

ASSOCIATION BETWEEN THE PERCENTAGE OF PERIPHERAL OXYGEN SATURATION AND HEART RATE BEFORE AND AFTER MUSIC THERAPY IN PREMATURE CHILDREN ADMITTED TO A NEONATAL INTENSIVE CARE UNIT

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Abstract: This study aimed to verify the association between the percentage of peripheral oxygen saturation and heart rate, before and after, music therapy in premature infants admitted to the NICU. A bibliographical survey was carried out followed by the musical selection. The 39 premature babies were exposed for 30 minutes daily, with saturation and heart rate measured before and after exposure. 51.3% were boys, the average gestational age at admission was 31.3 weeks and the most common diagnoses were neonatal infection (76.9%) and respiratory distress (61.5%). A significant difference was identified in the reduction in heart rate only on day 2 ($p=0.029$), and an increase in SpO₂ on days 2 and 3 ($p=0.009/p=0.015$). Even without significance, there was an improvement in saturation and heart rate. It was concluded that music is an easy and low-cost resource, which benefits the baby's care, comforting him, calming him, improving care, which provides behavioral changes in the patient. We suggest that new scientific research be carried out in order to guarantee safe therapy until strong data are available in the literature.

Keywords: Neonatal Intensive Care Units. Premature Newborn. Music therapy. Physiological processes.

INTRODUCTION

Birth is surrounded by natural circumstances; however, early birth often occurs and the unborn child will face conditions that they are not yet properly prepared to encounter. The premature baby will probably be sent to a Neonatal Intensive Care Unit (NICU) where he will "wait" for his body to mature and adapt to the necessary conditions that will allow him to survive; the time and weeks for your recovery while receiving hospital care and, if possible, other more humanized care that allows you

to have a better quality of life during this period, such as music therapy. The NICU is characterized as an area of care for critically ill, highly vulnerable newborns who require special and continuous nursing care, which requires professionals to have great scientific knowledge, technical skill and the ability to carry out particularly careful assessments of these patients. (DUARTE; ELLENSOHN, 2007).

Damasceno, Silva, Ximenes Neto, Ferreira and Silva (2014) reported that premature and low birth weight newborns have unique anatomophysiological characteristics that require a complex adaptation to the extrauterine environment, considering biological, social and psychological aspects, and may present complications resulting from infections and injuries, which can lead to cerebral palsy, mental retardation and other physical and/or neurological disorders. Therefore, special attention must be given, with adequate technical and social support to facilitate this adaptation, which must be provided during hospitalization, as they often require care in neonatal intensive care units until they leave the risk situation, and continue after hospital discharge.

Premature birth predisposes, in addition to nutritional risk, to implications arising from brain immaturity. We must try to preserve the neurodevelopment of this little one, so that these conditions are as close as possible to intrauterine conditions.

At birth, the baby does not have enough psychic maturity to realize that he is a subject in a world made up of several other subjects. He is unable to distinguish his own body from other objects, and especially from the mother, as the baby needs to be united in symbiosis with another. He is totally dependent on this "Big Other" in every way. She is largely responsible for guiding this new being into her registration as a unique subject in the world. It is through the desire for an "other" that the

baby can develop his psyche and realize that he is a “separate” being that belongs to this world of language. Thus, the maternal function becomes the mainspring of this construction. It is being willing and available to lend your desires and meanings to another being through looking, speaking, caring, contact, affection, affection and love. This bond between mother and child is not born ready-made, it must be built (WINANDY, 2009; NEGREIROS et al., 2003a; NEGREIROS; CARVALHO, 2003b).

When a baby is born and goes to a NICU, some difficulties threaten the establishment of this bond due to separation and little contact, in addition to being removed from your arms very early. There is also the fear of becoming attached to a being that could die, that is, there is the fear, in these cases, of a very real and definitive separation: death, an anxiety-provoking situation that generates stress and anguish. The caregivers of that child become the doctors, the team, and not the parents, which makes it difficult to establish the bond as this occurs through being in contact, speaking, singing, touching and looking at the baby (WINANDY, 2009; NEGREIROS et al., 2003a; NEGREIROS; CARVALHO, 2003b).

Music, as it is universal, is considered an excellent tool for working with patients. Strategies are extracted from it and considered tools to be applied in therapies with patients. Music Therapy is a form of therapy based on musical experiences that enable the individual to develop relationships between themselves and their various sound universes. The activities developed allow the subject to understand, internalize and experience all sound parameters such as intensity, height and duration, and aspects such as body vibration, musical texture and dynamics, rhythmic pulsation, among others that involve the field of music. It reaches the subject at the physical, mental, emotional and social levels, facilitating their expression, movements and

feelings, promoting learning, and internal organization (PEREIRA; CHAVES, 2013; REINERT; ANSAY, 2019).

