



## EFFECTS OF EARLY NEONATAL MASSAGE WITH THERAPEUTIC POSITIONING IN PRETERM AND LOW BIRTH WEIGHT BABIES ON NEUROBEHAVIORAL AND NEURODEVELOPMENTAL STATUS.

**RAGURAMAN RAJARAM, D. MALAR VIZHI\*, V.P.R.SIVA KUMAR**

SRM College of Physiotherapy. SRM University, Chennai, Tamilnadu.

### ABSTRACT

Background: India has the greatest number of premature infants and low birth weight population. Infant massage and therapeutic positioning has been documented for several decades to have a positive effect on preterm and low birth weight infants. Objective of the study was to determine the effects of early neonatal massage with therapeutic positioning in preterm and low birth weight babies on neurobehavioral and neurodevelopmental status. Methodology: Study design was quasi experimental, thirty preterm (32-37 weeks) and low birth neonates (1.5-2.5kg) were recruited. Infant Massage with therapeutic positioning was administered to the subjects for eight weeks after taking baseline Neonatal Neuro behavioral Examination (NNE) and Infant Neurological International Battery (INFANIB) scores. Comparison was made between pre and post NNE and INFANIB scores. Results: Findings of the study showed significant difference between pre and post NNE and INFANIB scores ( $p < 0.05$ ). There was significant correlation between chronological age with NNE ( $r = 0.557$ ,  $p < 0.05$ ) and INFANIB ( $r = 0.442$ ,  $p < 0.05$ ) baseline scores, however gestational age and birth weight were not significantly correlated ( $p < .05$ ). Conclusion: The study concluded that neonatal massage and therapeutic positioning have significant effects in improving neurobehavioral and neuro development in preterm and low birth weight babies.

**KEYWORDS:** *Infant massage, therapeutic positioning, Neonatal Neuro behavioural examination, Infant Neurological International preterm, low birth weight*



**D. MALAR VIZHI\***

SRM College of Physiotherapy. SRM University, Chennai, Tamilnadu.

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## INTRODUCTION

An estimated 20 million babies are born too early and with low birth weight in the world are concentrated in two regions of the developing world; Asia (72%) and Africa (22%). India alone accounts 40% of low birth weight babies and preterm births in overall developing world and more than half of those babies are born in Asia.<sup>1</sup> The World Health Organisation (1992) defines low birth weight as a weight at birth less than 2500 grams, irrespective of gestational period and pre-term is defined as babies born before 37 weeks of pregnancy completed. Thus, LBW can arise through one or both of two mechanisms. Infants who are born "too soon" are referred as preterm, which WHO defines as a gestational age at birth <37 weeks. Infants can also be LBW because they are born "too small" for their age (small for gestational age, SGA), which has several definitions, the most common of which is a birth weight below the 10<sup>th</sup> percentile of gestational age based on appropriate reference<sup>2</sup>. Infants who are born with a low birth weight or preterm are at biological risk for developmental disorders<sup>4</sup>. Therefore these infants often are called high risk (HR) infants. In general HR infants have poorer cognitive, motor and behavioral outcomes than infants born at term. The less advantageous outcome is not only present at school-age, but persists into adolescence and adulthood. The prevalence of developmental delay for moderately preterm and late preterm infants is twofold compared to that of full term infant<sup>5</sup>. Infants born preterm /low birth weight are deprived of the uterine crowding during the third trimester of pregnancy. As preterm infants are deprived, they often lack adequate muscle tone and strength at birth. This often causes them to maintain their bodies in extended positions<sup>6</sup>. Several approaches have been adopted by therapists working to optimize the development of the infant born preterm and low birth weight; One of the earliest problem oriented developmental intervention is neonatal massage and therapeutic positioning. Neonatal massage therapy is the process of using tactile and kinaesthetic stimulation through a variety of massage strokes. Vimala McClure the founder of Infant/neonatal massage brought the concept from India to United States in early 1970's and later founded the International Association of Infant Massage. Her theory of massage is called auditory, tactile, visual and vestibular (ATVV) multi-sensory intervention. This method uses not only moderate pressure strokes, but also natural maternal sensory stimulations<sup>7,20</sup>. Therapeutic positioning reduces the potential for acquired positional deformities that can effect motor development, play skills and social attachment<sup>3</sup>. The goal of therapeutic positioning for preterm and high risk infants is to provide adequate support and containment as indicated is to sustain flexed and midline postures in an attempt to minimize potential deformities and assist infants in remaining calm and organised<sup>3,21</sup>. Extended positioning can affect acquisition of developmental motor skills, hinder self-regulation<sup>8</sup>. Different interventions have been initiated to counteract the increased probability of adverse development in preterm and low birth weight infants<sup>9,23</sup>. Infant massage and therapeutic positioning are both independent developmentally supportive interventions

