EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES

A Thesis

submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai

for the award of the Degree of

DOCTOR OF PHILOSOPHY IN NURSING

By

L. M. MAJELLA LIVINGSTON, M.Sc.(N), M.B.A.(HM)

Professor,
Nehru Nursing College,
Vallioor.

Under the Guidance of

Dr. C. NALINI JEYAVANTHA SANTHA, M.Sc.(N), Ph.D.,
Research Guide,
Sacred Heart Nursing College,
Madurai-625 020.

DECEMBER - 2014

CERTIFICATE

This is to certify that this thesis **“EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES” is a** bonafide work done by **L. M. MAJELLA LIVINGSTON** during the period 2010 to 2014. This has been submitted in partial fulfillment of the award of **Ph.D., in Nursing** by the Tamilnadu Dr. MGR Medical University, Chennai-600 032.

Prof. Dr. C. NALINI JEYAVANTHA SANTHA, M.Sc.(N), Ph.D.,
Principal,
Sacred Heart Nursing College,
Madurai.

CERTIFICATE

This is to certify that the thesis titled **"EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES"** hereby submitted by **L. M. MAJELLA LIVINGSTON** for the degree of **Ph.D., in Nursing** in the Tamilnadu Dr. M.G.R. Medical University is a record of bonafide research work carried out by her under our guidance and supervision during the period 2010-2014.

GUIDE

Prof.Dr.C.Nalini Jeyavantha Santha,M.Sc (N), Ph.D.,

Principal,

Sacred Heart Nursing College,

Madurai.

CO-GUIDE

Prof. Dr. Jeya Singh,MD,,DV., PhD.,

Former professor and HOD of STD,

Coimbatore Medical College,

Coimbatore.

DECLARATION

I hereby declare that this thesis entitled **"EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES"** is an original work done by me under the guidance of **Dr. C. NALINI JEYAVANTHA SANTHA, M.Sc.(N), Ph.D.,** Principal, Sacred Heart Nursing College, Madurai and has not been submitted elsewhere, either partially or fully for the award of any other degree, or diploma, Associateship, Fellowship or any other similar title.

L.M.MAJELLA LIVINGSTON, M.Sc.(N), M.B.A.(HM)
Professor,
Nehru Nursing College,
Vallioor.

ACKNOWLEDGEMENT

***"I thank you Lord, with all my heart, I sing praise to you before the Gods. I face your holy Temple, bow down, and praise your name because your constant love and faithfulness*". Psalms:138**

The satisfaction and pleasure that accompany the successful completion of any task would be incomplete without mentioning the people who made it possible, whose constant guidance and encouragement rewards any effort with success. I consider it a privilege to express my gratitude and respect to all those who guided and inspired me in the completion of this project.

I extent my respectful gratitude to **Prof. K.R.Arumugam, M.Pharm,** Correspondent , Sacred Heart Nursing College, Ultra Trust, Madurai for his support and for providing required facilities for the successful completion of this study.

I express my deep sense of gratitude to my guide**, Dr. C. Nalini Jeyavantha Santha, M.Sc (N), Ph.D.,** Principal, Sacred Heart Nursing College, Madurai for laying strong foundation in molding in this thesis by giving her expert guidance, immense patience, special care with her rich and varied experience in research, valuable suggestions and help rendered at every step of this study.

I convey my special thanks to **The Dean and HOD of pediatrics, Kanyakumari Govt. Medical College Hospital, Asaripallam** for granted permission me to conduct the study and provided necessary support throughout my data collection period.

I also express my deep sense of gratitude to my Co- Guide **Dr. Jeya Singh, MD., DV.**, **Ph.D.,** Former professor and head of STD Department, Coimbatore Medical College, Coimbatore for his active guidance and valuable suggestions and time spent in every step of this study.

I extend my sincere thanks and gratitude to **Dr. Paul Kumaran, Ph.D.**, ICMR for extending necessary guidance and help.

I am also indebted to **Dr. Pethuru Devadhasan, M.D.,** Professor, Department of Community Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam for his guidance ,criticisms, constant encouragement, moral support, valuable suggestions and helpful criticisms on this study.

I extend my sincere thanks and gratitude to **Dr. Sebastian, Ph.D**., Professor, St. Xavier's Catholic college of engineering for helping me with his brilliant editorial skills.

I wish my sincere thanks to **Dr. Margret Ranjitham, M.Sc.(N), Ph.D.,** Principal, Nehru College of Nursing for her valuable guidance and constant support for the successful completion of the study.

My sincere thanks are due to **Dr. Chandrakala M.Sc.(N), Ph.D.,** Vice Principal Sacred Heart Nursing College, Madurai for their constant encouragement and timely expert guidance.

I owe my thanks to all the **Ethical Committee Members** of Sacred Heart Nursing College, Madurai for providing me an opportunity to undertake this study.

I wish to express my sincere thanks to **Dr. Suresh Balan, M.D.,** Associate Professor and HOD, Department of Community Medicine, Kanyakumari Government Medical College, Asaripallam for his valuable support & suggestions for the successful completion of this study.

