatial memory and neurogenesis in the hippocampus of developing rats, *Brain and Development J*, 28, 109-114.
- Kisilevsky B.S and Davies G.A.L. (2007). Auditory processing deficits in growth restricted fetuses affect later language development, *Medical Hypotheses*, 68, 3, 620-628.
- Lifer, Geloria (2009), (lecture about nursery and mothers and babies' hygiene by Lifer), (translated by Mahnaz Shoji and Mahnaz Sanjari), Tehran, Salemi, and p: 31-41.
- Lewis M.J. (2011). *Music, Encyclopedia of Creativity (Second Edition)*, 166-173.
- Meng B, Zhu Z, Li S, Zeng, Q and Mei B. (2009). Global view of the mechanisms of improved learning and memory capability in mice with music -exposure by microarray. *Brain Research Bulletin*, 80, 1-2, 36-44.
- Namdar, Nader and Azimzade, Manije (2001). Effect of music on germ, baby and pregnant, Tehran.
- Nishio H, Kasuga S, Ushijima M and Harada Y. (2001). Prenatal stress and postnatal development of neonatal rats sex-dependent effects on emotional behavior and learning ability of neonatal rats, *Int J Dev Neurosci*, 19, 1, 37-45.
- Parncutt R. (2006). *Prenatal development: The child as a musician*, Oxford university press, 1-131.
- Qasemzade, Mohamad Javad (1390), (child psychology, Tehran), Shamim, p.50.
- Rabat, A .Bouyer, J. J., George, O., Le Moal, M., Mayo, W. (2006). Chronic exposure of rats to noise:

relationship between long-term memory deficits and slow wave sleep disturbances. *Behav Brain Res*,171,2, 303-12.

Rice, Philip (1992), *human development (developmental psychology from birth to death)* (translated by Mashhad Forouqan), Tehran, Arjmand, 1388.

Sadler, T.W and Langman J. (2012).*Langman's medical embryology (12th ed)*, Philadelphia: Wolters Kluwer Health/Lippincott Williams and Wilkins.

Standley, J.M. (2000). The Effect of Contingent Music to Increase Non-Nutritive Sucking of Premature Infants, *Pediatric Nursing*, 26, 5, 493-499.

Stephanie, j and Standley, JM. (2003). Effect of Music on Gender and Behavior and Heart Rate in one Day Old Infants. a thesis submitted to the School of music in partial fulfillment of the requirements for the degree of master of music