that have been documented for several decades to have a positive effect on preterm and low birth weight infants. Previous studies have examined the physiological benefits of infant massage in healthy, preterm and low birth weight infants. However, there are limited studies that focus on the combination of neonatal massage with therapeutic positioning and its impact on neurodevelopmental, neurobehavioral outcome. Yet the effectiveness of this intervention is inconclusive and therefore need further investigation. Hence this study aimed to addresses the role of early neonatal massage with therapeutic positioning in high risk infants. The general objective of this study was determine the effects of early neonatal massage with therapeutic positioning in preterm and low birth weight infants on neurobehavioral and neurodevelopmental status. The specific objectives were to understand the relation between individual characteristics - chronological age, birth weight and gestational age with the neurobehavioral and neurodevelopmental outcome. To estimate the relationship between Neurobehavioral and Neurodevelopmental outcome.

## METHODOLOGY

Study design was quasi-experimental study, the study type was pre test ,post test, sampling method was convenient sampling ,study setting was SRM Hospital and research centre Kattankulathur and Ashwini Hospital, Villupuram) in a semi-urban place in Tamilnadu. 30 pre term babies were selected .Inclusion criteria were Gestational age (GA) between 32 and ≤37 weeks, Birth weight of 1500 gm / 3 ½ pounds to 2499 gm. / 5 ½ pounds Chronological age ≤ 28 days old neonates , of drugs and From 1<sup>st</sup> day after birth and on enteral feed , Medically stable with no requirement discharge from NICU ,Absence of congenital abnormalities and neuromuscular disorders ,Optimal neonatal behavioural state i.e. awake, eyes open with min. movements and no crying. Exclusion criteria were Neonates with medical conditions such as respiratory distress syndrome, apnoea, elevated bilirubin, and mild hypoglycaemia and hypocalcaemia were excluded, Neonates having congenital anomalies, evidence of intraventricular haemorrhage grade three and above on ultrasound, CT scan, MRI or neurological examination, Neonates having fragile skin or skin disease since birth, pathological fractures, bony deformities and contractures. The data collection used was two standardized assessment for infants including preterm and low birth weight. Morgan's Neonatal Neurobehavioral Examination (NNE), Infantile Neurological International Battery (INFANIB). The study was approved by the Institutional Ethical Committee and informed consent was obtained from all the mothers involved in the study. Thirty preterm (32-37 weeks gestational age) and low birth neonates (1.5 to 2.5kg) of both sexes meeting the criteria were recruited. Infant Massage with therapeutic positioning were administered to the subjects weekly once for 30 minutes after taking baseline Neonatal Neurobehavioral Examination (NNE) and Infantile International Battery (INFANIB) scores. Neonates were massaged using Vimala's infant massage protocol and traditionally positioned while the mother was also present each time. During the protocol,

