

EFFECTIVENESS OF COMBINATION OF MASSAGE THERAPY AND MUSIC ON BREATHING FREQUENCY AND WEIGHT IN PREMATURE BABIES

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ABSTRACT

Indonesia is listed at number 7 out of 10 countries with the highest infant mortality in the world based on WHO 2019 data. The most common cause of infant mortality in Indonesia is low birth weight which can occur in premature babies. Vital signs are body parameters to assess the physiological function of the body's vital organs or the body's homeostatic mechanism. Various problems in premature babies include the risk of infection, difficulty breathing, hypothermia, poor sucking reflex, nutritional disorder, hypoglycemia, intracranial bleeding, meconium aspiration syndrome and hyperbilirubinemia. Premature babies are at risk for respiratory problems and impaired growth and development due to organ immaturity. Some interventions that can improve the health condition and growth and development of premature babies are massage therapy and music therapy.

This study aims to determine the effectiveness of the combination of infant massage therapy and music on respiratory frequency and body weight in premature babies.

The research method is quantitative using a quasi experiment with one group pre and posttest without control design on 10 premature babies, giving a combination of massage and music therapy for 7 days.

The result of the research indicates that the combination of massage therapy and music is effective on respiratory frequency and weight of premature babies.

Keywords: premature baby, weight, respiratory rate, music, massage therapy

BACKGROUND

Data from the World Health Organization (WHO) in 2019 recorded that there were 2,4 million infant deaths in the world. Indonesia is number 7 out of 10 countries with the highest infant mortality rate in the world in 2019 with death rate of 60/1.000 live births. Based on data from the Directorate of Family Health in 2019 in Indonesian Health Profile in 2020, 80% of all reported neonatal deaths (16.156 deaths) occurred in the first six days of life. The most common cause of neonatal death was Low Birth Weight (LBW) with 7.150 deaths (35,3%).

Low Birth Weight Babies (LBW) are babies with birth weight less than 2500 grams regardless of gestational age. LBW can occur in premature babies and term babies (dysmatur). (Amellia, 2019) Premature babies are at risk for various health problems such as instability of vital signs, difficulty eating and sleeping disorders. This problem is due to the low level of organ maturity, thus disrupting various physiological functions in the body.

Under normal circumstances, newborns have a body temperature of around 36,5°C to 37,5°C or the same as the mother's body temperature, but in certain cases such as low birth hypothermia tend to occur. Immaturity of the central nervous system is a condition that often occurs in premature babies. One of the fatal consequences of the immaturity of the central nervous system is respiratory distress syndrome which is often the cause of death in premature babies. (Efendi, 2019)

Premature babies also have a high risk for impaired growth and development ranging from mild to severe levels that have an impact on disability. Science and technology developed today is not only to make premature babies survive and adapt to their environment, but also to increase growth and development in order to catch up with premature births. (Emaliyawati, 2018)

One of the interventions that can be used to improve the health condition and development of premature babies is music therapy. Music is used to calm, increase the ability to receive stimulation, increase the suction reflex, reduce pain, improve the relationship between mother and baby and shorten the length of hospitalization. (Emaliyawati, 2018) Another intervention that can be used in improving the development of premature babies is massage therapy. Massage therapy as a non-invasive procedure has positive effect on the physical and development of premature babies

including weight gain associated with shorter hospital stays, neurologic and neuromotor development, reduced stress and improved sleep quality. (Bayomi & El-Nagger, 2015) This is supported by Gultom's research (2015) regarding the effectiveness of infant massage on increasing the weight of premature babies at Imelda Hospital, Medan.

This research aims to determine the effectiveness of the combination of massage therapy and music on respiratory frequency and weight of premature babies. This research is different from previous research because the strength of this research is that baby massage is given of special massage for premature babies including tactile and kinesthetic stimulation combined with therapy with lullaby music which is the right type of music and is recommended to be given to babies with really high volume setting according to the provisions to the baby, this research is very helpful in effort to improve the condition of premature babies who have problems with respiratory instability and as an effort to increase body weight.

METHOD

The research is a quantitative research with a quasi-experimental type and one group pre and posttest without control research design. The study was conducted on 10 premature babies selected by non-probability sampling through an accidental sampling approach. The criteria for premature babies to be sampled in this study were premature babies with gestational age > 24 weeks, aged 0-7 days, born at RSUD Dr. Gunawan Mangunkusumo Ambarawa, had no congenital abnormalities complications and did not use a breathing apparatus.