I wish to express my sincere thanks to **Dr. Alber M. Mathiarasu, M.D.,** Assistant Professor, Department of Community Medicine, Kanyakumari Government Medical College, Asaripallam for his valuable support, guidance, criticisms, constant encouragement, moral support ,help and concern rendered in each and every step for the successful completion of this study.

I am grateful to **Dr. Suguna, Ph.D.,** Professor, Sree Mookambika College of Nursing, Kulasekharam for her help and advice for the successful completion of the study.

I wish to express my sincere thanks to **Prof. Kumar**, Bio-Statistician, Department of Community Medicine, Sree Mookambika Institute of Medical Sciences, Kulasekharam for his valuable guidance.

I am very grateful to my parents **Rev.Fr. Lord. M. Winner, CMF.** Mission Procura, Ranchi for their constant support, prayers and encouragement throughout this endeavor.

I am very grateful to my parents **Mr. V. Louis Raja Retnam and Mrs. S. Mary Joice, My sisters and brother** for their constant support, prayers and encouragement throughout this endeavor.

I extend my sincere thanks and gratitude to **Mrs. Merlin Anand, M.E.,** Professor and HOD, St.Joseph College of Engineering, Chennai, for helping me with his brilliant editorial skills.

I extend my sincere thanks and gratitude to **Dr. Jenila Frank, Ph.D.,** Professor, VIT, Chennai, for helping me with his brilliant editorial skills.

I extend my sincere thanks and gratitude to **Mrs. Jobin prakash, M.Sc.(N),** Nursing Supervisor, Kuwait, for the advise and help for successful completion of the study.

I extend my sincere thanks to **Mr.C.A.S.V. Vijilius,. Ph.D. scholar** in England, for the advise and help for successful completion of the study.

I extend my sincere thanks and gratitude to **Mr. L. G. X. Agnel Livingston, M.E**, **M.B.A.** Professor, St. Xavier's Catholic college of engineering for helping me with his brilliant editorial skills.

I also wish to express my sincere thanks to **Mrs. Parvathi,** Sacred Heart Nursing College, Madurai for their valuable suggestions and guidance.

I am grateful to the **library staff** of Sacred Heart Nursing College, Madurai for granting permission to utilize the library facility.

It is my pleasure and privilege to express my sincere gratitude to **the panel of experts** for their suggestions, and valuable recommendations which guided me to refine the tool.

I am very thankful to **Mr. N. Babu, Computer World,** Ramanputhur, Nagercoil for DTP work and bringing out this dissertation in printed form.

I am very thankful to my children **A. John Prasad Alber and A. Jain Prasad Alber** for their sincere co-operation in the completion of my thesis.

I express my gratitude to all **Co-Ph.D. scholars** and my friends for their love and support throughout the study.

Also I am thankful to all **parents / caregivers** of preterm neonates who enthusiastically participated in this study.

Mrs. L. M. MAJELLA LIVINGSTON

ABSTRACT

The present study evaluates the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates admitted in selected hospitals at Nagercoil.

Introduction

Prematurity is defined as babies born alive before 37 weeks of gestation. Since preterm neonates offers less time of growth or development in the uterus of mother the internal organs are not matured fully. Due to this, it will take few more weeks to the preterm neonates in the NICU for further maturation of organs to lead a life without medical care .So the infant needs special care in the NICU until the organs have developed enough to keep the baby alive without medical support. This may take weeks to months. In the NICU preterm neonates are repeatedly subjected to painful, intrusive procedures develop touch aversion and exposed to noisy monitor sounds develop noise aversion. Gentle tactile and auditory stimulation reduce infant morbidity and mortality rates and helps to maintain the normal physiological parameters.

The aim of the study was to evaluate the effect of tactile and auditory stimulation among preterm neonates and those who received it will experiences more significant weight gain, stable temperature, stable heart rate, stable respiratory rate, oxygen saturation, improved feeding pattern, increased sleeping time, decreased crying spells and increased urination compared to control group.

Objectives

1. To assess the pre and post intervention physiological parameters among experimental group of preterm neonates who had tactile & auditory stimulation
2. To assess the pre and post intervention physiological parameters among control group of preterm neonates

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

4. To find out the association between the physiological parameters after tactile & auditory stimulation & selected demographic variables such as gestation weeks, age, sex, birth weight of the baby, APGAR score and mode of delivery.

Methodology

A quantitative research approach with true experimental research design was adopted for this study. 120 preterm neonates who got admission and present in the NICU or postnatal unit of KKMCH, whose age is between 10 to 24 days, with 5 minute Apgar score of 6 or more, physically stable preterm babies with the birth weight of 1000 gram to 2000 gram were selected as study samples. Among them 60 preterm neonates were assigned in experimental group and 60 preterm neonates were assigned to control group randomly. Preterm neonates in experimental group received tactile stimulation by using coconut oil along with auditory stimulation in the form of lullaby by using Neelambari raga for 10 minutes twice a day for 5 consecutive days. The changes in physiological parameters were assessed before, during (3^{rd} day) and after (5^{th} day) the intervention period in both groups. The tool was developed, validated by experts and checked for its reliability (Physiological parameters: Weight: r = .705, Temperature: r = .658, Heart rate: r = .845, Respiratory rate: r = .736, Oxygen saturation: r = .622, Structured Interview Schedule: r =

.746 and the internal consistency of the tool (r = 0.95)) before applied to collect data from samples.