reaction to stimulation was continuously monitored for any adverse physical or behavioural signs. Mothers were subsequently advised to perform massage on their babies themselves at home, and their performance was evaluated for correct implementation. In the first phase of Vimala's neonatal massage protocol, infant was placed in supine position and massaged using cold pressed unscented oil- massage benefits are more pronounced when massage is combined with usage of specific oils in the following order<sup>7</sup>. Feet: from thighs to the knees to the legs (Indian milking) in both feet. Abdomen: ('I love you' method). Massage is performed starting from left-upper abdomen location right under the ribs downwards, then starting from right-upper abdomen exactly beneath the ribs to its opposite point, then down, and starting from right side under abdomen upward and continuously following the previous procedures. Chest: Centre of the chest to the sides, across rib. Face: from the center of forehead to the sides of face. Locations in front of ears and jaw were then massaged in a rotary scheme. Arms and hands: from shoulder to wrist, and from wrist to the fingers via rotating movements (Indian milking) in both hands. During the second phase, infant was put in prone position, and neck to the waist and vice versa was massaged with both hands in positioned in tangential position to his/her back, with movements in opposite directions. Traditional therapeutic positioning is followed with infant massage protocol after the first 15 minutes. This includes use of blankets and towel rolls in specific ways to facilitate containment and comfort positioning procedure protocol is advised in 3 positions supine, side lying and prone<sup>10</sup>. In supine rolls under the knees and boundaries at the arm allow physiological flexion position with upper and lower limb in midline. In side lying, a roll behind the head as it can overextend the neck and supporting a midline position and promoting fine motor skills and alternate left and right lateral positions with position changes. In prone- roll under the hips, providing boundaries (rolls) to the feet and arms with rolls/nests, alternate the head right and left in turn and tucking the baby in with a sheet or

blanket for extra security (Neonatal Network Board – positioning guidelines 2012). The protocols were carried out once a week for a total period of eight weeks. At two weeks interval subjects were reassessed using the outcome measures for eight weeks. Comparison was made between pre and post NNE and INFANI Neonatal Neurobehavioral Examination and Infantile Neurological International Battery were used for evaluation. The Neonatal Neurobehavioral Examination consists of 27 items divided into three sections: 1) tone and motor patterns, 2) primitive reflexes, and 3) behavioral response. The behavioral responses section consists of three subsections: (a) responsiveness, (b) temperament, and (c) equilibration (i.e., the ability to return to an emotional baseline). Exaggerated responses are considered as signs of neurological injury and this assessment is intended for use with infants 32 to 42 week's conceptual age<sup>11,12</sup>. Infant Neurological International Battery used in this study has 20 items where 14 out of 20 items in the INFANIB scale were applied to the neonates. Each item was scored as 1, 3 or 5 points. The cut off points for neonatal category was as follows: abnormal  $\leq 48$ , transient = 49-65, normal  $\geq 66$ . In this study the INFANIB range mean is 58.90, the minimum range is 46 and the maximum range is 65<sup>13,14</sup>.

## RESULTS

Data obtained were analysed both descriptively and analytically using SPSS Statistical Package version 17. Comparison of mean values between pre and post test scores was done using paired t-test. Analysis of variance was used to investigate changes in groups. Relationship between Chronological Age, Birth Weight, Gestational Age, Neonatal Neuro-behavioural Examination and Infant neurological International Battery was determined using Pearson Co-efficient Correlation. The significance was set both at  $\leq 0.01$  and  $\leq 0.05$ .

**Table 1**  
**Demographic characteristics of the subjects**

Variables	Mean±SD	
Chronological Age(days)	13.13 ± 8.085	
Gestational Age(Weeks)	35.03 ± .964	
Birth Weight(kg)	2.263 ± .14768	
Neuro Behavioural Baseline	52.10±4.957	
Neuro Developmental Baseline	58.90 ±4.700	
	Frequency (N)	Percentage (%)
Gender		
Male	15	50
Female	15	50
Mode of Delivery		
Vaginal	9	30
Caesarean	19	63.3
Forceps	1	3.3
Induced	1	3.3