A survey conducted on the stimulation of mothers and babies during pregnancy and the neonatal period was completed by 82 members of the neonatology team at hospital NICUs in the United States. 72% used music in the NICU as stimulation (FIELD, et al., 2006). Music tries to bring a proposal beyond the sounds and noises to which premature babies are continually exposed. A quality differential that you receive and welcome in a moment, as a way of feeling calm, calm, safe, away from manipulations and interventions from the team at that moment.

Among the parameters that are checked during the baby’s hospitalization are the heart rate (HR) and the percentage of peripheral oxygen saturation (SpO₂). These are observed on the monitor panel and connected to the baby’s lower limb. The SpO₂ range considered clinically stable for preterm infants is unknown, and may vary as the corrected gestational age advances. A standard SpO₂ level of 95% during normal breathing can help prevent harmful episodes of saturation drops. A range between 91% and 95% may be the safest to use. The ideal SpO₂ levels required for premature babies help maximize survival and also minimize pulmonary complications (YAMAMOTO et al., 2017). In technical terms, FiO₂ must be adjusted to maintain SpO₂ between 91-95%, so that alarms are maintained between 88-95% (COALA PROJECT).

The heart rate can be considered bradycardic when it is less than 80 beats per minute (bpm), and tachycardic if the heart rate is above 160 bpm (NICOLAU et al., 2008, SMITH, 2015).

Thus, observing the oxygen saturation level and heart rate allows the professional to check how the patient is doing, and music as

a strategy can help stabilize these parameters. This time, the application of music in the neonatal intensive care unit emerges as another therapeutic proposal that integrates the other care provided to the patient, with “the use of music as a complementary tool for health promotion” (SILVA et al., 2013).

METHODOLOGY

The study was developed in the NICU of Hospital Geral Waldemar Alcântara (HGWA), from 2020 to 2021, after registration on Plataforma Brasil and substantiated opinion No. 3,984,159 from the Research Ethics Committee. The methodological procedure adopted to develop this study is a quantitative approach. The HGWA NICU has 8 beds and is a reference for patients from all over the State. According to Carabetta Júnior and Brito (2011), quantitative research is based on experimentation and measurement, involving specific numerical and statistical data. This approach must be chosen when there is a well-defined problem and there is information and theory regarding the object of knowledge, that is, the focus of the research and/or what you want to study. Quantitative research is chosen when you know the qualities and have control over what you are going to research (SILVA; LOPES; BRAGA JUNIOR; 2014).

Initially, a bibliographic study was carried out considering the descriptors premature, infant, premature, premature newborn, music therapy, music therapy, heart rate, heart rate, complementary therapies, vital signs, and vital signs, and in scientific publications on the subject, including relevant websites on the internet, such as PUBMED, MEDLINE, prioritizing the last 5 years.

Next, a repertoire of instrumental songs was chosen. When choosing the repertoire, stable, soft, rhythmic melodies, with light timbres, consonant, repetitive and predictable harmonies were considered, as well as sounds

of nature (birds and running water) and white noise. The media were selected: Baby Mozart (Andante – Sonate KV 545; Adagio – Sonate KV 570; 12 minuets, K.103/61d), Baby Mozart (8 Minuets, K. 315a/315g; 11 Minuets, K.176; Piece in F Major, KV.33b), and, Best Mozart for babies (Music to Sleep, Mozart Music Therapy). The repertoire was previously listened to and analyzed for its musical construction. During the implementation of the project, other songs were selected as long as they followed the preliminary musical construction. The entire repertoire was previously analyzed before being put into practice in the unit.

The documents from the Speech Therapy Service were analyzed and the necessary variables were selected, with a form being filled out by the service’s speech therapist in their care. Every day, after handling the baby by the multidisciplinary team, a portable speaker, containing a pendrive with selected instrumental music, was placed on the station counter with low intensity (ambient music - <50dB). The exposure time was 30 minutes or more while the unit’s lighting was turned off. Before and after exposure, each patient’s saturation and heart rate data were recorded, taken directly from the monitor attached to the patient’s foot or hand.

The sample consisted of all premature newborn patients admitted to the NICU with clinical stability for auditory stimulation, who required treatment during the project execution period. Patients in critical isolation, full-term newborns and those without clinical conditions for auditory stimulation were excluded.

