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ASSESSMENT OF PRETERM NEONATES' RESPONSE TO TACTILE AND KINESTHETIC STIMULATION

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ABSTRACT: Objective: To assess the response of Preterm neonates to Tactile and Kinesthetic Stimulation. **Methods:** The study was conducted in a Neonatal Intensive Care Unit of a tertiary care hospital in India. Twelve stable preterm neonates were selected as per the inclusion and exclusion criteria and randomized into the intervention and control group. Seven days of tactile and kinesthetic stimulation was given three times in a day to intervention group along with the routine care, and the control group was given only the routine care. The pre and post-test assessment was done among both the groups. The weight gain and other physiobehavioural parameters were compared with the control group. **Result:** The preterm neonates in the intervention group gained more weight than the control group, and also there was a significant difference found in the physio-behavioural parameters between the two groups. **Conclusion:** Tactile and kinesthetic stimulation is a non-invasive cost-effective intervention that promotes weight gain and reduces hospital stay. Hence it can be recommended to the preterm neonates in the Neonatal Intensive Care Unit along with the routine care.

INTRODUCTION: World Health Organization data shows preterm birth is the major cause of death among under-five children. Day by day, there is an increase in preterm delivery in all countries. Some cost-effective essential care to the neonates during birth and postnatal period can save more than three-quarters of premature newborns [1]. Over the past half-century, numerous studies have reported that premature birth is associated with a neurodevelopmental impairment that is inversely proportional to the gestational age and birth weight of the infant [2].

Twenty-eight percent of early neonatal death without congenital anomaly occurs due to premature birth. The morbidity related to premature birth accounts for the development of physical, psychological and economic costs in the later stage. Preterm birth rates available from some developed countries, such as the United Kingdom, the United States and the Scandinavian countries, show a dramatic rise over the past 20 years [3].

The incidence of preterm birth in the developed countries during the last 20-30 years has been increased to 5-7%. The incidence in the United States is higher, at about 12%. Most mortality and morbidity affect "very preterm" infants (those born before 32 weeks' gestation), and especially "extremely preterm" infants (those born before 28 weeks of gestation) [4]. According to The Touch Research Institute, Mailman Center for Child Development, Miami, Florida and the massage

therapy promotes weight gain in preterm infants, Enhances attentiveness, Alleviates depressive symptoms, Reduces pain, Reduces stress hormones, and Improves immune function [5]. Tactile stimulation has the advantages of being non-invasive, inexpensive, and safe [6].

Research studies showed that there was an increase in weight and heart rate within the normal limit, evidenced in the preterm newborn and low birth weight in the test group who received tactile stimulation [7, 8, 9]. A systematic review on Paediatric massage therapy reported that massage improves growth, reduces pain, psychological problems, gastrointestinal problems, increased vagal activity, and decreased stress hormones [10]. A study result revealed that there was a significant increase in the oxygen saturation in the tactile stimulated group preterm neonates than the control group [11].

Tactile and kinesthetic stimulation based on Field technique found a significant difference in the weight and frequency of 'inactive awake state, mean heart rate and O_2 saturation between two groups [12]. Oil massage (medium-chain triglyceride) accelerates weight gain among stable preterm neonates [13]. Massage therapy enhanced the optimal physiological responses and behavioral organization of premature infants [14].

Tactile and kinesthetic stimulation improved the motor behavior of the low birth weight infants [15]. Study results indicate that kangaroo mother care and Tactile and Kinesthetic Stimulation were equally effective in improving the weight and the mother-child bonding [16]. Attachment theory is described as a reciprocal process of recognizable patterns of interactive behaviors through physical and emotional proximity between parent and infant [17].

H-HOPE (Hospital to Home Transition-Optimizing Premature Infant's Environment) Multisensory intervention (Auditory, Tactile, Visual and Vestibular stimuli) gained more weight and length than the control group infants. The effect of counseling on massage practice found that the practice score after the counseling of mothers was increased [18]. Research results shows that the massage therapy infants weight, height and chest circumference increased. Regarding the gastrointestinal function, the pre-feed gastric residual was decreased, and the bowel movements were significantly increased in the experimental group [19]. In the NICU environment of care, many parents struggle with limited parental interactions and difficulty in establishing their parental role since nurses and other health care providers care for their preterm infant. Not only are parents separated from their infant, sometimes for long durations, they are also unsure of how to handle their medically fragile child.

