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Effectiveness of Tactile and Auditory Stimulation on Physiological Parameters among Preterm Neonates at NICU - a RCT Study Design

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Abstract

Purpose: To evaluate the effectiveness of tactile & auditory stimulation on physiological parameters weight, temperature, heart rate, respiratory rate, oxygen saturation, feeding pattern, sleeping hours, crying spells and urination among preterm neonates.

Material and Methods: A quantitative research approach with true experimental research design was adopted for this study Samples: 120 preterm neonates who got admission and present in the NICU or postnatal unit of KKMCH, who satisfied inclusion criteria. Tool**:** The tool was developed, validated by experts and checked for its reliability Sample Size: Open Epi, Version 3, open source calculator Sample Size for Comparing Two Means from pilot study. Total sample size 120. Among them 60 preterm neonates were assigned to experimental group and control group each randomly. Statistical analysis used: Demographic data using frequency and percentage distribution. Physiological parameters were analyzed by using mean, standard deviation, paired T test. Structured interview schedule by Chi Square test. Association by Multiple Logistic Regression.

Findings: Out of 120 preterm neonates, 48.3 % males, 51.7 % females and 42.5 % Hindus, 52.5% Christians and 5 % Muslims. Gestational age 18.33 % between 28 – 30 weeks, 40 % between 31 – 33 weeks and 41.67 % between 34 – 36 weeks. The paired difference of mean in pre term neonates on post - intervention 3rd day and 5th day in experimental and control group in weight gain were 109.83, 176.33 grams & 78.16, 118.33 grams, temperature were 0.27^0, 0.87^{0}Celsius & 0.15^0, 0.31^0 Celsius, heart rate were 10.17, 9.30 & 4.63, 3.93 beats/ minute, respiratory rate were 5.70, 11.23 & 3.00 , 5.80 breaths / minute ,mean oxygen saturation were 2.47, 4.65% & 1.12, 2.23 % . Themean pre intervention Vs post intervention on 5th day among over all physiological parameter consists of structured interview schedule in experimental group and control group includes increased feeding pattern by 50% and 11.7% (X^2 = 26.612), increased sucking pattern by 55% and 10% (X^2 = 30.572), increased duration per sleep by 68.3% and 5% (X^2 = 56.885), increased sleeping pattern by 61.7% and 6.7% (X^2 = 43.364), decreased crying pattern by 60% and 1.7% (X^2 = 48.553) and increased urination pattern by 73.3% and 6.7% (X^2 = 58.989) than control group. The present study findings concluded that the tactile and auditory stimulation had positive effects on growth and maturation in

preemies. It can be used in any clinical and community settings to maintain the physiological parameters among preterm neonates.

Implications to Theory, Practice and Policy: Since massage therapy is a cost effective therapeutic technique it should be encouraged in all community especially rural poor pre term babies. Health education about massage & music therapies should be given to NICU nurses, staff nurses, village health nurses, Auxiliary nurse midwife in order to promote these therapies as a routine care in the management of preterm neonates & low birth weight babies.

Keywords: *Tactile Auditory Stimulation, Pre Term Neonates, Physiological Parameters, RCT Study*

1.0 INTRODUCTION

The newborn baby is an amazing gift of nature, the consequence of 40 weeks of life in humid, comfortable and liquefied intra-uterine environment. [1] After its birth, the extra uterine life presents a challenge to the newborn baby, because the newborn baby undergoes a conventional sequence of events to become accustomed to the extra uterine life. However, they remain at risk to airway obstacle, hypothermia and infection. The degree of risk depends principally on their level of ripeness. So the gestational age of a baby is the single most significant determinant of its probability of survival.

Preterm babies are classified into four subtypes according to weeks of pregnancy[2].Late preterm babies - delivered amongst between 34 and 36 weeks. Moderately preterm babies - delivered amongst between 32 and 34 weeks. Very preterm babies – delivered amongst lesser than 32 weeks. Extremely preterm babies – delivered earlier than 25 weeks. The causes for pre-term deliveries include diabetes, hypertension, maternal stress and infection. Influences such as improper pregnancy preparation, Past history of premature birth, Amniotic membrane infections or recurrent urinary tract infection in ANCmother, Malnutrition before or during antenatal period, Pregnancy induced hypertension (preeclampsia), Early rupture of the membranes, placenta in the lower segment of uterus causing uterine outlet obstruction(placenta previa). Other socio demographic factors include: Early primigravidae (age<16 years), Elderly primigravidae (age >35years), Black racial predominace, Inadequate antenatal care, Below poverty line mother with low SES, Maternal addict to tobacco and drugs like including cocaine or amphetamines.

The APGAR score is a screening test used worldwide to quickly assess the health of an infant one minute and five minutes after birth. The five criteria are summarized using words chosen to form a backronym (Appearance, Pulse, Grimace, Activity, Respiration). The 1-minute APGAR score measures how well the newborn tolerates the birthing process. The 5-minute APGAR score assesses how well the newborn is adapting to the environment. Tactile stimulation/massage therapy began as a sacred system of natural healing.. Tactile stimulation is part of massage therapy. While doing tactile stimulation the skin is being stimulated. The skin is the largest organ of the body. It has countless nerve endings for touch; pain and pressure that are accountable for various tactile sensationsthat take part a significant responsibility in the maturity of the infant. The skin has intimate contact with the Central Nervous System (CNS). Stroking or massaging the preterm neonates makes a delightful contact and afford them with the state of satisfaction and improves affection[3].

Field conducted meta-analysis study, preterm and term infant massage therapy studies were revised. This study found that the application of moderate pressure during massage improved the weight gain in preterm & term neonates. It also revealed that there was a significant gain in weight and bone density in both term and preterm infants receiving massage and massage therapy led to weight gain in preterm and term infants when moderate pressure massage was delivered. In studies on passive movement of the limbs, preterm and term infants also gained significantly more weight, and their bone density also increased. The use of oils including coconut oil and sunflower oil increased vagal activity, improved the average weight gain and lead to the shorter stay in hospitals. A study was conducted by Shankaranarayanan, Mondkar et.al to assess the effect of massage with coconut oil, mineral oil, placebo on growth velocity and neuro-behavior assessment in preterm and term babies at NICU in Mumbai hospital. RCT trial was done. Oil massage was given on day 2 to day 31 for four times a day. Babies were followed up and anthropometry measurements had been taken. Neurobehavioral outcome was

assessed by the Brazelton Score at 0, 7, 31 days. Results confirm that coconut oil massage had significantly greater weight gain and growth velocity compared to mineral oil and placebo group. The neurobehavioral assessment has shown no statistically significant difference. Sari Goldstein Ferber, Jacob Kuint et.al conducted a study on massage therapy in preterm infants for weight gain. Random cluster design was used.

57 healthy preterm infants assigned to three groups, two treatment groups for massage by mother and professional care giver and one control group was formed. Massage as given for 10 days. Results were analyzed. The two treatment groups gained significantly more weight compared to the control group (291.3 and 311.3vs 225.5 g, respectively. Calorie intake has no difference in between these 3 groups. Mothers and trained professionals' groups have shown almost the same increase in weight gain.

This confirms that massage by mother shows cost-effective application of the treatment within NICU. Field, Diego, et.al, conducted a study on effects of massage therapy on insulin-like growth factor 1 (IGF-1) and serum insulin in preterm neonates. RCT was done .42 preterm neonates were randomly assigned into 21 in massage therapy group and 21 control group. Massage group had body stroking and passive limb movements for 15minutes for three times /day and for 5 consecutive days. Serum was collected in days 1st & 5th and assayed for insulin and insulin-like growth factor-1 (IGF-1). Weight gain was also recorded daily. Results revealed that greater increase in weight gain was significantly correlated with more insulin and IGF-1on 5 day in the massage group.

Auditory stimulation has been used as a curative energy for centuries. Playing specially selected music raga that is soothing, like a lullaby that support one's senses, is Neelambari.[4] This is a raga that is associated with relaxation,peace, and slumber. This raga brings forth piety, devotion, and maternal instincts in ones heart. Any kind of tune can be played in Carnatic music. Neelambari is the elegant raga for sleep. In Tamil "Thalaattu" songs, in other words lullabies have the same ragam which promotes the infant's mental development. Raga Neelambaricharacterizes the worldwide exploit of music to lower tension and psychiatric problems including mood disturbances, brings out bodily enjoyable activity decreases tiredness or anxiety, promotes sleep, stimulates the all the organs in our body and raises excellent quality or condition and memory power improvement. Listening to good music can arouse the immune system into functioning harder thus making those feels better. Camila Mendes da Silva, Jessica Marcelle et al 144 evaluated the physiological responses on classical music therapy among hospitalized preterm newborns.