*The table 1 classifies demographic characteristics of 30 neonates assigned for Neo-natal massage with therapeutic Positioning in preterm and low birth weight (32-37 weeks gestation & 1500gm ≤ 2500gm).*

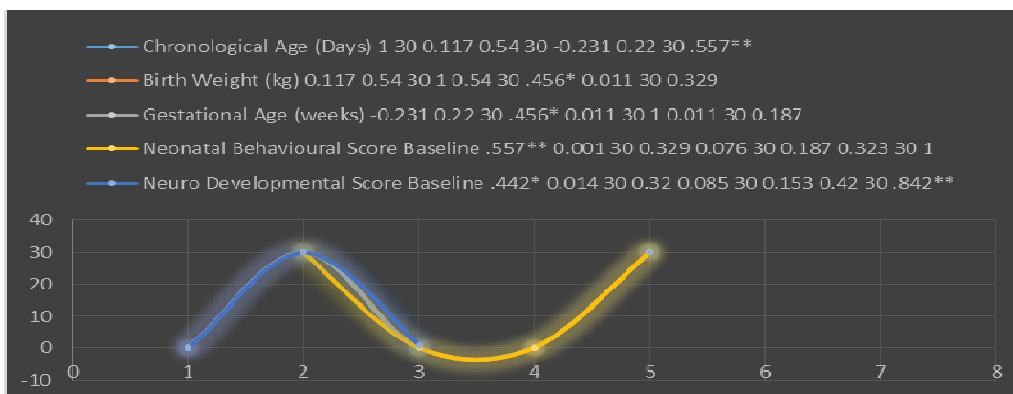
**Table 2**  
**Relationship between demographics and outcome measures.**

Demo graphs	Neurobehavioral(NNE)	Neurodevelopmental(INF)
Chronological Age r	.557	.442
p-value	.001	.014
Birth Weight r	.329	.320
p-value	.076	.085
Gestational Age r	.187	.153
p-value	.323	.420

**Correlation is significant at  $p < 0.005$**

The table 2 revealed that chronological age is significant to both neuro-behavioural scale ( $p < 0.05$ ,  $r = 0.557$ ) and Neurodevelopmental scale ( $p < 0.05$ ,  $r = 0.442$ ) However there is no significant correlation between birth weight and Gestational age with neuro behavioural and neuro developmental score.

**Graph-1**  
**Relations between demographics and outcome measures**

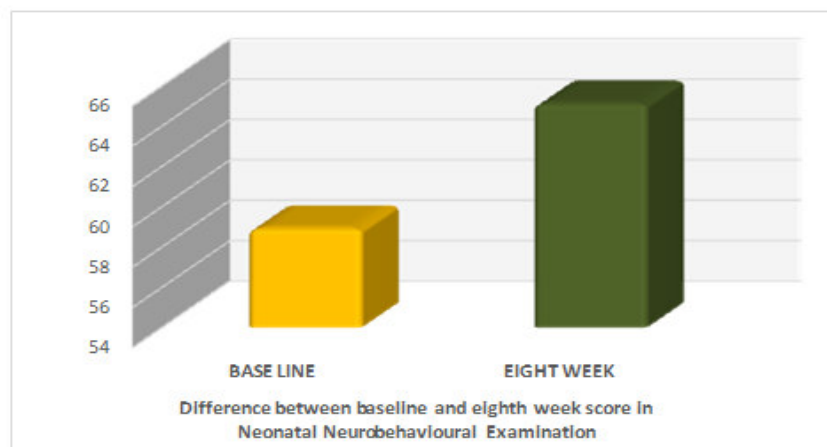


**Table 3**  
**Difference between nne baseline and subsequent scores**

	t value	p-value
Neonatal Behavioural Score Baseline	57.563	<0.05
Neonatal Behavioural Score 2 <sup>nd</sup> week	59.665	<0.05
Neonatal Behavioural Score 4 <sup>th</sup> week	62.827	<0.005
Neonatal Behavioural Score 6 <sup>th</sup> week	65.327	<0.005
Neonatal Behavioural Score 8 <sup>th</sup> week	68.949	<0.005

The table 3 reveals difference in baseline, second to eighth week with significant level  $p$ -value  $< 0.05$  and the  $t$ -value ranges from 57.563-68.949 in Neonatal Neuro Behavioural Examination.