The PASW program (version 17- SPSS) was used for statistical analysis, using proportions, prevalence ratio (PR), 95% confidence interval (95% CI), mean, standard deviation (SD), paired t-test for comparisons between two paired groups, adopting a significance level of

5% ($p < 0.05$).

RESULTS ANALYSIS

The study population consisted of 39 clinically stable premature newborns, 20 (51.3%) male, 18 (46.2%) female and 1 (2.6%) unregistered. The average gestational age (GA) at admission is 30.5 with a standard deviation of 4.5 and the corrected gestational age (IGC) during care is 31.3 with a standard deviation of 3.1. The babies were cared for during their ICU stay for at least 5 days.

The most common diagnoses that could be cumulative were neonatal infection (INN) 30 (76.9%) of cases, respiratory distress syndrome (RDS) 24 (61.5%), and neonatal jaundice (TSI) 23 (59%).

The table below shows a significant difference in heart rate only on day 2 $p = 0.029$. After music therapy treatment, the heart rate reduced. On the other days, except day 3, although the relevance was not significant, a reduction in heart rate could be observed in patients after music therapy (TABLE 1).

Day	n	Initial heart rate	Final heart rate	P
Day 1	35	149 ± 17,4	149,8 ± 14,4	0,594
Day 2	26	159,9 ± 22,6	154,7 ± 23,1	0,029
Day 3	19	154,7 ± 20,8	156,8 ± 16,5	0,441
Day 4	17	156,6 ± 14,1	154,9 ± 13,7	0,646
Day 5	15	165,3 ± 19,9	156,7 ± 15,8	0,097
Day 6	11	156,1 ± 15	156,5 ± 21,1	0,951
Day 7	8	155,3 ± 16,1	164,3 ± 17,6	0,088
Day 8	7	150,6 ± 30,2	162,9 ± 19,3	0,601

Table 1. Initial and final heart rate demonstration before and after music therapy.

Source: Produced by the author.

NOTE: Quantitative data expressed as mean ± standard deviation. Categorical data expressed as absolute counts and percentages in parentheses.

*Paired t-test was used for comparisons between two paired groups.

Figure 1 shows that there was a reduction in heart rate over 3 days, but for the most part it remained relatively stable or increased.

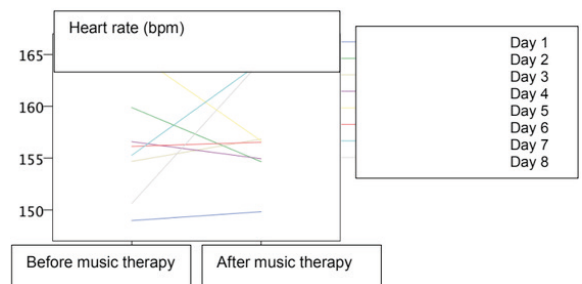


Figure 1. Initial and final heart rate before and after music therapy during 8 days of treatment.

Source: Produced by the author.

Marks; Zanella; Leal and Merrey (2013) observed that music influenced the anxiety of mothers of babies admitted to a neonatal intensive care unit. Musical sounds have important effects on the human brain. The available data related to this variable are still discrete, but it is known that respiratory frequency (RR), cardiac output and HR influence gas exchange, justifying the reduction in HR, RR and increase in SpO₂.

The table below shows a significant difference for SpO₂ on days 2 and day 3 $p = 0.009$ and $p = 0.015$ respectively. After the music therapy service, saturation increased. On the other days, although the relevance was not significant, behavioral changes could be observed in the family (TABLE 1).

Day	n	Initial saturation	Final saturation	p
Day 1	35	95,5 ± 4,5	96,2 ± 3,9	0,285
Day 2	26	94,9 ± 3,9	96,6 ± 2,6	0,009
Day 3	19	95,5 ± 3,6	97,4 ± 3,8	0,015
Day 4	17	95,4 ± 4,8	96,3 ± 3,4	0,514
Day 5	15	94,6 ± 6,9	96,3 ± 4,9	0,091
Day 6	11	93,3 ± 7,4	94 ± 6,6	0,699
Day 7	8	96,5 ± 3	97 ± 2,9	0,378
Day 8	7	98,4 ± 2	98,5 ± 1,6	0,916

Table 1. Initial and final saturation statement before and after music therapy.

Source: Produced by the author.

NOTE: Quantitative data expressed as mean ± standard deviation. Categorical data expressed as absolute counts and percentages in parentheses.

*Paired t-test was used for comparisons between two paired groups.