This study was a non-controlled clinical trial which comprises 120 preterm neonates with the gestational age of 36 weeks and impulsive breathing. The preterm infants experienced 15-minute sessions of classical music therapy twice a day (morning and afternoon) for three successive days. Results revealed that there was a reduction in the heart rate after the second session of music therapy and an upsurge at the end of the third session. Respiratory rate diminished during the fourth and fifth sessions.

Regarding oxygen saturation, there was an upsurge after the fifth session. Thus the study showed that music therapy may change short-term physiological responses of hospitalized preterm newborn infants. Miriam Lense et.al.145 carried out a study to analyze the scrupulous use of recorded vocal music to lessen physiological and behavioral responses to heel stick in 13 premature infants via an experimental design. During a 10-minute recovery following the heel stick, heart rate, and crying significantly diminished in infants unprotected to music but not in unexposed infants. The results revealed that controlled music stimulation appears to be

a safe and effective way to increase pain and stress in premature infants following heel sticks.

Caine did a study to assess the effects of Music Therapy on Vital Signs, Feeding, and Sleep in Premature Infants. The objective of this study was to document music risks overstimulation in NICUs. A randomized clinical multisite trial of 272 premature infants aged 32 weeks with respiratory distress syndrome, clinical sepsis, and SGA (small for gestational age) assisted as their personal controls in 11 NICUs.

The study confirmed that purposeful therapeutic use of live sound and parent- preferred lullabies applied by a certified music therapist can influence cardiac and respiratory function. Entrained with a premature infant's observed vital signs, sound and lullaby may increase feeding behaviors and sucking patterns and may increase elongated periods of quiet–alert states. Parent-preferred lullabies, sung live, can augment bonding, thus decreasing the stress parent's associate with premature infant care.

Chou, Wang et al assessed the effects of music therapy on oxygen saturation in premature infants receiving endotracheal suctioning. A convenience sample of 30 premature infants was selected from three neonatal intensive care units. The results revealed that premature infants getting music therapy with endotracheal suctioning had a significantly higher SPO (2); than when not getting music therapy ($p < .01$), and the level of oxygen saturation resumed to the baseline level faster than when they did not receive music therapy ($p < .01$). The study confirmed that giving suitable music therapy as developmental care to premature infants when execution of any nursing intervention may improve not only the quality of nursing care but also quality of the infant's life.

A study was carried out by Hartling, Shaik, Tjosvold, Leicht, Liang, Kumar to assess the respiratory effects of noise on preterm infants. In this study, 65 preterm infants (26–32 weeks GA) were appraised. With .25 Sound levels, oxygen saturation and infant states were documented in a pre-study state with the infant in the incubator. The acoustic foam kept in incubator in a pre-study state and in a post-study state the acoustic foam was removed. With the foam in place, there was an average reduction in the noise levels of 3.27 dB. Oxygenation improved by more than 1% for all infants with the acoustic foam, and was continued for 10 min following removal of the foam ($p<0.01$).25 However, this could be due to normal variations in oxygen saturation and the fact that the main stream of these infants was on supplemental oxygen therapy.

Preterm neonate or premature baby is a newborn born earlier than thirty-seven weeks or 259th day of gestation period. Premature delivery is really a universal crisis and over sixty percentage take place in Africa and South Asia. Twelve percentage of babies are born preterm in the undeveloped countries compared with the nine percentage in the developed countries. Below poverty line families are at more risk within the countries.

The following top ten countries with the utmost number of premature births:

- India: 3 519 200
- China: 1 172 400
- Nigeria: 773 600
- Pakistan: 748 300
- Indonesia: 675 900
- America: 517 800

- Bangladesh: 424 300
- The Philippines: 348 700
- The Democratic Republic of the Congo: 341 500
- Brazil: 279 600

According to World Health Organization, around 1.2 million neonates die yearly in India alone, amounting to nearly one-fourth of all worldwide newborn deaths. 2/3 of infant deaths in India happening in the first month of life, and 3/4 of newborn deaths occur in the first week and percent of all neonatal deaths happen by the 15th day of life. 70% of newborn in India die owing to low birth weight, infections and complications of pregnancy. In developing countries preterm deliveries are very common compared to 5% to 7 % in developed countries these deaths due to prematurity were tend to increasing in developing countries nowadays resulting in the major foundation of neonatal mortality and the second frequent cause of mortality in children under the age of five. More or less 13 million premature neonates are born worldwide. Nearly 11 million of these premature neonates are born in Africa and Asia, where numerous neonates do not have admittance to valuable care. Preterm is a most important communal health crisis in a lot of developing countries including our country. India ranked first in the world in givingbirth of nearly 36 lakhs of premature neonates and India had 13% of preterm births annually next to China. The rate of preterm birth in India is approximately 21%[5.] Globally, India accounts for the maximum number of newborn mortality.

In Tamil Nadu around 20 per cent of women go for pre-term birth[6] According to WHO survey, the major causes of neonatal mortality were prematurity (15%), pneumonia (13%), birth asphyxia (10%), diarrhea (9%) and neonatal sepsis (7%). Around 1.2 million neonates die yearly in India alone, amounting to nearly one-fourth of all worldwide newborn deaths. 2/3 of infant deaths in India happening inthe first month of life, and 3/4 of newborn deaths occur in the first week and 90 percent of all neonatal deaths happen by the 15th day of life. 70% of newborn in India die owing to low birth weight, infections and complications of pregnancy.[7] Even though tactile and auditory stimulations are traditionally practiced in India, it is not routinely practiced in the hospital setting. If practiced in hospital setting it will play an important role in reducing infant morbidity and mortality rate and helps to maintain the normal physiological parameters.

The study was conducted after getting approval from the ethical committee of Sacred Heart Nursing College, screening committee of Dr. M.G.R. Medical University, Chennai. Permission was obtained from Dean, Kanyakumari Government Medical College Asaripallam for data collection. Consent of each subject was obtained from the parents beforestarting the data collection. Assurance was given to them that the secrecy of each subject would be maintained.

Aims & Objectives

To evaluate the effectiveness of tactile & auditory stimulation on physiological parameters among preterm neonates.

2.0 MATERIALS AND METHODS

A quantitative research approach was considered to be the most appropriatefor this study. So it was adopted in order to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters such as weight, heart rate, temperature, respiratory rate, oxygen

saturation, sleeping pattern, feeding skills &crying spells among preterm neonates. A True Experimental Randomized Control Trial Research Design was adopted for this study, as it is the most powerful method available for testing hypothesis of cause and effect relationship among variables.

Target Population

Preterm neonates who were born between 28 and 36 weeks of gestation with a birth weight of 1000 gm to 2000 gm.

Accessible Population

Preterm neonates who were born between 28 and 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted from 01/07/2013 to 15/06/2014 into the neonatal care units of Kanya Kumari Medical College Hospital, Nagercoil.

Settings of the Study

This study was conducted in the neonatal units of Kanyakumari MedicalCollege Hospital, Asaripallam, Nagercoil, which is situated around 2 kilometers awayfrom Nagercoil town. It is a 750-bedded multispecialty Government medical college hospital. The pediatric unit comprises of Pediatric medical ward, surgical ward, Isolation ward, Pediatric Intensive Care Units, and Neonatal Intensive Care Units.

Sample Size Calculation: Open Epi, Version 3, Open Source Calculator

Table 1: Sample Size for Comparing Two Means from Pilot Study

Input Data

Confidence Interval (2-sided)	95%		
Power	90%		
Ratio of sample size (Group 2/Group 1)	1		
	Group 1	**Group 2**	**Difference***
Mean	1650	1750	-100
Standard deviation	153.4	182.3	
Variance	23531.6	33233.3	

Sample size of Group 1	60
Sample size of Group 2	60
Total sample size	120

*Difference between the means

Selection of Study Samples

In this study, all subjects admitted in the NICU at Kanyakumari Govt Medical College hospital, Asaripallam were accessed for eligibility. Out of 471 admitted for one year from 01.07.2013 to 15.06.2014, 317 preterm neonates were excluded from the study after inclusion criteria and 34 eligible preterm neonates were excluded for not giving consent. By this the required sample size of 120 pre term neonates were selected at the mid of the 12th month.