**Graph 2**  
**Difference between nne baseline and subsequent scores**

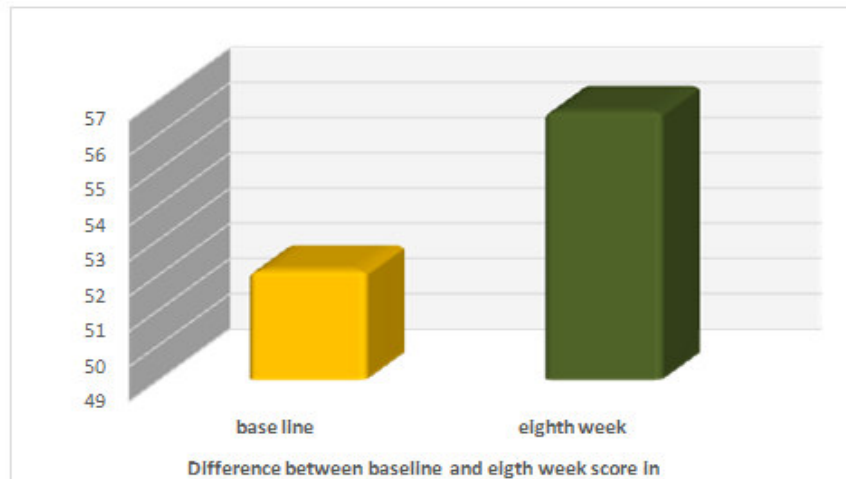


**Table 4**  
**Difference between infanib baseline and subsequent scores**

	t-value	p-value
Neuro Developmental Score Baseline	68.635	<0.005
Neuro Developmental Score 2	76.962	<0.005
Neuro Developmental Score 4	72.879	<0.005
Neuro Developmental Score 6	76.600	<0.005
Neuro Developmental Score 8	82.885	<0.005

The table 4 indicates difference in baseline, second to eighth week with significant level (p-value<0.05) and the t-value ranges from 68.635 to 82.885 in INFANIB.

**Graph 3**  
**Difference between nne baseline and subsequent scores**



**Table 5**  
**Comparison between nne and infanib baseline scores with their respective final scores**

	t	df	p-value
NNE BaselineVs Week 8	15.600	29	<0.05
INFANIB Baseline Vs Week 8	17.864	29	<0.05

The table 5 showed NNE baseline score and eighth week score is highly significant (p-value <0.05, t-15.600), apparently the INFANIB baseline score and eighth week score is highly significant. The Analysis shows that there is significant difference between baseline score and the final scores in both NNE and INFANIB.

## DISCUSSION

This study determined the effectiveness of Neonatal massage with therapeutic positioning in improving the neurobehavioral and neuro-developmental status of preterm and low birth neonates. Findings of this study showed a significant MNNE and INFANIB (Morgan's Neonatal Neuro Behavioral Examination and Infant International Neurological Battery) responses following eight weeks of neonatal massage with therapeutic positioning and alternate weeks of intervention, the subsequent NNE and INFANIB scores varies. A study identified that NNE scores were significantly higher on subscale after swaddling positioning i.e. change in active and passive tone in preterm infant<sup>15,27</sup>. Another similar trail that evaluated the effect of tactile stimulation using Braselton's neuro-behavior scoring demonstrated the beneficial role of infant massage in improving neuro-behavior of preterm<sup>16,28</sup> and in terms of orientation, range of state, regulation of state, and autonomic stability<sup>17,22</sup>. In the present study individual variables were also found to correlate with base line NNE and INFANIB scores particularly chronological age but, birth weight and gestational were not significantly correlated with either NNE or INFANIB score. Insignificance in

