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Exploring the Correlation Between Physiological Stability and Oral Motor Development Scores Among Preterm Infants After Multisensory Stimulation

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Abstract: Prematurity remains the leading cause of death among children under five years of age globally, with notable differences in survival outcomes between countries. Long-term consequences often include impairments such as vision and hearing loss, along with learning difficulties. Thus, early intervention programmes provided in NICU in the form of sensory or motor stimulation can help prevent long term disabilities. This study aimed to explore the correlation between selected physiological scores (i.e mean SPO_2 rate and mean weight gain) in intervention and control group among preterm infants admitted in the NICU at Selected Hospital, Greater Noida. A total of 130 preterm infants were included in this quantitative research study. The result showed that in pretest in intervention group the mean oral development score, weight gain and SPO_2 rate was 26.33 $\pm$ 5.64, 1.84 $\pm$ 0.39 and was 92.69 $\pm$ 3.94 respectively. The coefficient of correlation calculated between oral development scores and selected physiological stability parameters i.e weight gain (r=0.19; p=0.11; p>0.05) and SPO_2 rate (r=0.45; p=0.07; p>0.05). However, post-test III in intervention group the mean oral development score, weight gain and SPO_2 rate was 31.49 $\pm$ 3.28, 1.95 $\pm$0.30 and 92.69 $\pm$ 3.94 respectively. The coefficient of correlation calculated between oral development scores and selected physiological stability parameters i.e weight gain (r=0.24; p=0.05; p<0.05) and SPO_2 rate (r=0.27; p=0.03; p<0.05). There was significant positive correlation was found between selected physiological stability scores and oral motor development scores in intervention group after the intervention. The study concluded that multisensory stimulation has significantly improved oral motor skills that positively impacted the oxygen saturation level as well as increased the weight of preterm infants. There is need for more protocols in routine care of preterm infants to improve physiological parameters and reduce hospital stays.

Keywords: Correlation, Multisensory stimulation, Oral motor development, Physiological stability, Preterm infants.

I. Introduction

A full-term baby is born between 37 and 40 weeks of gestation, marking the conclusion of the pregnancy phase and the start of the newborn's extrauterine challenges. Preterm newborns, often known as preemies or preterm, are babies born before 37 weeks of pregnancy according to the WHO. Preterm newborns are classified as extremely preterm (born before 28 weeks GA), very preterm (born between 28 and less than 32 weeks GA), and moderate to late preterm (born between 32- and 37-weeks GA) [1].

Preterm delivery is considered to be one of the main risk factors for infant mortality and is a global burden. Stunted growth, mental and intellectual difficulties, and the early start of chronic illnesses are among the immediate and long-term effects that are associated with it. As per the literature, 5 to 10% of pregnancies ends up complicated and preterm labor is a leading cause of maternal illness and death in both developed and developing nations. Preterm babies are more vulnerable to infection and undeveloped organ structures since they are born earlier and have fewer subcutaneous fat deposits [2].

As per WHO, South Asia alone accounts for 15 million (11.1%) of the world's preterm births each year. In developing nations (2020–2024 data), 13% of preterm births and about 65% of preterm deliveries occurred in Sub-Saharan Africa and Southern Asia in 2020. Bangladesh (16.2%), Malawi (14.5%), Pakistan

(14.3%), Serbia (3.8%), Moldova (4%) and Kazakhstan (4.7%) are the countries most affected. Preterm birth is not just a problem in low- and middle-income countries; it is also a problem in industrialized nations like the United States of America (10%) and Greece (11.6%). Furthermore, preterm birth rates range from 4.4 to 8.2% in other nations, including Sweden, Japan, Australia, and New Zealand [3].

Soon after birth, preterm babies should synchronize their changes in psychosocial behavior and physiological activities. When preterm newborns are placed in the NICU after delivery, where there is no clearly defined diurnal time in terms of loud noise, bright illumination, or therapeutic touch, it affects their biorhythms, which impact sleep regulation. As a result, premature babies become disorganized. Preterm infants require special feeding techniques and are too little to nurse effectively. Bonding and nutritional status are always affected, which reduces weight and increases the risk of failure to thrive in preterm newborns [4].

An experimental study was carried out on 52 preterm infants (n=26 in experimental group and control group) to assess the effectiveness of multi-sensory stimulation (Oral motor and auditory) in terms of feeding progression among preterm infants. Convenience sampling technique was used to select the study samples and standardized scale preterm oral feeding readiness assessment scale was used to collect the data. The finding revealed that oral feeding skills progression was found to be statistically significant after implementation of multisensory stimulation on preterm infants. The study concluded that oral stimulation with music has been proved to be effective in improving feeding progression of preterm infants and reducing the length of hospital stay [5].