Randomization

Randomization was done in the selected study samples of the 120 preterm neonates. Initially tossing a coin had been done to select the first study sample group allocation. Head had been

assigned to the experimental group and Tail had been assigned to the control group .Since head came while tossing the coin, first study sample was randomly allocated to the Experimental group and the subsequent second study sample was allocated to the control group simultaneously. This alternate random assignment of study subjects was continued till the required sample size of 120 was reached. Thus, the required 60 experimental group study samples and 60 control group study samples were selected.

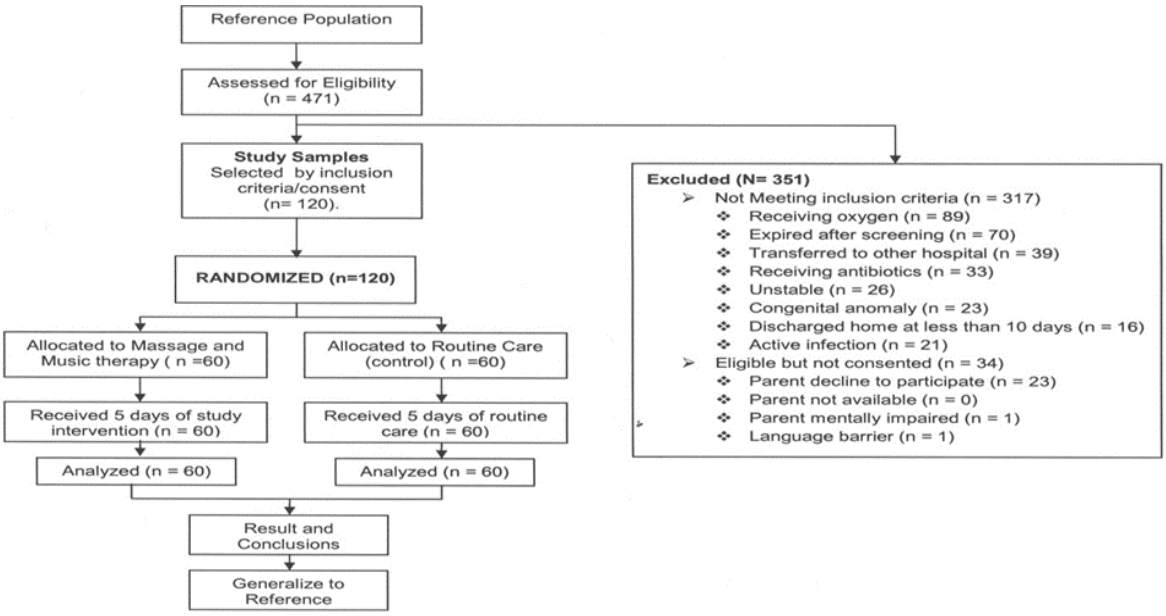

Figure 1: Study Flow Diagram Showing the Sample Selection

Inclusion Criteria

- Preterm babies who got admission and present in the NICU or postnatal unit of KKMCH
- The preterm neonate whose age is between 10 and 24 days.
- Preterm neonates with 5 minute APGAR score of 6 or more.
- Physically stable preterm babies.
- Preterm babies with the birth weight of 1000 gram to 2000 gram.

Exclusion Criteria

- Critically ill preterm baby
- Preterm babies with respiratory distress & on assisted ventilation
- Preterm neonates with genetic (or) CNS abnormalities
- Preterm neonates with severe birth injuries, skin infection & open wounds.
- Preterm neonates on sedatives.
- Preterm neonates on phototherapy treatment.
- Preterm neonates with Ryle's tube feeding and expressed Breast feeding.

Description of the Tool

The tool used for data collection consists of 3 parts.

Part I: It consists of demographic variables such as Gestational age, Sex, Religion,Birth weight, Age of the child, Mode of delivery, Order of Birth, APGAR score at Birth andat 5 minute, Weight of the child at the time of intervention started.

Part II: It consists of observation checklist, which includes weight, temperature, heart rate, respiratory rate and oxygen saturation.

Part III: It consists of structured interview schedule, which includes feeding skills, crying spells, sleeping pattern and urinary elimination. All the items have three answers. In that option A‟ scores 1 mark, option „B‟ scores 2 marks and option „C‟ scores 3 marks. Scoring key: 6 -9 Unsatisfactory,10-14 – Satisfactory,15 -18 – good.

Intervention

Tactile stimulation: It is a stimulation in which the preterm neonates will receive specific stimulation such as feathering, vibration, effleurage and circular movements to their skin from leg to face with the hand by using 5ml of coconut oil for 10 minutes, twice a day. Auditory stimulation: It is a stimulation in which the preterm neonates will hear a recorded *lullaby music*, which is based on *Neelambari raga* by „tab‟ for 10 minute along with tactile stimulation.

To ensure the content validity the instrument was given to 15 experts (other than my guide) from different fields along with the introduction, need for the study, significant of the study, methodology, procedure manual, tools and content validity check list. The reliability of the tool was established after collecting data from 10 preterm neonates from Kanyakumari Medical College hospital, Nagercoil, Tamilnadu. Reliability of the tool was established by using inter-rater method and split-half method was used to assess the internal consistency of the tool**.**

The reliability of inter- rater method was obtained by using Cohen's kappa formula and split – half method was obtained by using Crohnbach's formula.The reliability obtained by inter rater method is as followsPhysiological parameters:Weight: r = .705,Temperature: r = .658, Heart rate: r = .845,Respiratory rate: r = .736, Oxygen saturation: r = .622 , Structured Interview Schedule: r = .746 .The above scores show that the reliability of the tool was good. The internal consistency ofthe tool was achieved by using split half method, in which r = 0.95 and that is excellent.

Data Analysis

In this study the data obtained was analyzed by both descriptive and inferential statistics, on the basis of objective and hypothesis of the study. A master data sheet was prepared to compute the data. SPSS software version 20 was used for statistical analysis. Results were analyzed in three parts.

Part I: Demographic data analyzed by frequency and percentage distribution

Part II: Physiological parameters were analyzed by using mean, standard deviation, paired T test.

Part III: Structured interview schedule was analyzed by using mean, standard deviation, Chi Square test. Association between demographic variable and changes in the post test parameter scores was analyzed by using ANOVA, Chi-Square Test, Multiple Logistic Regression. The findings were expressed in the form of tables and graphs.

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3.0 FINDINGS

Out of 120 preterm neonates, 48.3% males, 51.7% females and 42.5% Hindus, 52.5% Christians and 5 % Muslims. Gestational age 18.33 % between 28 – 30 weeks, 40 % between 31 – 33 weeks and 41.67 % between 34 – 36 weeks.

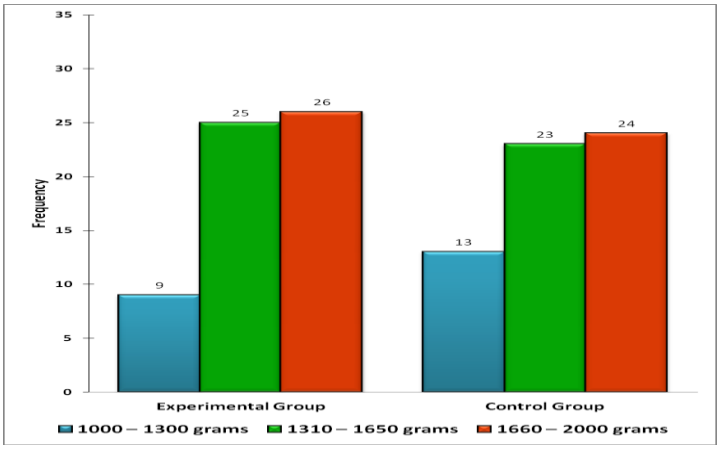

Figure 2: Frequency Distribution of Samples Based on Birth Weight of Preterm Neonates