In our study, it was possible to observe that the variable peripheral oxygen saturation (SpO₂) showed a statistically significant difference on the second day of intervention after the music therapy session, as well as heart rate (HR). This finding is in line with the results found in the researched literature.

Studies have demonstrated music therapy as a way to improve the clinical status of premature babies, improving vital signs and reducing episodes of death (MORAN et al., 2014).

Figure 2 shows that there is an increase in oxygen saturation even if there is no significance.

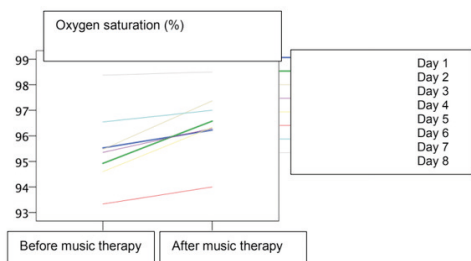


Figure 2. Peripheral oxygen saturation (SpO₂) initial and final before and after music therapy during 8 days of treatment.

Source: Produced by the author.

Another study composed of clinical trials showed that music therapy has an important clinical benefit for premature babies in the NICU (STANDLEY, 2002). Results show a positive effect on certain variables involving this baby, such as weight gain, length of stay, as well as a beneficial effect on oxygenation, behavioral assessment and heart rate (STANDLEY, 1998).

In the experiment on day 2, a correlation was carried out between the variation in peripheral oxygen saturation (SpO₂) and the variation in initial and final heart rate (HR) before and after music therapy, however, no significant difference was observed, as shown in Figure 3.

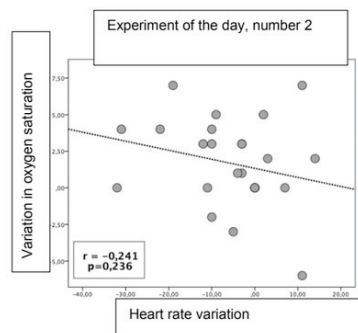


Figure 3. Correlation between peripheral oxygen saturation (SpO₂) and initial and final heart rate (HR) before and after music therapy – Day 2 Experiment.

Source: Produced by the author.

The available literature suggests that the presence of rhythmic and harmonic sound can alleviate pain from physical and emotional causes and act on hemodynamic parameters, such as heart rate (HR), systemic arterial pressure (BP) and body temperature (TC), in addition to promote regularization of breathing rhythm, muscle relaxation and improved sleep. It can be seen that music was used as a strategy to reduce pain and stress in premature babies, having a positive effect. Another relevant point found was related to weight gain, reduced energy expenditure,

early sucking and better acceptance of food (ZANI; ZANI, 2017).

Premature babies' energy savings occur through periods of sleep and reduced crying, leading to weight gain. This way, it favors its growth and, consequently, its rise. A study observed the physiological responses of preterm newborns and found that music therapy can modify the physiological responses of pre-hospitalized newborns in the short term with a minimum exposure of daily sessions (SILVA et al., 2013). Although the quantitative data are not so statistically relevant, the mothers' statements reinforced the results of music therapy.

Some studies have shown that music therapy can reduce maternal anxiety, helping mothers to deal with their newborns' admission to the NICU, and also influence the behavior of premature babies, providing longer periods of peaceful sleep, less crying and increased in weight gain (LAI et al., 2006, CEVASCO, 2008, KEMPER; HAMILTON, 2008; KEITH; RUSSELL; WEAVER, 2009). In this study, mothers reported observing positive effects on their babies and, consequently, this creates comfort for them and helps them to endure the days of hospitalization.

Studies show music therapy as a way to improve the clinical and social status of premature newborns, improving, among

other conditions, heart and respiratory rate, oxygen saturation levels, reducing episodes of crying and, thus, promoting sleep quality (MORAN et al., 2014). In the present study, a significant variation in peripheral oxygen saturation (SpO₂) was observed on day 2, as well as a significant variation in heart rate (HR).

FINAL CONSIDERATIONS

It was concluded, among the benefits observed in this work, the behavioral improvement of babies perceived by mothers. Music is a resource, an easy and low-cost strategy, which provides humanization in the care of babies, whether premature or not, soothing them, calming them, improving care, as well as reinforcing the mother-baby bond. It was also observed that it provides behavioral changes in both the patient and the team according to the team's reports, including improvements in the professional-patient relationship. We suggest that new scientific research be carried out in order to guarantee safe therapy until strong data are available in the literature. We also suggest the inclusion of music therapy in intensive care institutions with the aim of improving both the organizational climate and the environment for the patient.

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