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## Effects of Mother's Voice Recording Toward Premature Infant Heart Rate Changes at the RSUD Dr. Moewardi

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### Abstract

**Background:** The World Health Organization (WHO) states that premature birth occurs before 37 weeks of complete pregnancy and is a leading cause of death of newborns. As for interventions that could be done to improve this, includes listening to the mother's voice and lullabies (lullaby). Mother's voice can affect respiration rate, heart rate, oxygen saturation, infant's oral feeding skill, premature infant weight gain, brain maturation, and the infant's physical response.

**Objective:** The purpose of this research was to find the effect of mother's voice recordings on the state of the heart rate of premature babies in the HCU Neonatal Room of RSUD Dr. Moewardi. This study was completed in the neonatal HCU room of RSUD Dr. Moewardi.

**Method:** The sampling technique used is consecutive sampling method, based on inclusion and exclusion criteria. This study uses a quasi-experimental design with a pre and post-test design without control group. The analysis test used was paired t-test since the normality test results showed p values of >0.05 (normal distribution).

**Result:** The results of the Paired T-Test showed a p-value of 0,000 ( $p < 0.05$ ) which means, there is significant difference in heart rate between before and after the application of the mother's voice recording.

**Conclusion:** In conclusion Mother's voice recording influences changes in the heart rate of premature babies. The implications of the mother's voice recording can be used for the treatment of premature infants in the HCU Neonatal room and NICU.

**Keywords:** Premature; heart rate; recording; mother's voice

### INTRODUCTION

The World Health Organization (WHO) stated that premature birth occurs before 37 weeks of complete pregnancy and is a leading cause of newborn's death (WHO, 2018). Premature babies are at higher risk for illness, disability, and death. Premature birth could be caused by anemia in pregnant women. If not immediately addressed, it can affect the growth and development of the fetus/baby during and after pregnancy (Kementrian kesehatan RI, 2019).

The global premature birth rate, according to WHO, increased from 2.0 million in 1990 to almost 2.2 million in 2010. In 2010, Southeast Asia was ranked 3, with the highest number of preterm births globally. The number of births were around 11.200 with 13.5% of premature births. Indonesia ranked 4th after India, China, Nigeria and Pakistan, with 675.700 preterm births (WHO, 2017).

Premature babies in the Neonatal Intensive Care Unit (NICU) are accustomed to hospital noise. The

noise is emitted from the incubator, monitoring alarm and the sound from the healthcare team (Krueger, 2010). Efforts to improve comfortable hospital environment for premature babies are the primary focus when it comes to reducing hospital noise and maintaining a calm environment (Webb et al., 2015).

Premature births and most deaths in premature babies that occur can be prevented by interventions that are proven to be a low cost solution (WHO, 2018). An example of interventions that can be done to improve this condition includes, listening to the mother's voice and listening to lullabies (lullaby)(Krueger, 2010). Research from (Kisilevsky et al., 2009) provides evidence that while still in the womb, the fetus begins to pay attention, remember, and learn sound and language. The fetal nerve network is sensitive to the mother's voice and speech of the mother language that is being formed.

Previous research has suggested that mother's voice can affect respiration rate, heart rate, oxygen saturation, oral feeding skills of infants, premature infant weight gain, brain maturation and infant physical responses (Krueger, 2010); (Chorna et al., 2014); (Webb et al., 2015); (Ahmadi Vastani et al., 2016); and (Uchida et al., 2018). The mother's voice is developed according to the baby's sensory needs (e.g., touch, illumination, smell) to stimulate the maturity of the sensory system (Krueger, 2010).

A study from (Ahmadi Vastani et al., 2016) aimed at comparing the effects of the mother's voice and a stranger's voice on the heart rate of premature infants treated at the NICU. The sample was divided into two groups namely mother's voice group and stranger's voice group with 22 participants for each group. The results of the study stated that there was no significant difference in the changes of the heart rate of premature babies after being given the two interventions with a p-value of 0.345 ( $p > 0.05$ ). The significant result during the intervention was obtained with a p-value of 0.016 ( $p < 0.05$ ). During the intervention, the most significant heart rate occurred in the mother's voice group. After that, it decreased when the intervention is finished.

The results of this study attracted researchers to perform further study by providing mother's voice recordings. The research aimed to determine the effect of mother's voice recording on changes in heart rate of premature babies in the HCU Neonate Room of RSUD Dr. Moewardi.