Table 2: Basic Characteristics of the Study Population

Demographic Factors	Category	Total (N=120)	Experimental Group (N=60)	Control Group (N=60)	Chi^2 Value	df	p – Value
Gender	Male	58	30 (51.7%)	28 (48.3%)	0.133	1	0.715
	Female	62	30 (48.4%)	32 (51.6%)			
	Hindu	51	25 (49.0%)	26 (51.0%)			
Religion	Christian	63	33 (52.4%)	30 (47.6%)	0.826	2	0.661
	Muslim	6	2 (33.3%)	4 (66.7%)			
	Normal Vaginal Delivery	45	19 (42.2%)	26 (57.8%)			
MOB	Instrumental Delivery	7	2 (28.6%)	5 (71.4%)	3.845	2	0.146
	LSCS	68	39 (57.4%)	29 (42.6%)			
	First Order	51	28 (54.9%)	23 (46.3%)			
OOB	Second Order	56	25 (44.6%)	31 (55.4%)	1.866	3	0.601
	Third Order	3	1 (33.3%)	2 (66.7%)			
	Twins	10	6 (60.0%)	4 (40.0%)			
	5	22	12 (54.5%)	10 (45.5%)			
APGAR @ Birth	6	45	19 (42.2%)	26 (57.8%)	1.824	3	0.610
	7	41	22 (53.7%)	19 (46.3%)			
	8	12	7 (58.3%)	5 (41.7%)			
APGAR @ 5 Minutes	7	22	32 (46.4%)	37 (53.6%)			
	8	48	23 (56.1%)	18 (43.9%)	0.972	2	0.615
	9	50	5 (50.0%)	5 (50.0%)			
	28 – 30 Weeks	22	10 (45.5%)	12 (54.5%)			
Gestational Age	31 – 33 Weeks	48	23 (47.9%)	25 (52.1%)	0.585	2	0.746
	34 – 36 Weeks	50	27 (54.0%)	23 (46.0%)			
	10 – 14 Days	54	26 (48.1%)	28 (51.9%)			
Age Category	15 – 19 Days	42	20 (47.6%)	22 (52.4%)	0.836	2	0.658
	20 – 24 Days	24	14 (58.3%)	10 (41.7%)			
Birth Weight Category	1000–1300 grams	22	09 (40.9%)	13 (59.1%)			
	1310 – 1650 grams	48	25 (52.1%)	23 (47.9%)	0.891	2	0.641
	1660 – 2000 grams	50	26 (52.0%)	24 (50.0%)			

Table 3: Distribution of Mean and SD of the Physiological Parameters of the Experimental Group on 3rd & 5th Day

Parameters	Test	Mean	SD
Weight	Pre Intervention	1597.67	173.90
	Post Intervention on 3rd Day	1707.50	176.41
	Post Intervention on 5th Day	1774.00	184.93
Temperature	Pre Intervention	36.56	0.09
	Post Intervention on 3rd Day	36.83	0.08
	Post Intervention on 5th Day	37.43	0.07
Heart Rate	Pre Intervention	150.90	4.56
	Post Intervention on 3rd Day	140.73	4.21
	Post Intervention on 5th Day	131.43	4.18
Respiratory Rate	Pre Intervention	49.47	4.62
	Post Intervention on 3rd Day	43.77	3.98
	Post Intervention on 5th Day	38.23	3.17
Oxygen Saturation	Pre Intervention	93.57	0.69
	Post Intervention on 3rd Day	96.03	0.58
	Post Intervention on 5th Day	98.22	0.58

Table 4: Distribution of Mean and SD of the Physiological Parameters of the Control Group on 3rd & 5th Day

Parameter	Test	Mean	SD
Weight	Pre Test	1608.00	168.41
	Post Test 3rd Day	1686.17	175.17
	Post Test 5th Day	1726.33	182.18
Temperature	Pre Test	36.54	0.05
	Post Test 3rd Day	36.54	0.05
	Post Test 5th Day	36.86	0.08
Heart Rate	Pre Test	151.33	5.03
	Post Test 3rd Day	146.70	4.34
	Post Test 5th Day	142.77	4.14
Respiratory Rate	Pre Test	49.33	4.36
	Post Test 3rd Day	46.33	4.36
	Post Test 5th Day	43.53	4.06
Oxygen Saturation	Pre Test	93.45	0.68
	Post Test 3rd Day	94.57	0.69
	Post Test 5th Day	95.68	0.71

Table 5: Comparison of Mean Pre-Intervention vs Post-Intervention Weight-Physiological Parameter among Preterm Neonates in the Experimental and Control Group

Group	Category	Mean	SD	Paired Difference		t-Value	p-Value
				Mean	SD		
Experimental	POST.WT.3D	1707.50	176.41	109.83	28.73	29.613	0.001***
	PRE.WT	1597.67	173.90				
	POST.WT.5D	1774.00	184.93	176.33	38.62	35.368	0.001***
	PRE.WT	1597.67	173.90				
Control	POST.WT.3D	1686.17	175.17	78.16	31.00	19.532	0.001***
	PRE.WT	1608.00	168.41				
	POST.WT.5D	1726.33	182.18	118.33	41.87	21.892	0.001***
	PRE.WT	1608.00	168.41				

(P<0.01*** very significant)

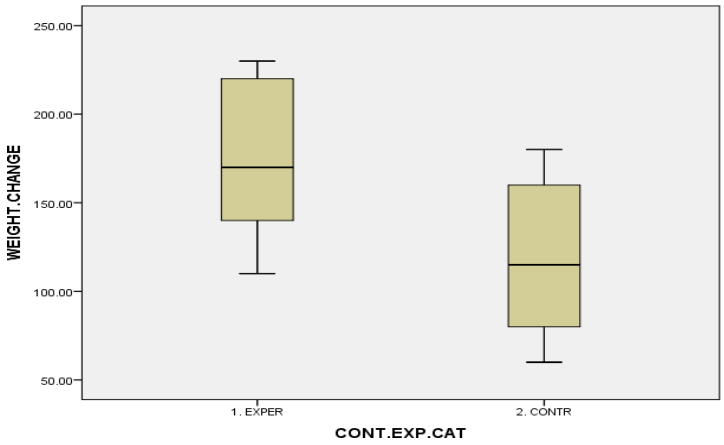

Figure 3: Box Plot Showing Change in Weight between Experimental and Control Groups

It also concluded the mean weight gain (176.33 grams) in the experimental group on day 5th is higher than the mean weight gain (118.33 grams) in control group on 5$^{th\ day}$.

Table 6: Comparison of Mean Pre-Intervention vs Post Intervention Temperature-Physiological Parameter among Preterm Neonates in the Experimental and Control Groups

Group	Category	Mean	SD	Paired Difference		t–Value	p–Value
				Mean	SD		
Experimental	POST.TEMP.3D	36.83	0.08	0.27	0.11	18.355	0.001***
	PRE.TEMP	36.56	0.09				
	POST.TEMP.5D	37.43	0.07	0.87	0.12	55.865	0.001***
	PRE.TEMP	36.56	0.09				
Control	POST.TEMP.3D	36.69	0.06	0.15	0.06	19.699	0.001***
	PRE.TEMP	36.54	0.05				
	POST.TEMP.5D	36.86	0.08	0.31	0.09	26.020	0.001***
	PRE.TEMP	36.54	0.05				

(P <0.01*** very significant)

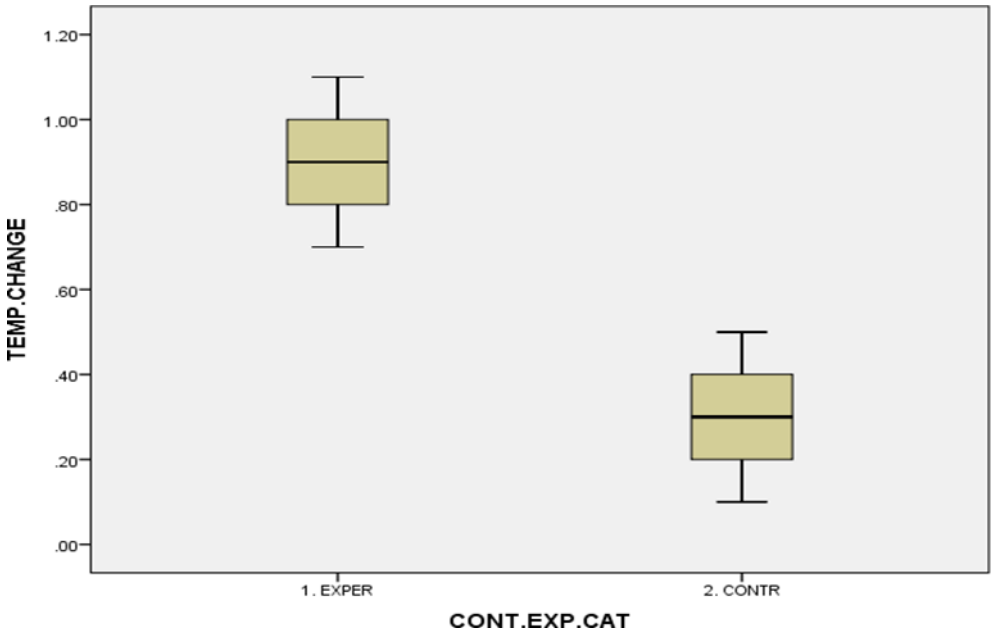

Figure 4: Box Plot Showing Change in Temperature between the Groups

This Box Plot shows, on 5th day shows the increase in temperature in the experimentalgroup is significantly more than the increase in temperature in the control group.