Attachment should be considered as an individualized process and may be dependent on the health status of the infant and the mother, environmental circumstances, and on the quality of care the infants receive in the NICU [20]. The present study aimed as a pilot trial to explore the preterm neonate's response to tactile and kinesthetic stimulation.

MATERIALS AND METHODS:

Design and Sample: The study design chosen for the present study is a quantitative experimental design. Stable preterm neonates with appropriate gestational age (calculated as per Dubowitz scale) from 28-36 weeks admitted in Neonatal Intensive Care Unit (NICU) of a private Medical College Hospital at Mangalore, India, were recruited for the present study.

Twelve preterm neonates who fulfilled the inclusion criteria were randomized into the experimental and control group by simple random technique. Hemo dynamically stable preterm neonates of both gender with no respiratory problems, at least up to 3 days of life, appropriate for gestational age, birth weight above 1000 grams were included, and the babies with genetic disorders, multiple congenital anomalies, infections, mechanical ventilator support, cardio-respiratory disorders, sepsis, restricted for movement with a fracture or joint contractures were excluded in the study.

Ethical Considerations: The study protocol was approved by Institutional Ethics Committee (Protocol No. 2016/023), and written consent was obtained from the mothers of the newborn. The informed consent form includes a participant information sheet and an informed consent sheet.

The participant information sheet includes the purpose, procedure of intervention, right to withdraw from the study. The informed consent sheet includes the voluntary consent for participation with a signature of the participant or parent with the contact details of the investigator.

Tool for Data Collection: The data collection tool was divided into Part I. Demographic variables which consist of gestational weeks, sex, birth weight, mode of delivery, birth order, duration of hospitalization, residence, education status of the mother, type of family, and social support for the mother, Part II.

Assessment of physiological parameters such as weight, temperature, heart rate, oxygen saturation and behavioural parameters such as state of arousal, facial expression, hand and leg response, cry and posture.

The demographic tool and the behavioural tool were validated by subject experts. Reliability for Observational checklist on behavioral parameters was calculated by inter-rater reliability by Kappa statistics shows 0.8 depicts reliable.

Procedure: The mothers of the intervention group were demonstrated about the intervention. Neonates 30 minutes to one hour after feeding was given a typical 10 min of tactile and kinesthetic stimulation 3 times per day (Morning, Afternoon, and Evening) for 7 days along with the routine care of the NICU.

First five minutes of tactile stimulation by stroking the babies back from head to toe with moderate pressure using the flats of the fingers of both hands. Followed by five minutes of kinesthetic stimulation by a gentle flexion and extension movement of the hands and legs were performed.

The control group babies were given routine care. Pre and Post-test assessments of physio-behavioral parameters were recorded for both groups. At the end of the 7th day after data collection, the mothers of the control group babies were demonstrated about the tactile and kinesthetic therapy.

Statistical Analysis: The collected data were analyzed by descriptive statistics such as frequency, mean, percentage, standard deviation, and the inferential statistics such as Repeated measures ANOVA, Friedman test, unpaired "t" test, and Manwhitney - U test to find out the statistical differences in the preterm response. The level of significance was set at $p < 0.05$ for all the tests. The data analysis was done by using SPSS version [23].

RESULTS: The majority of the samples were female (83.3%) in the experimental group, whereas in the control group, it was male (66.7%) babies. With regard to the gestational age in both, the group 50% belongs to 31-33 and 34-36 weeks.

Most of the samples' birth weight falls above 1500 kg (83.3) in the experimental group, and in the control group 50% were above 1500 kg, and 50% were between 1201 -1500. There was a significant difference in the pre and post-test of weight, heart rate, and oxygen saturation in the intervention group, whereas, in the control group, no significant difference was found in the pre and post-test of physiological parameters **Table 2.**

Pairwise comparison of weight was done with the post-hoc-Bonferroni test, which shows there was a significant increase in the weight on day 6 and day 7 in the intervention group when compared to the pretest, whereas in the control group, it was only on the 5th day **Fig. 1 & 2**.

There was a significant difference in the pre and post-test of the state of arousal, facial expression, leg relaxation, cry and posture in the intervention group, whereas in the control group, difference was found only in the state of arousal, cry and posture **Table 3**.

The effectiveness of tactile and kinesthetic stimulation and physio behavioural parameters between the group shows that there was a significant difference between the control and intervention groups regarding the temperature and hand relaxation on 7th day.

The average daily weight gain of the intervention group was 42 gms, whereas, in the control group, it was 38 grams.

There was an average weight gain of 145 gm in the intervention group after the 7 days of therapy, whereas, in the control group, it was 67 gm.