The study was conducted by measuring the respiratory frequency and weight of baby before and after giving a combination of massage and music therapy for 7 days. Premature babies were given massage therapy for premature babies which included tactile and kinesthetic stimulation 3 times a day in the morning, afternoon and evening with a duration of 15 minutes. Premature babies were also given music therapy with lullaby music 2 times a day in the morning and evening for 30 minutes with a volume of 50 dB. Data collection on 10 premature babies was carried out on July 21 to August 14, 2021 at Dr. Gunawan Mangunkusumo Hospital Ambarawa.

Data on respiratory frequency and weight of preterm babies before and after administration of a combination of massage and music therapy for 7 days were tested for normality. The result of the normality test show that all data are normally distributed, so the data analysis used the Paired-sample t-Test.

RESULT

1. Breathing Frequency of Premature Babies Before and After Combination of Massage and Music Therapy

The respiratory frequency of premature babies before the combination of massage and music therapy had an average of 61, a minimum value of 54 times/minute, a maximum value of 66 times/minute and standard deviation of 3,801. Meanwhile, the respiratory frequency of premature babies after giving a combination of massage therapy and music has an average of 52, a minimum value of 46 times/minute, a maximum value of 58 times/minute and a standard deviation of 4,422.

Table 1 Differences in The Respiratory Frequency of Premature Babies Before and After Giving Combination of Massage and Music Therapy n = 10

The Respiratory Frequency	Mean	Minimal	Maximal	Standard Deviation
Before	61	54	66	3,801
After	52	46	58	4,422

2. Premature Baby's Temperature Before and After Giving Combination Massage and Music Therapy

The temperature of premature babies before giving a combination of massage therapy and music has an average of 36,6°C, a minimum value of 36,5°C, a maximum value of 36,7°C and a standard deviation of 0,789. Meanwhile, the temperature of premature babies after giving a combination of massage therapy and music has an average of 36,7°C, a minimum value of 36,6°C, a maximum value of 36,9°C and a standard deviation of 0,943.

Table 2 Differences in Baby Temperature of Premature Babies Before and After Giving Combinatoin of Massage and Music Therapy n = 10

Baby Temperature of Premature Babies	Mean	Minimal	Maxsimal	Standard Deviation
Before	36,6	36,5	36,7	0,789
After	36,7	36,6	36,9	0,943

3. Premature Baby's Weight Before and After Giving Combination of Massage and Music Therapy

The weight of premature babies before giving a combination of massage therapy and music has an average of 1922 grams, a minimum value of 1500 grams, a maximum value of 2405 grams and a standard deviation of 305,380. Meanwhile, the weight of premature babies after giving a combination of massage therapy and music has an average of 1935 grams, a minimum value of 1525 grams, a maximum value of 2405 grams and a standard deviation of 305,541.

Table 3 Differences in The Weight of Premature Babies Before and After Giving Combinatoin of Massage and Music Therapy n = 10

The Weight	Mean	Minimal	Maximal	Standard Deviation
Before	1922	1500	2405	305,380
After	1935	1525	2405	305,541

4. The Effectiveness of The Combination of Massage and Music Therapy on the Respiratory Frequency of Premature Babies

The analysis of the effectiveness of the combination of massage therapy and music on the Respiratory Frequency of Premature Babies using the Paired-sample T-test, obtained p value 0,000 < 0,05. So it can be concluded that the combination of massage therapy and music is effective in reducing the respiratory frequency of premature babies in Dr. Gunawan Mangunkusumo Hospital Ambarawa.

Table 4 The Effectiveness of The Combination of Massage and Music Therapy on the Respiratory Frequency of Premature Babies

The Respiratory Rate	Mean	Mean Difference	SD	p-value
Before	61			
After	52	9,000	3,432	0,000

5. The Effectiveness of Combination of Massage and Music Therapy on The Temperature of Premature Babies

The analysis of the effectiveness of the combination of Massage and Music Therapy on the Temperature of Premature Babies using the Wilcoxon signed ranks test, obtained p value 0,142 < 0,05. So it can be conclude that the combination of Massage and Music Therapy is not effective against temperature reduction, meaning that body temperature remains stable after treatment of premature babies at Dr. Gunawan Mangunkusumo Hospital Ambarawa.

Table 5 The Effectiveness of The Combination of Massage and Music Therapy on the Temperature of Premature Babies

The Temperature	Mean	Mean Difference	SD	p-value
Before	35			
After	37	1,469	4,057	0,142

6. The Effectiveness of The Combination of Massage and Music Therapy on the Weight of Premature Babies

The analysis of the effectiveness of the combination of massage therapy and music on the weight of premature babies using the Paired-sample T-test, obtained p value $0,047 < 0,05$. So it can be concluded that the combination of massage therapy and music is effective in increase the weight of premature babies in Dr. Gunawan Mangunkusumo Hospital Ambarawa.