## METHODS

The design of this research was quasi-experimental with a pre and post-test design without control (Dharma, 2011). The interventions given in this study were carried out by recording the mother's voice of the premature babies in the incubator. This research was conducted from August to October 2019. The sampling method used was total sampling during data collection. This study obtained as many as 15 premature babies who met the inclusion criteria. The inclusion criteria in this study were premature infants who were in the incubator, infants born with gestational age  $< 37$  weeks, and physically stable infants. The exclusion criteria in this study were infants with significant congenital abnormalities, babies with hearing loss, infants who have seizures or have a history of seizures, malnourished infants, and infants attached with ventilator.

The research instruments used in this study were, a questionnaire assessing respondent's characteristics, mother's voice recording, heart rate observation sheet, Standard Operating Procedure (SOP) of mother's voice recording, FL studio program, and dB meter. The questionnaire of the respondent characteristics includes the type of childbirth (normal/cesarean), date of birth, gender, maternal gestational age, baby's weight, maternal age, and maternal education level (Ahmadi Vastani et al., 2016). Mother's recorded voice contains three types of voice namely speaking, reading, and singing, in which recorded for a duration of 15 minutes. The mother's voice recording then applied for 45 minutes (10 minutes before, 15 minutes during, and 20 minutes after the intervention) for three consecutive days. Exposure to recorded mother's voice is given to babies between 10:00 WIB (western Indonesia time) to 19:00 WIB (western Indonesia time), in 2 different shifts. The recording is played using a small speaker, placed in an incubator about 20 cm from the baby's ear with a volume of 65-75

decibels and at a frequency of 1000 Hz (Webb et al., 2015); (Nocker-Ribaupierre et al., 2015); and (Jabraeili et al., 2016).

In this study, researchers were assisted by nurses who had morning shifts and afternoon shifts in performing interventions. The researcher asked the willingness of prospective respondents by filling out informed consent. Researchers recorded Mother's voice for 15 minutes, which contained three sessions namely talking, reading, and singing. After recording the mother's voice, a 1000 Hz frequency was set using the FL studio application and the 65-75 sound volume was set using a dB meter. Pretest (the measurement of heart rate) is done 10 minutes before giving intervention. The mother's voice recording is given to the baby in an incubator about 20 cm from the baby's ear with a duration of 15 minutes for three consecutive days. Posttest was carried out 20 minutes after the last day of the intervention in the HCU Neonatal room of RSUD Dr. Moewardi. The number of ethical eligibility of this research is 710/V/HREC/2019.

Data analysis in this study were done using SPSS application. The Shapiro-Wilk normality test results (sample ≤ 50 respondents) obtained a p-value of 0.122 for pre-intervention heart rate and a p-value of 0.927 for post-intervention heart rate. Both have p-value > 0.05, so the data distribution is normal for pre-intervention and post-intervention heart rates. The statistics used is parametric paired T-test.

**RESULTS**

**The Characteristic of The Respondents**

Table 1 shows that the youngest mother was 21 years old, and the oldest was 43 years old, with a mean of 31.80 ± 7.830 years old. The shortest gestational age was 28 weeks, and the longest gestational age was 35 weeks, with a mean of 32.20 ± 1.821 weeks. The lowest birth weight was 1000 grams, and the heaviest birth weight was 2050 grams, with a mean of 1548 ± 288.400 grams. The baby's gender majorities were female, with nine respondents (60%). The majorities of the respondents gave birth by Cesarean delivery, with ten respondents (66.7%). Also, most of the

respondents have a high school degree, with nine respondents (60%).

**Table 1. The Characteristics of the Respondents (n=15)**

Mother's characteristics	Min.	Max.	Mean	Standard deviation
Mother's age	21	43	31.80	7.830
Gestational age	28	35	32.20	1.821
Baby's Birth weight	1000	2050	1548	288.400
Mother's characteristics	Frequency		%	
Sex:				
• Male	6		40	
• Female	9		60	
Type of Childbirth:				
• Normal	5		33.3	
• Caesar	10		66.7	
• Induction	0		0	
Mother's education level:				
• Elementary school	5		33.3	
• Junior high school	9		60	
• Senior High School	0		0	
• Academic (D1/D2/D3)	1		6.7	
• College				
<b>Total</b>		<b>15</b>		<b>100%</b>

**Heart Rate of Respondents Before and After Listening to the Voice Recordings of the Mother**

**Table 2. The frequency distribution of premature baby's heart rate pre and post-listening to the recordings of the mother's voice (n=15)**

Heart Rate	Min	Max	Mean	Std. Deviation
Pre	136	168	155.80	9.734
Post	120	155	136.07	9.339

Table 2 shows the frequency distribution of heart rate for pre and post-listening to the recorded mother's voices. For the pre-value, the lowest value was 136 bpm, and the highest value was 168 bpm. As for the post-test, the lowest value was 120 bpm, and the most significant value is 155 bpm.