TABLE 1: FREQUENCY AND PERCENTAGE DISTRIBUTION OF BASELINE DATA

Baseline Data	Experimental Group		Control Group	
	Frequency	Percentage	Frequency	Percentage
Gestational Weeks of the Baby				
a. 28-30	3	50	1	16.7
b. 31-33	3	50	1	16.7
c. 34-36	-	-	4	
Gender				
a. Male	1	16.7	4	66.7
b. Female	5	83.3	2	33.3
Birth Weight (in Grams)				
a. Between 800-1000	-	-	-	-
b. Between 1001- 1200	-	-	-	-
c. Between 1201-1500	1	16.7	3	50
d. Above 1500	5	83.3	3	50
Study Entry Weight (in Grams)				
a.1000-1500	2	33.3	3	50
b.1501-2000	1	16.7	2	33.3
c.2001-2500	3	50	1	16.7
d. Above 2500	-	-	-	-
Mode of Delivery				
a. Normal vaginal	1	16.7	3	50
b. L.S.C.S.	5	83.3	2	33.3
c. Others	-	-	1	16.7
Duration of Hospitalization (at Study Entry time)				
a.Less than one week	6	100	6	100
b. 1-2 weeks	-	-	-	-
c. 2-3 weeks	-	-	-	-
d.3-4 weeks	-	-	-	-
e.More than 4 weeks	-	-	-	-
Residence				
a. Rural	3	50	1	16.7
b. Urban	3	50	5	83.3
Education Status of the Mother				
a. No formal education	-	-	1	16.7
b. Primary education	4	66.7	2	33.3
c. High school	1	16.7	2	33.3
d. Higher secondary	1	16.7	1	16.7
e. Diploma	-	-	-	-
f. Graduate	-	-	-	-
g. Any Other (Specify)…….	-	-	-	-
Type of Family				
a. Nuclear	5	83.3	2	33.3
b. Joint family	1	16.7	4	66.7
c. Exteded				
Social Support for the Mother				
a. Husband	6	100	6	100
b. Parents	-	-	-	-
c. In-Law's	-	-	-	-
d.Neighbours /Friends	-	-	-	-
e. Others	-	-	-	-
f. None	-	-	-	-

TABLE 2: COMPARE THE MEAN, STANDARD DEVIATIONS OF PHYSIOLOGICAL PARAMETERS WITHIN THE GROUP n = 12

Parameters	Time Frame	Experimental Group			Control Group		
		Mean ± SD	R-ANOVA F	P-Value	Mean ± SD	R-ANOVA F	P-Value
Weight	Pre test	1.8567 ± 0.41			1.6067± 0.37		
	Day 1	1.8567 ± 0.41			1.6033 ± 0.38		
	Day2	1.8700 ± 0.43			1.6017 ± 0.37		
	Day3	1.9000 ± 0.42	6.30	0.000*	1.6017 ± 0.37	0.17	0.988
	Day4	1.8950 ± 0.40			1.6067 ± 0.37		
	Day5	1.9133± 0.41			1.5833 ± 0.41		
	Day6	1.9667 ± 0.43			1.5900 ± 0.41		
	Day7	2.001 ± 0.43			1.6000 ± 0.41		
Temperature	Pre test	36.3500±0.12			36.3333±0.16		
	Day 1	36.5167±0.09			36.3167±0.14		
	Day2	36.5333±0.10			36.4000±0.12		
	Day3	36.4667±0.10			36.4000±0.21		
	Day4	36.4667±0.16	2.09	0.071	36.3167±0.16	0.87	0.538
	Day5	36.5167±0.09			36.3000±0.10		
	Day6	36.5667±0.08			36.3000±0.10		
	Day7	36.5333±0.10			36.2333±0.24		
Heart Rate	Pre test	132.00±11.24			141.00±14.51		
	Day 1	137.66±9.33	3.90	0.003*	145.66±9.07		
	Day2	142.66±10.25			142.66±16.28		
	Day3	140.33±10.98			145.66±14.27	0.35	0.923
	Day4	146.00±7.04			140.66±10.09		
	Day5	144.33±5.57			141.00±9.35		
	Day6	145.33±5.60			140.00±6.06		
	Day7	145.00±5.17			144.00±8.57		
Oxygen Saturation	Pre test	96.16±3.31			98.50±1.04		
	Day 1	97.00±1.78			97.50±1.87		
	Day2	98.16±2.13			98.00±1.41		
	Day3	98.00±2.00			97.00±1.67		
	Day4	98.00±1.26	2.34	0.045*	97.00±3.40	1.68	0.145
	Day5	98.50±1.37			98.16±0.75		
	Day6	99.00±0.89			99.33±0.51		
	Day7	99.66±0.51			98.33±0.81		