Table 7: Comparison of Mean Pre-Intervention vs Post-Intervention Heart Rate-Physiological Parameter among Preterm Neonates in the Experimental and Control Groups

Group	Category	Mean	SD	Paired Difference		t-Value	p–Value
				Mean	SD		
Experimental	POST.HR.3D	140.73	4.21	10.17	1.49	52.985	0.001***
	PRE.HR	150.90	4.56				
	POST.HR.5D	131.43	4.18	9.30	1.76	40.948	0.001***
	PRE.HR	150.90	4.56				
Control	POST.HR.3D	146.70	4.33	4.63	1.54	23.304	0.001***
	PRE.HR	151.33	5.03				
	POST.HR.5D	142.77	4.14	3.93	1.326	22.978	0.001***
	PRE.HR	151.33	5.03				

P <0.01*** very significant

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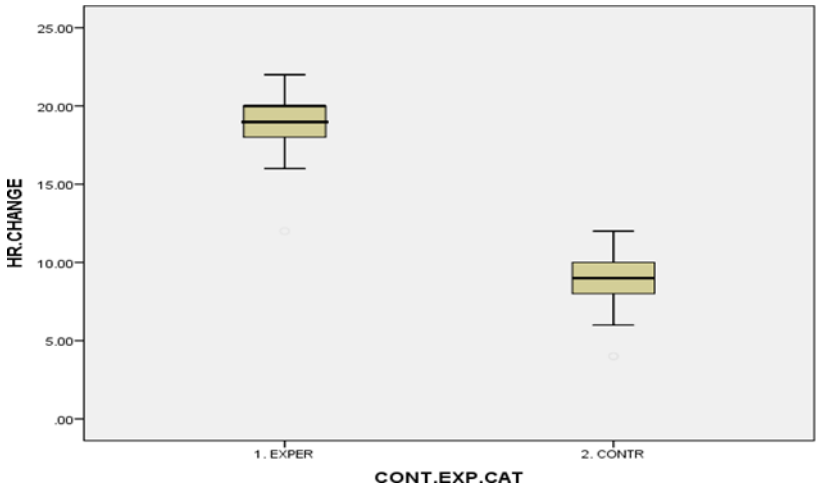

Figure 5: Boxplot Showing Change in Heart Rate between the Groups

This Box plot shows the stabilization of heart rate on the 5th day in the experimental group is significantly more than stabilization of heart rate in control group on 5th day**.**

Table 8: Comparison of Mean Pre-Intervention vs Post-Intervention Respiratory Rate-Physiological Parameter among Preterm Neonates in the Experimental and Control Groups

Group	Category	Mean	SD	Paired Difference		t–Value	p-Value
				Mean	SD		
Experimental	POST.RR.3D	43.77	3.99	5.70	1.47	30.141	0.001***
	PRE.RR	49.47	4.63				
	POST.RR.5D	38.23	3.17	11.23	2.12	41.078	0.001***
	PRE.RR	49.47	4.63				
Control	POST.RR.3D	46.33	4.36	3.00	1.07	21.646	0.001***
	PRE.RR	49.33	4.65				
	POST.RR.5D	43.53	4.06	5.80	1.31	34.236	0.001***
	PRE.RR	49.33	4.65				

(P <0.01*** very significant)

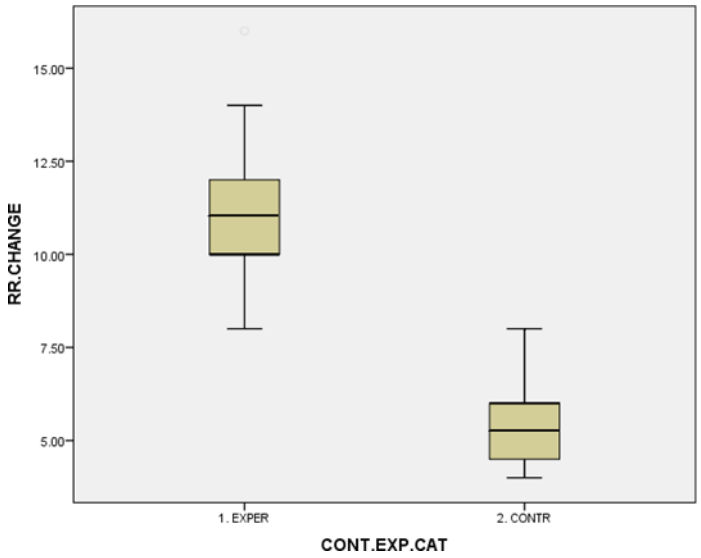

Figure 6: Box Plot Showing Change in Respiratory Rate between the Groups

This Box plot shows the normalization of respiratory rate in the experimental groupon day 5th is significantly more than normalization on day 5th in control group.

Table 9: Comparison of Mean Pre-Intervention vs Post-Intervention Oxygen Saturation -Physiological Parameter among Preterm Neonates in the Experimental and Control Groups

Group	Category	Mean	SD	Paired Difference		t-Value	p–Value
				Mean	SD		
Experimental	POST.O2SAT.3D	96.03	0.58	2.47	0.59	32.077	0.001***
	PRE.O2SAT	93.57	0.69				
	POST.O2SAT.5D	98.22	0.59	4.65	0.82	43.937	0.001***
	PRE.O2SAT	93.57	0.69				
Control	POST.O2SAT.3D	94.57	0.69	1.12	0.37	23.225	0.001***
	PRE.O2SAT	93.45	0.68				
	POST.O2SAT.5D	95.68	0.70	2.23	0.47	37.238	0.001***
	PRE.O2SAT	93.45	0.68				

(P <0.01*** very significant)

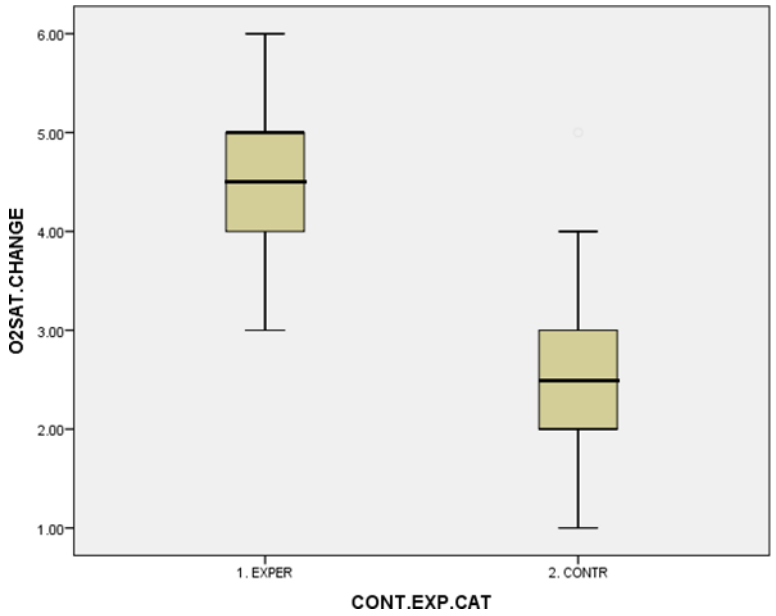

Figure 7: Box Plot Showing Change in Oxygen Saturation between the Experimental and Control Groups

It concluded that, on day 5th in the experimental group the mean raise in oxygensaturation (4.65%) is higher than mean raise in oxygen saturation (2.23%) in control group.

Table 10: Comparison of Mean Posttest Physiological Parameter Score among Preterm Neonates in the Experimental and Control Groups on Day 5

Parameters	ExperimentalGroup		Control groupMean SD		t value	P- value
	Mean	SD				
Weight	1774.00	184.93	1726.33	182.18	62.21	0.001***
Temperature	37.43	0.07	36.86	0.08	160.8	0.001***
Heart Rate	131.43	4.18	142.77	4.14	222.72	0.001***
Respiratory Rate	38.23	3.17	43.53	4.06	63.59	0.001***
Oxygen Saturation	98.22	0.58	95.68	0.71	462.08	0.001***

(P <0.01*** very significant)

The paired difference of mean in pre term neonates on post - intervention 3rd day and 5th day in experimental and control group in weight gain were 109.83, 176.33 grams & 78.16, 118.33 grams, temperature were 0.27^0, 0.87^0Celsius & 0.15^0, 0.31^0 Celsius, heart rate were 10.17, 9.30 & 4.63, 3.93 beats/ minute, respiratory rate were 5.70, 11.23 & 3.00, 5.80 breaths / minute, mean oxygen saturation were 2.47, 4.65% & 1.12, 2.23 %. This reveals that the mean posttest weight gain, temperature regulation, heart rate stabilization, respiratory rate normalization, increasing oxygen saturation among experimental & control group on post- intervention 5th day was statistically significant at 0.01 level.