Table 6 The Effectiveness of The Combination of Massage and Music Therapy on the Weight of Premature Babies

The Weight	Mean	Mean Difference	SD	p-value
Before	1922			
After	1935	-13,000	17,826	0,047

DISCUSSION

1. Breathing Frequency of Premature Babies Before and After Combinatoin of Massage and Music Therapy

The average respiratory frequency of premature babies before the combination of massage and music therapy was above the normal value. Where the normal value of the baby's respiratory frequency is 30-60 times/minure. (Moelyo & Dkk, 2019) This is accordance with research conducted by Chirian et al (2021) in Japan which showed that 68% of premature babies in the Neonatal Intensive Care Unit (NICU) had respiratory distress syndrome. (Emaliyawati, 2018) Where one of the manifestations that arise from respiratory distress syndrome is an increase respiratory frequency.(Emaliyawati, 2018)

Research by Dina and Yuliaswati in 2013 also showed the effect of prematurity on respiratory disorder in babies. This study, which was conducted at one of the General Hospitals in Surakarta, showed that deliveries with preterm gestation had a 2,9 times greater risk of giving birth to babies with respiratory disorders compared to those at term. (Hartatik & Yuliaswati, 2013)

Respiratory disorders in premature babies are caused by the immaturity of the neurological system that regulates breathing and surfactants which are the lubrivant in the expansion and contraction of the lungs that are not fully formed. The presence of surfactant is to reduce the tension of the alveoli and prevent the alveoli from collapsing during the process of inspiration and expiration. (Emaliyawati, 2018)

The risk of the occurrence of respiratory distress syndrome is also greater in babies with smaller gestational age. According to Euro Neo Stat in the Ethics study (2017), premature babies will be at risk of experiencing respiratory distress syndrome by 91% at 23-25 weeks' gestational, 88% at 26-27 week's gestational, 74% at 28-29 week's gestational and 52% at 30-31 week's gestational.(Emaliyawati, 2018)

In addition to the baby's physical condition, the baby's respiratory problems can also be exacerbated by the baby's stressful condition. According to Hastuti's research (2016), stress in babies can cause physical responses in premature babies such as an increase in heart rate, an increase in respiratory frequency, a decrease in saturation and an increase in intracranial pressure and changes in facial responses. (Hastuti & Juhaeriah, 2016) Stress conditions in babies can be caused by environemntal conditions and treatment procedures in the NICU. As stated by Wahyuni (2013), the installation of breathing apparatus, blood sampling, infusion and diaper changes can cause the baby to feel uncomfortable which causes stress to the baby. (Arifah, 2013)

Meanwhile, the result of the study showed that the average respiratory frequency after giving a combination of massage and music therapy for 7 days showed a decrease to 52 times/minute or a different of 9 times/minute compared to the respiratory frequency of premature babies before giving a combination of massage and music therapy. This respiratory frequency value is included in the normal value range, which according to Engel in Fitriana (2017) the normal value of a baby's respiratory frequency is between 30 to 60 times/minute

2. Premature Baby's Temperature Before and After Giving Combination Massage and Music Therapy

Premature baby's temperature before giving a combination of massage and music therapy was in the normal range. Under normal circumstances, newborn have a body temperature around $36,5^{\circ}\text{C}$ to $37,5^{\circ}\text{C}$ or the same as the mother's body temperature. Body temperature reflect the balance between heat generation and loss. Hypothermia is a danger sign because it can cause changes in body metabolism, hypoglycemia, metabolic acidosis and shortness of breath. Hypothermia is common in premature babies because of low fat tissue and relatively large body surface area.