P< 0.05 Level * Significance

TABLE 3: COMPARE THE MEAN, STANDARD DEVIATIONS OF BEHAVIOURAL RESPONSES WITHIN THE GROUP

State of Arousal		Experimental Group				Control Group			
		Mean	SD	Friedman Test Value	P-Value	Mean	SD	Friedman Test Value	P-Value
	Pre test	1.83	0.40	19.37	0.007*	2.00	0.00	14.7	0.04*
	Day3	1.16	0.40			2.33	0.51		
	Day 5	1.00	0.00			2.00	0.00		
	Day7	1.00	0.00			1.66	0.51		
Facial Expression	Pre test	2.33	0.51	37.06	0.000*	2.00	0.89	6.24	0.51
	Day3	1.16	0.40			2.33	0.81		
	Day5	1.00	0.00			2.16	0.75		
	Day7	1.00	0.00			2.50	0.83		
Hand Relaxation	Pre test	2.66	0.51	5.77	0.56	2.66	0.51	5.77	0.56
	Day3	2.83	0.40			2.83	0.40		
	Day5	2.66	0.51			2.66	0.51		
	Day7	2.55	0.83			2.50	0.83		
Leg Relaxation	Pre test	2.66	0.51	29.20	0.000*	2.66	0.51	4.2	0.75
	Day3	1.33	0.51			2.50	0.54		
	Day5	1.16	0.40			2.66	0.51		
	Day7	1.00	0.00			2.33	0.81		
Cry	Pre test	1.83	0.75	23.17	0.02*	1.83	0.40	6.5	0.48
	Day3	1.00	0.00			2.00	0.51		

	Day5	1.00	0.00			1.83	0.40	
	Day7	1.00	0.00			1.83	0.40	
Posture	Pre test	2.16	0.75	28.48	0.000*	1.16	0.81	9.04	0.24
	Day3	1.00	0.00			2.16	0.75	
	Day5	1.00	0.00			1.83	0.75	
	Day7	1.00	0.00			2.16	0.75	

TABLE 4: COMPARE PHYSIOLOGICAL PARAMETERS BETWEEN THE GROUPS

| Physiological Parameters	Time period	Experimental Group	Control Group	Unpaired t-test	P-Value
		Mean ± Standard Deviation	Mean ± Standard Deviation		
Weight	Before intervention	1.8567 ± 0.41	1.6067± 0.37	-1.094	0.299
	After intervention (7th day)	2.001 ± 0.43	1.6000 ± 0.41	-1.633	0.13
Temperature	Before intervention	36.3500 ±0.12	36.3333±0.16	0.2	0.42
	After intervention(7th day)	36.5333±0.10	36.2333±0.24	2.79	0.009*
Heart Rate	Before intervention	132.00±11.24	141.00±14.51	1.20	0.12
	After intervention(7th day)	145.00±5.17	144.00±8.57	0.24	0.40
Oxygen saturation	Before intervention	96.16±3.31	98.50±1.04	1.64	0.65
	After intervention(7th day)	99.66±0.51	98.33±0.81	-0.79	0.22

P< 0.05 Level * Significance

TABLE 5: COMPARE THE BEHAVIOURAL RESPONSES BETWEEN THE GROUPS

Behavioural Parameters	Time period	Mean	Mean	Manwhitney -U test Z-Value	P-Value
State of Arousal	Before intervention	1.83	2.00	-0.40	0.68
	After intervention (7th day)	1.00	1.66	-1.84	0.06
Facial Expression	Before intervention	2.33	2.00	0.56	0.57
	After intervention (7th day)	1.00	2.50	2.32	0.20
Relaxation Hand	Before intervention	2.66	2.16	0.08	0.93
	After intervention (7th day)	1.00	2.33	2.32	0.03 *
Relaxation Leg	Before intervention	2.66	2.16	0.08	0.93
	After intervention (7th day)	1.00	2.33	2.32	0.20
Cry	Before intervention	1.83	1.83	0.00	1
	After intervention (7th day)	1.00	1.83	2.32	0.20
Posture	Before intervention	2.16	1.16	0.96	0.33
	After intervention (7th day)	1.00	2.16	2.32	0.20