correlation may be due to small sample size and Mean (SD) gestational age and birth weight is 35±.964 and 2.263 ± .14768 respectively. The average gestational age are likely to be late preterm and are defined as those born at 34-0/7 to 36-6/7 week's gestational age (GA). Several studies have explored the benefits of providing touch and the results in most cases are promising; increased motor activity and decreased behavioural distress in premature infants<sup>18,29</sup>, infants who demonstrated increased alertness in response to touch are more likely to do well while unresponsive infants are likely to do less well<sup>19,22</sup>. Field T et.al, identified preterm infants who received moderate pressure therapy (5days) were less fussy, cried less and showed less stress behaviour and in another subsequent research it is proved that moderate pressure massage therapy group appeared to be more relaxed and less aroused than light pressure massage group<sup>18,30</sup>. Field in his studies proved the extraordinary effects of massage on growth and development of new born. Yet the evidence on the effectiveness on developmental care interventions for preterm and low birth weight neonates is inconclusive<sup>19,24</sup>. A firm belief in an intervention method, despite the absence of research evidence, is a well-known obstacle in the evaluation of

new forms of developmental care<sup>30</sup>. This is well suited for the current study as it is one of the initial attempts to prove the combination of two different developmental care interventions in moderate preterm and low birth weight neonates. Positioning of the preterm low birth weight infant has been cited as an important factor in shaping and aligning the musculoskeletal system, which may have implications for later motor development<sup>5</sup>, use of postural support rolls and postural support nappy improved hip posture in very preterm infants<sup>25,26</sup>. Chandria D. Nayak et. al states that incidence of low birth weight neonates were less in South India<sup>31</sup>. Neonatal positioning in preterm infants not only promote flexion and midline orientation, but also include prevention of head flattening, external rotation of the hips and symmetrical posture and movement<sup>32</sup>. Traditional positioning for preterm infants positioned appropriately had more variation in the velocity of movements, bringing hands to midline more than infants who didn't receive the intervention<sup>12</sup> however a recent study proved the effects of alternate positioning on preterm in NICU reduced asymmetry among infants<sup>8</sup>. Bhagya states that BERA is the only method to confirm the hearing ability of neonates<sup>33</sup>. This study outlines infant massage with therapeutic positioning has significance effects between pre and post intervention in improving neuro-behavioural and neurodevelopmental status of preterm and low birth weight infants. The difference between NNE and subsequent score t- value ranges from 57.563 to 68.949, with INFANIB and subsequent scores ranges from 68.635 to 82.885. Infant Massage and therapeutic positioning intervention is feasible to

implement in a community setting, and to be able to be generalized across different age groups in India and internationally. Overall the combination of neonatal massage with therapeutic positioning has shown significant effects in short period of time however the long term effects of infant massage and therapeutic positioning are important to investigate, there is currently no up to date available research on long term outcomes for both interventions.

## CONCLUSION

Neonatal massage with therapeutic positioning has significant effects in improving neuro- behavioural and neurodevelopmental status. The results indicate that massage is beneficial for stable preterm and low birth neonates. This is one of the attempts to assess neurobehavioral and neurodevelopmental outcomes in neonatal period. The impressive findings in this study warrant further research using randomized controlled trials (RCTs) with similar or same populations with control group, which could provide further support to the benefits of infant massage and therapeutic positioning. It is also suggested for future researchers to have larger sample size through the process of Randomization to minimize bias and to identify strong correlation in physical or demographic characteristics.

## CONFLICT OF INTEREST

Conflict of Interest declared none.

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### **Prof S Mercy Clara**

Professor in Physiotherapy, Madha  
College of Physiotherapy  
Madha Nagar ,Kundrathur,Chennai-69  
Tamil Nadu ,India.



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Drug Design Discovery & Development (C-  
4D) , SRM University, Delhi-NCR,Sonepat.



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