Table 11: Comparison of Mean Pre-Intervention vs Post-Intervention Feeding Pattern Score among Preterm Neonates in the Experimental and Control Groups

Feeding pattern	Category	Total N=120	Group		Chi² Value	p –Value
			Experimental N=60	Control N=60		
Pre-intervention	1. < 6 times	20	7 (11.7%)	13 (21.7%)	2.160	0.142
	2. 6-10 times	100	53 (88.3%)	47 (78.3%)		
	3. > 10 times	0	0 (0.0%)	0 (0.0%)		
Post intervention 3rd Day	1. < 6 times	11	1 (1.7%)	10 (16.75)	25.690	0.001***
	2. 6-10 times	88	39 (65.0%)	49 (81.7%)		
	3. > 10 times	21	20 (33.3%)	1 (1.7%)		
Post intervention 5th Day	1. < 6 times	10	0 (0.0%)	10 (16.7%)	26.612	0.001***
	2. 6-10 times	73	30 (50.0%)	43 (71.7%)		
	3. > 10 times	37	30 (50.0%)	7 (11.7%)		

(P <0.01*** very significant)

Table 12: Comparison of Mean Pre-Intervention vs Post-Intervention Sucking Pattern Physiological Parameter among Preterm Neonates in the Experimental and Control Groups

Sucking pattern	Category	Total N=120	Group		Chi² Value	p –Value
			Experimental N=60	Control N=60		
Pre – intervention	1. < 5 minutes	23	14 (23.3%)	9 (15.0%)	1.345	0.246
	2. 5-10 minutes	97	46 (76.7%)	51 (85.0%)		
	3. > 10 minutes	0	0 (0.0%)	0 (0.0%)		
Post intervention 3rd Day	1. < 5 minutes	6	0 (0.0%)	6 (10.0%)	21.100	0.001***
	2. 5-10 minutes	90	39 (65.0%)	51 (85.0%)		
	3. > 10 minutes	24	21 (35.0%)	3 (5.0%)		
Post intervention 5th Day	1. < 5 minutes	6	0 (0.0%)	6 (10.0%)	30.572	0.001***
	2. 5-10 minutes	75	27 (45.0%)	48 (80.0%)		
	3. > 10 minutes	39	33 (55.0%)	6 (10.0%)		

(P <0.01*** very significant)

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Table 13: Comparison of Mean Pre-Intervention vs Post-Intervention Sleeping Pattern among Preterm Neonates in the Experimental and Control Groups

sleeping pattern	Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimental N=60	Control N=60		
Pre - intervention	1.<30 minutes	22	14 (23.3%)	22 (13.3%)	2.004	0.157
	2. 30mins–1hr	98	46 (76.7%)	52 (86.7%)		
	3. 1-2 hours	0	0 (0.0%)	0 (0.0%)		
Post - intervention 3rd Day	1.<30 minutes	8	0 (0.0%)	8 (13.3%)	26.520	0.001***
	2. 30mins–1hr	91	40 (66.7%)	51 (85.0%)		
	3. 1-2 hours	21	20 (33.3%)	1 (1.7%)		
Post - intervention 5th Day	1.<30 minutes	8	0 (0.0%)	8 (13.3%)	43.364	0.001***
	2. 30mins–1hr	71	23 (38.3%)	48 (80.0%)		
	3. 1-2 hours	41	37 (61.7%)	4 (6.7%)		

(P <0.01*** very significant)

Table 14: Comparison of Mean Pre-Intervention vs Post-InterventionSleeping Hours Per Day among Preterm Neonates in the Experimental and Control Groups

Sleeping hours perDay	Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimental N=60	Control N=60		
Pre - Intervention	1. <10 hours	26	15 (25.0%)	11 (18.3%)	0.786	0.375
	2. 10-18 hours	94	45 (75.0%)	49 (81.7%)		
	3. > 18 hours	0	0 (0.0%)	0 (0.0%)		
Post - Intervention 3rd Day	1. <10 hours	17	1 (1.7%)	16 (26.7%)	40.807	0.001***
	2. 10-18 hours	77	33 (55.0%)	44 (73.3%)		
	3. > 18 hours	26	26 (43.3%)	0 (0.0%)		
Post– intervention 5th Day	1. <10 hours	16	0 (0.0%)	16 (26.7%)	56.885	0.001***
	2. 10-18 hours	60	19 (31.7%)	41 (68.3%)		
	3. > 18 hours	44	41 (68.3%)	3 (5.0%)		

(P <0.01*** very significant)

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Table 15: Comparison of Mean Pre-Intervention vs Post-Intervention Crying Pattern among Preterm Neonates in the Experimental and Control Groups

Crying pattern	Category	Total N=120	Group		Chi² Value	p –Value
			Experimental N=60	Control N=60		
Pre–intervention	1. > 10 times	14	6 (10.0%)	8 (13.3%)	0.323	0.570
	2. 5-10 times	106	54 (90.0%)	52 (86.7%)		
	3. < 5 times	0	0 (0.0%)	0 (0.0%)		
Post - intervention 3rd Day	1. > 10 times	2	0 (0.0%)	2 (3.3%)	27.902	0.001***
	2. 5-10 times	93	36 (60.0%)	57 (95.0%)		
	3. < 5 times	25	24 (40.0%)	1 (1.7%)		
Post - intervention 5th Day	1. > 10 times	2	0 (0.0%)	2 (3.3%)	48.553	0.001***
	2. 5-10 times	81	24 (40.0%)	57 (95.0%)		
	3. < 5 times	37	36 (60.0%)	1 (1.7%)		

(P <0.01*** very significant)

Table 16: Comparison of Mean Pre-Intervention vs Post-Intervention Urination among Preterm Neonates in the Experimental and Control Groups

Urination	Category	Total N=120	Group		Chi² Value	p –Value
			Experimental N=60	Control N=60		
Pre Intervention	1. < 5 times	28	17 (28.3%)	11 (18.3%)	1.677	0.195
	2. 5-10 times	92	43 (71.7%)	49 (81.7%)		
	3. >10 times	0	0 (0.0%)	0 (0.0%)		
Post Intervention 3rd Day	1. < 5 times	16	1 (1.7%)	15 (25.0%)	42.461	0.001***
	2. 5-10 times	73	29 (48.3%)	44 (73.3%)		
	3. >10 times	31	30 (50.0%)	1 (1.7%)		
Post Intervention 5th Day	1. < 5 times	14	0 (0.0%)	14 (23.3%)	58.989	0.001***
	2. 5-10 times	58	16 (26.7%)	42 (70.0%)		
	3. >10 times	48	44 (73.3%)	4 (6.7%)		

(P <0.01*** very significant)

Themean pre intervention Vs post intervention on 5th day among over all physiological parameter consists of structured interview schedule in experimental group and control group includes increased feeding pattern by 50% and 11.7% ($X^2 = 26.612$), increased sucking pattern by 55% and 10% ($X^2 = 30.572$), increased duration per sleep by 68.3% and 5% ($X^2 = 56.885$), increased sleeping pattern by 61.7% and 6.7% ($X^2 = 43.364$), decreased crying pattern by 60% and 1.7% ($X^2 = 48.553$) and increased urination pattern by 73.3% and 6.7% ($X^2 = 58.989$) than control group. Hence, the feeding pattern, sucking skills, crying spells, sleeping pattern and urinary elimination in both experimental & control groups on post- intervention 3rd day and post- intervention 5th day were statistically significant at 0.01 level. This indicates that the difference between the experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation.