P< 0.05 Level * Significance
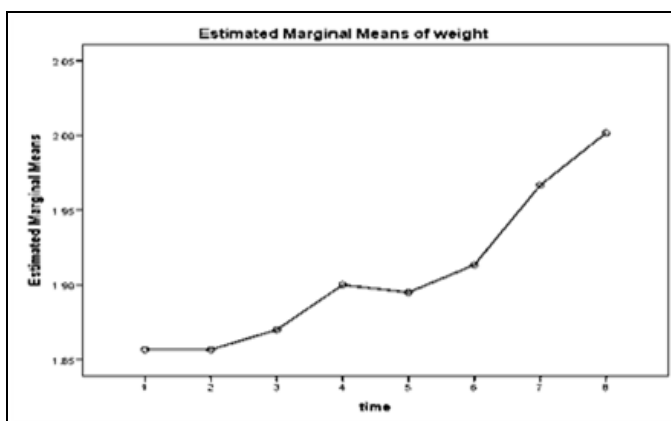
FIG. 1: VARIATION IN THE WEIGHT OF THE EXPERIMENTAL GROUP OVER A TIME PERIOD
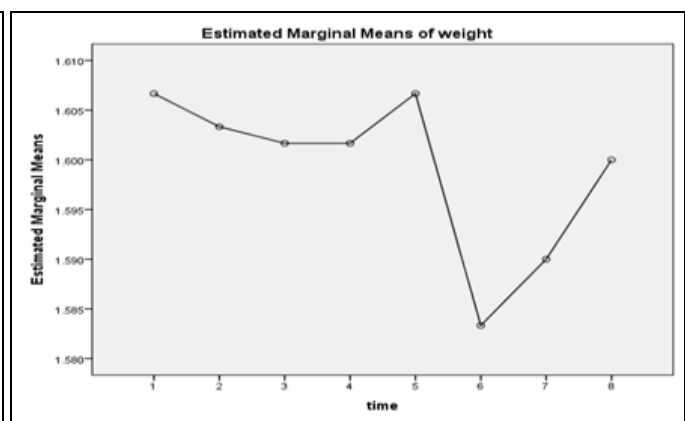
FIG. 2: VARIATION IN THE WEIGHT OF THE CONTROL GROUP OVER A TIME PERIOD

DISCUSSION: Overall, the three times massage therapy with kinesthetic stimulation improved the weight gain of the preterm neonates. The present study results are consistent with the findings of a quasi-experimental study conducted in 4 hospitals in Sudan among 160 preterm infants. It showed that there was a significant weight gain and shorter hospital stay in the preterm neonates who received tactile stimulation [21]. The result of the present study reveals that the average daily weight gain of the

experimental group was 42 grams, and it was supported by a similar study with a weight gain of 48.7 grams per day [22]. There was an improvement in the oxygen saturation in the intervention group after tactile stimulation. This is supported by a similar study where it was observed that the non stimulated babies were intubated very often than the tactile stimulated preterm neonates, and the tactile stimulation initiates spontaneous breathing [23]. A systematic review proved that tactile and kinesthetic stimulation is a promising tool to improve weight gain among preterm neonates [24]. Massage therapy in kangaroo position increases the weight of the preterm newborn [25]. Massage therapy helps to improve the maternal attachment behaviours among premature neonates in a neonatal intensive care unit (NICU) [26].

The limitation of the study was smaller samples were selected as it was a pilot trial. The generalization also is limited to the preterm of 28-36 weeks of gestation and study entry weight above 1000 grams. It can be checked with the preterm below 1000 gms weight in further studies. The primi mothers of the interventional group were a little hesitant to continue the therapy compare to multi gravid as they were scared and constant motivation by the investigator helped to succeed in performing the intervention.

Recent trends of advanced neonatal care help in the reduction of morbidity.[27]Studies proved that tactile stimulation provides various benefits for preterm babies. This study can be conducted as a comparative study between preterm and low birth weight neonates and also it can be extended to assess the growth and development of children who received Tactile and Kinesthetic stimulation. The nursing students and nurses have to be trained for the techniques of providing tactile and kinesthetic stimulation and update the knowledge on recent practices or trends. In-service education to be given to updating their knowledge and skills regarding massage therapy.

CONCLUSION: There is a significant difference found between the pretest and post-test of physio behavioural parameters within the group after seven days of tactile and kinesthetic stimulation. As tactile and kinesthetic stimulation is a safe complementary therapy, it can be implemented the preterm neonates admitted to the Neonatal Intensive Care Unit.

CONFLICTS OF INTEREST: None

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