Such early intervention programs that offer sensory or motor stimulation in the NICU can aid in identifying and preventing issues that preterm newborns may encounter. Multimodal therapies that incorporate information from auditory, tactile, visual, vestibular, kinesthetic, gustatory, and/or olfactory modalities can be very beneficial for preterm infants. These sensory enrichment programmes such as gentle touch, music, oral massage provide calming effects. The fundamental theory behind these programmes is that premature babies experience sensory deprivation that stunts their development in future [6].

According to research, NICU care provider are unaware of the supportive care that should be given to a newborn who is born prematurely. Furthermore, intra-unit meetings or one-time training had little effect on knowledge acquisition, and NICU care providers lacked sufficient understanding of supportive care for preterm babies due to their educational background or professional experience [7]. Thus investigator wanted to explore the effectiveness of multisensory stimulation in terms of correlation between selected physiological stability scores and oral motor development after implementation of multisensory stimulation among preterm infants admitted in neonatal intensive care unit.

II. Material and Method

A quantitative research approach with Quasi-experimental research design (Pretest Post test Control group) was adopted in the study. Total 130 preterm infants (sample size was calculated using power analysis) admitted in neonatal intensive care unit of selected hospital were included using total enumeration sampling technique to collect data [8]. The tool utilized in the present study was: 1) Physiological assessment proforma, 2) Preterm oral feeding readiness assessment scale (standardized). The variables adopted in the study were: 1) Multisensory Stimulation as independent variable, 2) Physiological Stability (Temperature, Heart rate, respiratory rate, oxygen saturation and weight) and Oral Motor Development as dependent variables and 3) Age, Gender, Type of birth, APGAR Scoring at 1 and 5 minutes as demographic variables.

The preterm infant included in study were those having gestational age of 28-34 weeks, included in study after 72 hours of birth, with APGAR score of more than 6, alert / awake, were able to tolerate enteral feeding and admitted in NICU for more than 7 days. The preterm infants requiring ventilatory support or having any Significant medical complication such as hypoxic encephalopathy, hemorrhage, necrotizing enterocolitis or more were excluded from the study. Data was analyzed using descriptive and inferential statistics (correlation coefficient r).

Ethical permission was obtained from Institutional Ethics Committee, Head of Department, Nursing in charge. Informed consent was obtained from mothers of preterm infants enrolled in the study.

III. Results

In the present study correlation between the pretest and posttest oral motor development score with selected Physiological stability scores (Weight Gain and SPO_2 rate) among preterm infants in intervention and control group was assessed using Pearson's co-relation (r) co-efficient before and after the intervention in both groups. The data revealed that in intervention group in pre-test, (Table I) the overall mean oral motor development score was 26.33 ± 5.64 and mean weight gain scores was 1.84 ± 0.39. The r value was 0.19 (weight gain) and 0.45 (SPO_2 rate) with calculated $p>0.05$ which was not found to be significant. Similarly, in control group the overall mean oral motor development was 26.33 ± 5.64 and mean SPO_2 rate was 92.69 ± 3.94. The r value was 0.45 (weight gain) and 0.20 (SPO_2 rate) with calculated p value 0.07 and 0.10 respectively ($p>0.05$) which was not found to be significant.

Table I: Correlation Between Pre-Intervention and Post-Intervention Oral Motor Development Scores and Physiological Stability Scores in Terms of Weight Gain and SPO_2 Rate Among Preterm Infants in Pretest

N=130

Groups	*Pretest*						
	Oral Motor Development Scores	*Weight Gain*	*r Value*	*p Value*	*SPO_2 Rate*	*r Value*	*p Value*
Intervention group	26.33 ± 5.64	1.84 ± 0.39	0.19	0.11	92.69 ± 3.94	0.45	0.07
Control group	25.06 ± 5.47	1.79 ± 0.30	0.07	0.54	92.40 ± 3.81	0.20	0.10

($p<0.05$ significant level)

Whereas, in post-test III (Table II) in intervention group the mean oral motor development score was 31.49 ± 3.28 and mean weight gain scores was 1.95 ± 0.30. The r value was 0.24 with calculated p value 0.05 ($p<0.05$) which was found to be significant. Similarly, the overall mean oral motor development score was 31.49 ± 3.28 and mean SPO_2 rate was 96.13 ± 3.03. The r value was 0.27 with calculated p value 0.03 ($p<0.05$) which was found to be highly significant. In control group the overall mean oral motor development score was 28.64 ± 4.68 and mean weight gain scores was 2.15 ± 0.41. The r value was 0.13 with calculated p value 0.28 ($p>0.05$) which was not found to be significant. Similarly, in post-test III the overall mean oral motor development scores was 28.64 ± 4.68 and mean SPO_2 rate scores was 93.47 ± 4.12. The r value was 0.22 with calculated p value 0.07 ($p>0.05$) which was not found to be significant.