Table 17: Demographic Factors with Change in Weight-Multiple Logistic Regression Analysis

Variables	B	S.E	Beta	t	Sig.
Gestational AgeCategory	25.592	8.882	0.489	2.881	0.001***
Age Category	-35.402	4.478	-0.732	-7.906	0.001 ***
Sex	0.886	5.432	0.012	0.163	0.871
Birth Weight Category	-12.846	9.752	-0.238	-1.317	0.194
APGAR @ 5 mins	-4.584	4.180	-0.077	-1.097	0.278
Mode of Delivery	1.755	2.860	0.042	0.614	0.542
Order of Birth	0.184	3.433	0.004	0.053	0.958
Constant	239.820	40.314		5.949	0.001***

(P <0.01***very significant)

After Multiple Logistic Regression Analysis, gestational age category and the age of the child category have the p valve less than 0.01 level. Logistic regression revealed odds ratio 0.489 indicating that with increasing scores on gestational age category positive predictor, the changes in weight gain was increasing by a factor of 0.489 times. Regarding the age of the child category (the odds ratio was -0.732, with increasing scores on age category negative predictor, the changes in weight gain were at decreasing by a factor of 0.732 times . Thus the demographic variables, gestational age category and the age of the child category have shown only significant association with the changes in weight gain with positive and negative odds.

Discussion

Key findings of this discussion include that there is a growing body of evidence supporting the use of tactile, auditory based interventions in the NICU with preterm neonates. The preterm neonates who received tactile and auditory stimulation had statistically improvements on all selected parameters regarding weight, temperature, heart rate, respiratory rate and oxygen saturation, feeding skills, sucking skills, crying spells, sleeping pattern and urinary elimination than the preterm neonates who did not receive it. The mean posttest weight was 1774 grams in the experimental group whereas in the control group it was 1726.33 grams.

Kim, Shin et.al[8]." Research in nursing & health 26.6 (2003) conducted an experimental study to estimate the responses of premature and term neonates to massage. The study concluded that massagetherapy might enhance optimal physiological responses. Similar results were reported for the study conducted to assess the effects of music therapy on vital signs, feeding, and sleep in premature infants. Conclusions from the study showed that learned, deliberate therapeutic use of live sound and parent-preferred lullabies applied by a certified music therapist can influence cardiac and respiratory function. Lullaby may improve feeding behaviors and sucking patterns and may increase prolonged periods of quiet– alert states.

Zohreh, Badiee, Shiva Samsamshariat, et, al[9] conducted a randomized clinical trial among three groups of preterm neonates. Results revealed that preterm babies who were massaged by their mothers also gained weight significantly more than the control group. The study concluded that the five days were enough for stable preterm infants to facilitate weight gain in neonate. A study was conducted by Shankaranarayanan, Mondkar et. al[10] to assess the effect of massage with coconut oil versus mineral oil and placebo (powder)on growth velocity and

neuro-behavior in full term and preterm babies. Results showed that coconut oil massage resulted in significantly greater weight and length gain velocity as compared to mineral oil and placebo in the preterm babies group and in the term baby group as compared to the placebo. Zohreh, Badiee, Shiva Samsamshariat, et, al did a randomized clinical trial study to assess the effect of Massage on weight gain in premature infants. The study concluded that the five days were enough for stable preterm infants to facilitate weight gain in neonate. Field, Diego et al [11] carried out a study on massage therapy and reported that the massaged preterm neonates showed greater increased during the 5-day period in: 1) weight gain; 2) serum levels of insulin; and 3) insulin-like growthfactor-1 (IGF-1). The result concluded that increased weight gain was significantly correlated with insulin and IGF-1.

Similar result was reported by Sari Goldstein Ferber Jacob Kuint et al [12] conducted a study on massage therapy. This study proved that massage therapy given by mothers and trained professionals improves weight gain in preterm infants. Vickers,[13]Ohlsson conducted a randomized controlled trial study to evaluate the effect of massage therapy. This study concluded that massage therapy increased weight gain and shorter hospital stay among clinically stable pretermnewborns. A Similar study was conducted by Darmstadt, Saha **[14]** et. al to determine whether preterm and/or low birth-weight infants. Massage interventions improved daily weight gain by 5.1g. Massage interventions also appeared to reduce length of stay by 4.5 days. There was also some evidence revealed that massage interventions have a slight, positive effect on postnatal complications and weight at 4 - 6 months· The mean posttest temperature score in experimental group was 37.43 whereas in control group was 36.86.

Auditory stimulation (Music) can energetically integrate mind and body, affecting emotional response, movement and sensory input. These outcomes inthe modification of neurological pathways in the brain facilitating changes in behavior**,** improve respiration, lower Blood Pressure, improve Carbon-di- Oxide, reduce heart rate and relax muscle. Auditory stimulation has also been revealed to lower amounts of the hormone cortisol, which becomes raised under stress, and to increase the release of endorphins, the body's natural feel- good hormones. When babies listen to rhythmic music their muscle activities become synchronized with the beat. As their motion become more regular and efficient their motor skills increase in turn. Entrainment can also reduce a sedative, soothing reply if the music has a slow, steady rhythm. A study to assess the effects of Music Therapy on Vital Signs, Feeding, and Sleep in Premature Infants was conducted. Conclusion from the study was thatthe purposeful therapeutic use of live sound and parent-preferred lullabies applied by a certified music therapist can influence cardiac and respiratory function.

Feeding behaviors and sucking patterns and elongated periods of quiet–alert states also increased. Parent-preferred lullabies, sung live, can augment bonding, thus decreasing the stress parent's associate with premature infant care. The mean posttest heart rate score in experimentalgroup was 131.43 whereas in control group was 142.77. It shows normalization of heart rate was more achieved due to tactile and auditory stimulation. Smith, Lux et. al [15] carried a study to find out the effect of massage on heart rate variability (HRV) as the substitution measure of autonomic nervous system (ANS) development. Massage therapy was given away for 4 weeks of hospitalization to improve heart rate variability of preterm infants. The result concluded that "Boys who received massage therapy demonstrated increased heart rate variability, but the therapy did not appear to affect HRV in girls". Miriam, Lense et al [16] conducted a study to scrutinize the scrupulous use of recorded vocal music to attenuate physiological and behavioral responses toheel stick in premature neonates via an experimental design. In both incidences, infants were exposed to music.

Result revealed that controlled music stimulation appears to be a safe and effective way to augment pain and stress in premature neonates following heel sticks. Live music is beneficial to preterm infants in the neonatal intensive care unit environment which was proved in the study conducted by Arnon S· Shapsa A et.al[17]The conclusion of the study was as follows: Compared with recorded music or no music therapy, live music therapy is associated with a reduced heart rate and a deeper sleep at 30 minutes after therapy in stable preterm infants. Doheny, Hurwitz et al [18] conducted a study to evaluate the exposure to biological maternal sounds progresses cardio respiratory regulation inextremely preterm infants. Result revealed that there was an overall decreasingtrend in CREs with age. The study concluded that there was preliminary evidence for short-term improvements in the physiological stability of NICU infants using MSS.

The mean posttest respiratory rate score in experimental groupwas 38.23 whereas in control group was 43.53 which concluded stabilization of respiratory rate were achieved by tactile and auditory stimulation. The current study findings are in line by a study conducted by Amini, Rafiei et. al.,[19] on massage therapy. This study was intended to identify the effect of lullaby and classical music on physiologic stability of hospitalized preterm neonates.

Result proved that lullaby promotes the stability of the physiological parameter of the infant. Live music is beneficial to preterm infants in the neonatal intensive care unit environment which was proved in the study conducted by Arnon and · Shapsa et. Al the conclusion of the study was as follows: Compared with recorded music or no music therapy, live music therapy is associated with a reduced heart rate and a deeper sleep at 30 minutes after therapy in stable preterm infants. Both recorded and no music therapies had no significant effect on the tested physiological and behavioral parameters· Similar findings were reported by Doheny and Hurwitz et.al. The mean posttest oxygen saturation score in experimental group was 98.22 whereas in control group was 95.68 which concluded more oxygen saturation were achieved due to tactile and auditory stimulation. Chou, Wang et al[20] conducted a study to assess the effects of music therapy on oxygen saturation in premature neonates receiving endotracheal suctioning. The results indicated that premature neonates receiving music therapy with endotracheal suctioning had a significantly higher SPO (2) than when not receiving music therapy ($p < .01$), and the level of oxygen saturation returned to the baseline level faster. Similar findings were reported by Doheny and Hurwitz et.al.

Arnon,· Shapsa et al study also proved the same report. This study evident that tactile and auditory stimulation increase the feeding pattern to the preterm neonates in experimental group. Field, Diego carried out a study on massage therapy among preterm neonates. This study concluded that moderate pressure massaged neonates were found to have significantly higher gastric motility and vagal nerve activity during and immediately after massage but baseline vagal activity continued the same. In addition, the amount of gastric motility and vagal activity was also related to increased weight gain.