According to Pantiawati (2010) the sign and symptoms of hypothermia include body temperature below normal, cold skin, cold skin and cyanosis. The temperature regulation center is in the hypothalamus. Body temperature is influenced by the baby's age, gender, environmental temperature and activity. Measurement of the baby's body temperature can be done through the mouth, rectum, ear and axilla. Measurement through the rectum is an accurate measurement that is often used in clinical practice, but its implementation is invasive so that is make the patient uncomfortable. (Hanum et al., 2014)

3. Premature Baby's Weight Before and After Giving Combination of Massage and Music Therapy

The weight of premature babies in this study before giving a combination of massage and music therapy was classified as Low Birth Weight (LBW). Where in theory LBW babies weigh less than 2500 grams. (Amellia, 2019) This is accordance with Hanum's research (2014) which state that 70,7% of low birth weight babies are premature babies. (Hanum et al., 2014) Not much different from previous research (2015) also showed 51,4% of the incidence of LBW in RSUP Dr. M. Djamil Padang is a premature baby. (Mahayana et al., 2015) Fathiyati's research (2019) also support previous research, where 96,8% of premature babies are classified as low birth weight babies. The result of statistical tests also showed a significant relationship between prematurity and the incidence of LBW. (Octavia & Fairuza, 2020)

In this study, the average weight of premature babies after the combination of massage and music therapy was 1935 grams. Of the 10 premature babies studied, 6 of them experienced weight gain. This weight gain in premature babies is in accordance with the theory that the baby's weight that had previously lost will rise again at the end of first week until the 10th to 14th day. Furthermore, a normal and healthy baby will gain weight regularly. (Sari & Khotimah, 2020)

Premature baby's weight gain is also in accordance with the theory of factors that affect baby weight such as genetics, environment, nutrition, hormones and stimulation. (Vasra & Dkk, 2018) The combination of massage and music therapy is one type of stimulation that can be given to premature babies. This is in accordance with the research of Ummi Lathifah et al (2015) which showed a different in body weight in infant before and after giving lullaby music therapy with a p value of 0,000. (Lathifah et al., 2015) The result of Bayomi's (2015) study also support this study, where the result of this study indicate that massage therapy can increase weight gain in infant. (Bayomi & El-Nagger, 2015)

4. The Effectiveness of the Combination of Massage and Music Therapy on the Respiratory Frequency of Premature Babies

This is in accordance with Bayomi's research (2015) where the result showed a positive effect on physical, physiological and behavioral conditions. Where the p value of the respiratory frequency is $0,000 < 0,05$, which shows the effect of baby massage on the respiratory frequency. (Bayomi & El-Nagger, 2015)

In line with previous research, Etika's research (2017) which examined the effect of lullaby music therapy on heart rate, respiration rate and oxygen saturation in premature babies. The result of this study indicate that the provision of lullaby music therapy is proven to have an effect on respiratory frequency with p value $0,000 < 0,05$. (Emaliyawati, 2018)

Premature babies during treatment are exposed to stress caused by organ immaturity, lack of surfactant and infant care during treatment. This stressful condition can increase heart rate and respiratory rate and decrease

oxygen saturation which can affect quality of life and neuropsychomotor development. This physical response is also followed by endocrine and metabolic responses with the release of the hormones adrenaline, noradrenaline and cortisol which can affect the hemostatic balance of premature babies. (Emaliyawati, 2018)

Giving a combination of massage and music therapy can increase relaxation in babies, where relaxed conditions will reduce the respiratory frequency of premature babies. Babies who receive regular massage will be more relaxed and calm. This is because massage in babies will increase the activity of the neurotransmitter serotonin which increase the capacity of receptor cells that bind to glucocorticoids (adrenaline). This process causes a decrease in levels of the hormone adrenaline/stress hormone. (Putri, 2016)

Music therapy also reduce stress levels in premature babies. Relaxing and regular music repeatedly creates vibrations that will stimulate the auditory drum. This stimulation will be transmitted to the central nervous system in the center the brain. The hypothalamus in the central nervous system will respond to the adrenal medulla gland to suppress the release of the hormones epinephrine and norepinephrine or the release of catecholamines into the blood vessels is reduced. As a result, the concentration of catecholamines in plasma becomes low, so that the heart rate decreases and oxygen consumption decreases, which eventually slows down the respiratory rate. (Emaliyawati, 2018)

5. The Effectiveness of Combination of Massage and Music Therapy on The Temperature of Premature Babies

In premature babies or under age, less heat is produced or body temperature is relatively low due to incomplete circulation, weak respiration, low oxygen consumption and muscles not yet fully active. A low ambient temperature causes the baby to lose more heat, so the body tend to be lower than in a warm environment. Baby boys tend to have less body fat baby girls which affect thermoregulation so that their body temperature tends to be lower.

The high ratio of body surface area to body area to body mass causes babies to lose four times more heat than adult through radiation and evaporation. Babies respond to heat loss by secreting catecholamines, which constrict blood vessels and use multivacuolar fat or brown fat. This response will increase the metabolic rate by twofold through the hydrolysis and oxidation of free fatty acids.