Overall data reveals that there was no meaningful relationship between the variables under study i.e oral motor development scores and physiological stability scores (SPO_2 and weight gain) in both the groups. But after implementation of multisensory stimulation the data showed significant positive correlation between oral motor scores and weight gain ($p=0.05$) and highly significant moderate positive correlation (0.001: $p<0.05$) in pretest mean oral motor scores and SPO_2 rate scores ($r=0.45$) in intervention group.

Hence, the research hypothesis H_{01} was partially rejected that inferred there will be no significant correlation between physiological stability scores and oral motor development scores among preterm infants in intervention and control group at 0.05 level of significance.

Table II: Correlation Between Pre-Intervention and Post-Intervention Oral Motor Development Scores and Physiological Stability Scores in Terms of Weight Gain and SPO_2 Rate Among Preterm Infants in Post-test III

N=130

Groups	*Post-Test III*						
	Oral Motor Development Scores	*Weight Gain*	*r Value*	*p Value*	*SPO_2 Rate*	*r Value*	*p Value*
Intervention group	31.49 ± 3.28	1.95 ± 0.30	0.24	0.05*	96.13 ± 3.03	0.27	0.03**
Control group	28.64 ± 4.68	2.15 ± 0.41	0.13	0.28	93.47 ± 4.12	0.22	0.07

($p<0.05$ significant level) ** Highly significant *Significant

IV. Discussion

Findings in the present study revealed significant positive correlation between physiological stability score in terms of weight gain and oral motor development scores in posttest III with r value in intervention group ($r=0.24$ with p value 0.05; $p<0.05$) and in control group ($r=0.13$ with p value 0.28; $p>0.05$). Also, in post-test III significant positive correlation was found between physiological stability score in terms of SPO_2 rate and oral motor development score with r value in intervention group ($r=0.22$ with p value 0.001; $p<0.05$) whereas in control group ($r=0.22$ with p value 0.07; $p>0.05$). Similar findings are reported in quasi-experimental research study conducted to examine the effectiveness of multisensory stimulation in terms of neonatal outcomes who also revealed positive correlation between physiological stability in terms of SPO_2 and neonatal outcomes with r value in intervention group ($r=7.20$ with p value 0.001; $p<0.05$) and in control group ($r=1.30$ with p value 0.12; $p<0.05$) [9].

Similarly, in consistent with present study another research evaluated the effectiveness and impact of early intervention in terms of oral motor management on feeding skills and neonatal outcomes among premature infants. The study also showed significant positive correlation between feeding skills (1916 ± 156 vs. 2003 ± 191 g, $p = 0.002$) and hospital stay (46.3 ± 25.3 vs. 54.7 ± 23.5 days, $p = 0.003$) between both

the groups. Further the study concluded that initiating early feeding intervention in very low birth babies improves feeding performance and positive neonatal outcomes [10].

Similarly, in consistent with present study another research explored the impact of oral motor therapy programme on successful transition to breastfeeding as well as enhancement of feeding skills among preterm infants. The study showed that there was significant correlation between the feeding skills among preterm infants before and after the intervention of oral motor therapy in intervention group ($p<0.05$). The study concluded that oral motor therapy improves the quality of sucking and promotes better oral motor skills among preterm infants facilitating early hospital discharge [11].

However, in consistent with present study a randomized controlled trial conducted to examine the effectiveness of oral motor stimulation also revealed significant correlation between oral motor stimulation and selected neonatal outcomes with p value 0.001 ($p<0.05$) [12].

V. Clinical Implication

A. Nursing Practice

Multisensory stimulation is an noninvasive, evidence-based intervention that can be incorporated to enhance the physiological stability and oral motor development of preterm infants in Neonatal Intensive Care Unit.

B. Nursing Administration

As healthcare field is evolving with technological advancement more focus is placed towards quality of care. The nurse administrators can develop and implement this protocol for wellbeing of the preterm infants. New guidelines and protocols can be prepared and also recommended to hospital authority to introduce multi-sensory stimulation in NICU as it has shown positive effects on health outcomes of infants. Hospital administrators should make arrangements to have manpower, training, material that is required to implement this developmental care intervention in Neonatal Units.

VI. Conclusion

Multisensory stimulation is an noninvasive intervention and present study proved that there was significant increase in weight of preterm infants who received the intervention. The present study not only added significant findings to the existing body of literature but also highlighted the importance of nurse-led stimulation. This study also provides a complete perspective on the significant role of nurses in the early assessment and care of preterm infants.

Conflict of Interest: None to declare.

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