Vianna et al[21] did an open randomized controlled trial on music therapy. Higher breastfeeding rates were revealed at the 60-day of follow-up visit. These findings may inspire the caregivers to use music as a stress reliever to mothers who need support and find it hard to continue breastfeeding during this difficult period in their life. Warren Hammer reported that massage therapy relieves constipation (specifically if a abdominal massage is given), relaxes the abdominal and intestinal muscles (therefore releasing tension in this area), eliminates waste materials and stimulates activity of liver and kidneys. Sinclair M.[22] also concluded use of abdominal massage to treat chronic constipation. Tactile stimulation is a natural and almost

instinctive way to care. It is the bestway to get oxytocin released into the body.

Oxytocin is a hormone produced by the hypothalamus and secreted by the dorsal (posterior) lobe of the pituitarygland in both sexes, which is considered as a neurotransmitter. Once it is released into the blood stream it cannot re-enter the brain because of the blood brain barrier. Instead, it affects certain neurological responses. Oxytocin fuels a coordinating and modulating system that links to important control centersof the brain. The release of oxytocin into the blood stream is thought to have important effects, both psychological and physiological· Oxytocin has been found to regulate the process of digestion. It stimulates the release of various digestive hormones and gastric juices, which in turn lead to more effective absorption of nutrients· Oxytocin has effects on its own, influencing the rest and digest mechanism in the nervous system. It also works closely with vasopressin, which is important in the flight or fight mechanism.

This study evident that tactile and auditory stimulation increase the duration of sucking in the preterm neonates in experimental group. The following study supports the current findings: Joanne Loewy, Kristen Stewart et. al[23] conducted a study to evaluate the effects of music therapy on Vital Signs, Feeding, and Sleep in Premature neonates. Lullabies, particularly the singing of parent, culturally relevant songs ease the stress and anxiety of mothers and fathers through NICU stays.The current study findings are in line with a study conducted by Yildiz, Arikan [24] on the effects of giving pacifiers to premature infants and making them listen lullabies on their transition period for total oral feeding and sucking success. These results demonstrated that giving pacifiers to premature infants and making them listen to lullabies has a positive effect on their transition period to oral feeding, their sucking success and vital signs (peak heart rate and oxygen saturation). This study evident that tactile and auditory stimulation increase theduration of sleep per feed to the preterm neonates in experimental group.

Field, Hernandez-Reif et.al[25]conducted a study to assess the effect of massage in which moderate pressure massage showed a smaller decrease in deep sleep, a greater decrease in heart rate and a greater increase in vagal tone. Agarwal, Gupta et. al.,[26] conducted an experimental study to find out the effects of massage and use of oil on growth and sleep pattern among infants. The result showed that massage improved weight, length and mid arm and midleg circumferences. Massage improved the post massage sleep, the maximum being 1.62 hours in the sesame oil group, Dieter et al studied the low birth weight infants in Russia, who were massaged from 2-8 months of life. This study proved that massaged infants were less likely to snore during sleep, required less feeding on waking-up at night, and seemed more alert during the day, signifying that massage assisted the infants to accomplish more effective sleeping. Preterm infants getting only 5 days of massage therapy gained 48% more weight than control infants.

These study findings evident that tactile and auditory stimulation decrease the crying pattern to the preterm neonates in experimental group. It was supported by Ramasundari.[27] The result of the study revealed that health promotion was achieved by applying massage therapy on and the crying spells reduced, feeding frequency increased and sleeping time increased. This study evident that tactile and auditory stimulation increase the frequency of urine per day to the preterm neonates in experimental group. White-Traut, Rosemary & Nelson [28] Effect of auditory, tactile, visual, and vestibular intervention on length of stay, alertness, and feeding progression in preterm infants. Vanessa C. Pepino, Maria Aparecida Mezzacappa [29] in his Application of tactile/kinesthetic stimulation in preterm infants: a systematic review 2015 , Massage alters growth and catecholamine production in preterm newborns Field Schanberg [30]

Bibliography–Touch research institute concluded 21% greater WG ($p = 0.003$) better performance on the habituation cluster following the treatment period, less time in active sleep, and less facial grimacing, mouthing/yawning, and clenched fists , 5 days less hospitalization.

4.0 CONCLUSIONS

The findings of this studies suggest that music & massage interventions may have positive effects on preterm infants in the NICU including increasedoxygen saturation levels, reduced heart rates, increased levels of quiet alert or quiet sleep states, improved feeding & sucking pattern, improved weight gain, and reduced length of hospitalization. NICU preterm babies are disturbed when they experience pain, deviated body temperature, changes in vital signs, noise and light etc. These are the problems experienced by the preterm babies who are related to their physiological condition, therapeutic interventions and the critical care environment. It helps to manage symptoms and promote healing in a holistic way. The present study on the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates proved that the experimental group have significant weight gain, temperature regulation, heart rate normalization, respiratory rate stabilization, increase in oxygen saturation, improved frequencyof feeding, duration of sucking, duration of sleeping hours, improved crying and passing urine . The observed statistical difference between the experimental and the control groups has confirmed that massage and music therapy are cost effective interventions in improving all physiological parameters of preterm neonates. Complementary and alternative therapies such as music therapy and tactile stimulation therapy provide additional tool for the healthcare providers to administer to the preterm neonates This study also concluded that there was significant association between the weight gain and the selecteddemographic variables such as gestational age, age of the preterm neonates.

Nursing Implications

The findings of the study have practical application in the nursing field. Nursing Service: Education and demonstration must be provided to all nurses and they shouldbe encouraged to practice tactile and auditory stimulation. Nurses should use the tactile and auditory stimulation which can be safely included in daily routine care. To conduct awareness programs regarding tactile stimulation and auditorystimulation for the antenatal and postnatal mothers.

Nursing Education: To conduct in service education programs regarding tactile stimulation and auditory stimulation to the staff nurses in order to increase knowledge. To include tactile and auditory stimulation in the nursing curriculum as it is much needed for graduate and undergraduate students to develop knowledge and skill which will be very essential to promote the wellbeing of the preterm and term neonates.

Nursing Administration: To prepare adequate learning materials regarding tactile and auditory stimulation. To formulate policy and protocols for practicing tactile and auditory stimulation as a routine care in the neonatal unit. To conduct health education campaign in the outpatient department regarding tactile and auditory stimulation by using handouts, pamphlets and demonstration. To plan and organize counseling session among preterm neonate’s mothers to continue tactile and auditory stimulation at home.

Nursing Research: To conduct further studies in different settings which might ultimately reduce the neonatal morbidity and mortality. To disseminate the findings through books, journals, seminars, workshop,conferences and World Wide Web, so that tactile and auditory

stimulation can be introduced in all hospitals.

Limitations

Sample size was limited to 60 preterm neonates in the experimental group and 60 preterm neonates in the control group. In characteristics of the infant that might affect response to the intervention considered include gender, gestational age; morbidity status etc and not considered includes behavioral state and hunger level at the time the music is administered and exposure to other types of stimulation. The physiological changes in the preterm neonates may be influenced byextraneous variables like environmental temperature, procedures preceding theobservation & stimuli present in the neonatal intensive care unit. (Light & Monitor sounds). In characteristics of the intervention, live maternal voice songs stimulationwas not considered instead of prerecorded music used. Long term follows up is not possible.

5.0 RECOMMENDATIONS

Since massage therapy is a cost effective therapeutic technique it should be encouraged in all community especially rural poor pre term babies. Health education about massage & music therapies should be given to NICU nurses, staff nurses, village health nurses, Auxiliary nurse midwife in order to promote these therapies as a routine care in the management of preterm neonates & low birth weight babies. Future studies should be based on clear conceptual models that specify the characteristics of the infant, setting, and intervention itself that might influence the infants‟ responses to the music intervention, and propose mechanisms by which music might influence infant responses. With increasing public demand for massaging as complementary and alternative medicine (CAM) and the concomitant increase of its use within the medical setting, the need for quality research to prove or disprove benefits of these treatments must take precedence. The further research can be conducted on the effectiveness of various types of massage and different music therapies in NICU. Future research to test music interventions in the NICU should be done as per detailed guidelines, based on the evidence high-quality research. Future research studies regarding characteristics of the intervention that shouldbe considered include type of music (e.g. live versus recorded, sedating versus stimulating, maternal voice versus other voice) which helps to evaluate the effectiveness of various kinds of auditory stimulation in preterm neonates.

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