6. The Effectiveness of Combination of Massage and Music Therapy on Premature Baby's Weight

The result of this study are supported by Bayomi's research (2015). Research conducted on the effect of the application of massage therapy on the physical, physiological and behavioral conditions of this neonate showed an increase in body weight of approximately 60,80 grams after giving massage therapy. The result of data analysis also showed p value < 0,05 which indicates the effectiveness of massage therapy on weight gain. (Bayomi & El-Nagger, 2015)

Yuyun and Ingrid's research (2020) also shows that music therapy is effective in increasing the weight of LBW babies in Majalaya Hospital. Where in this study, the average baby weight increased by 122 grams after giving music therapy for 3 days. (Sarinengsih & Dirgahayu, 2021)

The research of Manju C and Shilpi (2014) showed that moderate pressure massage with tactile stimulation can increase the weight of premature babies by increasing the baby's suction, increasing insulin release, reducing energy expenditure, decreasing norepinephrine, increasing gastric motility and better absorption of nutrients. This study also explains that tactile stimulation improves circulation of premature babies and increases blood supply to the stomach which accelerates gastric motility and digestion. (Bayomi & El-Nagger, 2015) This is supported by Gultom's (2015) research regarding the effectiveness of infant massage on increasing the weight of premature babies at Imelda Hospital, Medan. The result of the study on 35 preterm infant who were given preterm infant massage intervention showed a different in mean body weight before and after massage of 360 grams with a standard deviation of 112,328. The result of the statistical test obtained a p value of 0,000 which means there is a significant difference in the weight of premature babies before and after massage. (Gultom, 2015) The result of this study are also in line with the research of Febriyanti (2020) which states that baby massage therapy is effective for infant growth and development where baby massage will activate the release of insulin and

gastrin hormones they play a role in process of carbohydrate metabolism, glycogen storage, fatty acid synthesis which stored in the liver, fat and muscle. (Nur et al., 2020)

Babies who are massaged experience an increase in vagus nerve tone (10th brain nerve) which makes the levels of gastrin and insulin absorption enzymes increase so that the absorption of food juices is better which will increase growth. Baby massage also increase levels of serotonin secretion which will turn into melatonin which has a role in sleep and makes sleep longer and deeper. (Maharani et al., 2017) This also supported by research by Nurhudariani et al (2021), where infant massage therapy is effective on infant sleep quality with a p-value of 0,000. (Nurhudariani et al., 2021)

The result of this study are also in line with the research of Loewy et al (2013). The result of this study on premature infant with respiratory distress showed that music therapy affect the physiological function, sucking behavior and sleep of babies. (Efendi, 2019) Music therapy increases chemicals that are good for the body by increasing and stimulating the release of endorphins and serotonin. Serotonin is a chemical that transmits nerve impulses across the spaces between nerve cells or neurons and has a role in preventing anxiety. Increased serotonin can make the atmosphere calm, relaxed which will improve the quality of sleep in babies. (Maharani et al., 2017)

Comfortable conditions in babies will stimulate the hormone melatonin which regulates sleep patterns. Sleeping babies reduce the energy used in activities so that they can increase body weight. (Lathifah et al., 2015) This is in accordance with the research of Diler Aydin and Suan Yildiz which showed a significant reduction in stress in the classical music therapy intervention group compared to the control group. (Aydin & Yildiz, 2012)

Classical music is also beneficial in optimizing growth. Classical music therapy can improve the sucking reflex so that baby's nutrition can be fulfilled and can increase body weight. (Sumawidayanti et al., 2015) In addition, according to Lubetzky, music that is listened to will stimulate neurons to transmit impulses through neuroendocrine. This will increase the work of dehydroepiandrosterone (DHEA) which will increase the glucocorticoid hormone, which is a hormone that plays a role in nutrient metabolism. Increased nutrition will affect the growth of the baby. (Maharani et al., 2017)

CONCLUSIONS AND SUGGESTIONS

The combination of massage and music therapy is effective in reducing respiratory frequency, body temperature and increasing body weight of premature babies at Dr. Gunawan Mangunkusumo Hospital Ambarawa. Because the result of the study showed positive result in decreasing respiratory frequency, body temperature and increasing body weight of premature babies, the researchers suggested to parent, midwives and RSUD Dr. Gunawan Mangunkusumo Ambarawa to apply a combination of massage therapy and for 7 days in an effort to optimize infant care. Premature birth and effort to reduce infant mortality due to premature birth. Researches suggest that other studies be carried out that provide solutions to improve the condition of premature babies with other interventions that are possible and safe to do.

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