## Heart Rate of Respondents Before and After Listening to the Voice Recordings of the Mother

**Table 3. Paired T-test analysis of the effect of mother's recorded voice on the pre and post-test heart rate of the premature babies (n=15)**

Variable	Average (s.b)	Difference (s.b)	p-value
Heart rate before listening to mother's voice recordings (n=15)	155.80 (9.734)	19.733 (9.430)	<0.001
Heart rate after listening to the mother's voice recordings (n=15)	136.07 (9.339)		

*Paired T-test, there is a difference between before and after.*

Table 3 shows the heart rate difference before and after the baby listened to the recording of the mother's voice. Paired T-Test results show a p-value of <0.001 (<0.05) which means that it showed a significant difference in heart rate between the before and after listening to the recording.

## DISCUSSIONS

The results showed that the age of the mother range from 21 to 43 years with a mean of  $31.80 \pm 7.830$  years; the mother's gestational age range from 28 to 35 weeks with a mean of  $32.20 \pm 1.821$  weeks; and the birth weight of babies range from 1000 to 2050 grams with a mean of  $1548 \pm 288.400$  grams. The baby's gender majorities were female, with nine respondents (60%). Cesarean birth was the majorities of delivery method undergone by the respondents, with ten respondents (66.7%). Most of the respondents had a high school degree with nine respondents (60%). This fact is the same as earlier research from (Ahmadi Vastani et al., 2016) about the effect of voice of mothers for premature babies in which obtained data on the characteristics of mother's age, mother's gestational age, the birth weight of the baby, sex, type of childbirth, and mother's educational level. Mother characteristics in this study did not affect the heart rate of premature babies. As confirmed by research from (Rand & Lahav, 2014), respondent characteristics do not affect make any changes in heart rate for premature infants. The mother's voice recording type in this study includes talking,

reading, and singing. Each mother's voice was recorded for 5 minutes so that the entire recording duration is 15 minutes. Although all three recordings were given, not all of them were well received by the premature babies. Premature babies are more receptive to the mother's singing voice than the mother's talking voice (Carvalho et al., 2019). In addition, the mother's singing voice can improve the relationship between mothers and babies and can reduce anxiety in the mothers (Fancourt & Perkins, 2018).

The frequency distribution of baby's heart rate pre- and post-premature given the recorded mother's voice are as follows. At the pre-test, the lowest value is 136 bpm, and the highest value is 168 bpm. As for the post intervention value, the lowest value is 120 bpm, and the most significant value is 155 bpm. Research from (Rand & Lahav, 2014) states that giving a mother's voice recording for 30 minutes shows a decrease in the heart rate of premature babies since the mother's voice has a relaxing effect on her baby. Early hearing of mothers' voices can stabilize the baby's physiology, such as heart rate, respiratory rate, and SpO<sub>2</sub> (Picciolini et al., 2014). Giving a mother's voice recording in low intensity have a positive effect on the physiological response of premature babies, namely a decrease in SpO<sub>2</sub> during and after a mother's voice recording is given, as well as an increase in the heart rate and the respiratory rate during and after being given the mother's voice recording (Sajjadian et al., 2017).

This research shows a significant difference in heart rate between before and after the hearing of the recording of the mother's voice with a p-value of <0.001 (<0.05). Previous research (Rand & Lahav, 2014) in premature infants with 25-32 weeks gestational age which divided into two groups (treatment and control group). The treatment group was given the recording, and the other group did not. The results of the study obtained a p-value<0.0001, which means that in the first group, the baby experienced a decrease in heart rate during the mother's voice recording for 30 minutes in the incubator. Newborns can recognize their mother's voice because it has been heard by them since they were still in the mother's womb, and the voice can calm the baby. The phenomenon occurs since the baby's sensory

formed since they were in the womb by listening to his/her mother's voice (Kisilevsky et al., 2009). The mother's voice is expected to improve the emotional relationship between mother and baby. In this study, the researcher has the initiative to give a mother's voice recording to the baby. Introducing the mother's voice to a premature baby can affect the baby's behavior as well as the baby's emotions. Emotions of premature babies may affect the baby's brain development (Filippa et al., 2019).

### CONCLUSIONS

Giving the mother's voice recording of talking, reading, and singing for 15 minutes can lower the baby's heart rate. This phenomenon indicates an attachment of the premature infants to the mother's voice in a form of physiological responses, namely the heart rate of the premature infants.

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