Results

The results found that the preterm neonates, who received tactile and auditory stimulation achieved weight gain (t = 35.368), stable temperature (t = 55.865), stable heart rate (t = 40.948), stable respiratory rate (t = 41.078), stable oxygen saturation (t =43.937), increased feeding pattern (X^2 = 26.612), increased sucking pattern (X^2 = 30.572), increased duration per sleep (X^2 = 43.364), increased sleeping pattern (X^2 = 56.885), decreased crying pattern (X^2 = 48.553) and increased urination pattern (X^2 = 58.989) than control group preterm neonates. These results were statistically significant at 0.05 level. The present study findings concluded that the tactile and auditory stimulation had positive effects on growth and maturation in preemies.

Recommendations

Tactile and auditory stimulation can be used in any clinical and community settings to maintain the physiological parameters among preterm and term neonates.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

S.No	Abbreviations	Expansion
1	NICU	Neonatal Intensive Care Unit
2	CNS	Central Nervous System
3	Kg	Kilogram
4	cm	centimeter
5	HIV	Human Immunodeficiency Virus
6	HBsAg	Hepatitis B surface Antigen
7	IVC	Intra Venous Catheter
8	USA	United States of America
9	NNF	National neonatology Forum
10	RDS	Respiratory Distress Syndrome
11	CLD	Chronic Lung Disease
12	BPD	Broncho Pulmonary Dysplasia
13	NEC	Necrotizing Enterocolitis
14	GI	Gastro Intestinal
15	GER	Gastro Esophageal Reflux
16	IVH	Intra Ventricular Hemorrhage
17	ROP	Retinopathy of prematurity
18	CO_2	Carbon Di Oxide
19	WBC	White Blood Cells
20	PAC	Pacifier Activated Lullaby
21	Bp	Blood pressure
22	ACTH	Adrenocorticotrophic Hormone
23	ANS	Autonomic Nervous System
24	O_2	Oxygen
25	ANC	Antenatal case
26	SES	Socio Economic Status

S.No	Abbreviations	Expansion
27	PDA	Patent DuctusArteriosus
28	ADHD	Attention Deficit Hyperactive Disorder
29	SIDS	Sudden Infant Death Syndrome
30	ICT	Intra Cranial Tension
31	PaO_2	Partial Oxygen
32	C	Centigrade
33	F	Fahrenheit
34	CPAP	Continues positive Airway Pressure
35	ETT	Endo Tracheal Tube
36	IV	Intra Venous
37	ml	milli liter
38	CBF	Cerebral blood flow
39	+ve	positive
40	-ve	negative
41	FiO_2	Fraction of Inspired Oxygen
42	KMC	Kangaroo Mother Care
43	GHT	Gentle Human Touch
44	RCT	Randomized Control Trial
45	MT	Massage therapy
46	ECG	Electro Cardio Graphy
47	EGG	Electro Gastro Graphy
48	MAC	Mid Arm Circumference
49	CPK	Creatinine phosphokinase
50	HRV	Heart rate variability
51	SPO_2	Saturation of peripheral Oxygen
52	dB	decibel
53	CGA	Corrected Gestational Age
54	MMS	Maternal Sound Stimulation

INTRODUCTION

"***Touching and hearing are the first two communications a baby receives,***

The first languages of its development are through the skin and ear"

1.1 BACKGROUND OF THE STUDY

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. When the baby is born much in advance than expected and when it is very little and weak, the challenge to regulate the extra-uterine life is greater than for normal term babies. In general, the nearer they are to the normal term newborn in gestational age and birth weight, the easier will be their regulation to the external environment. 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 children are born too early. According to health care professionals preterm is defined as babies who are not in mother's uterus for full term of 38 – 42 weeks and also those births less than the 37th week of pregnancy[2] are called premature birth and such a baby is considered preterm. It offers the preterm neonates lower period to ripen in the uterus. Preterm children, particularly those have been given birth much earlier would be convoluted with higher medical issues.

These preterm babies are classified into four subtypes according to weeks of pregnancy[3]:

1. **Late preterm babies** - delivered amongst between 34 and 36 weeks.
2. **Moderately preterm babies -** delivered amongst between 32 and 34 weeks.
3. **Very preterm babies** – delivered amongst lesser than 32 weeks.
4. **Extremely preterm babies –** delivered earlier than 25 weeks.

Maximum preterm babies born in the period of late preterm.

The causes for pre-term deliveries include diabetes, hypertension, maternal stress and infection. Influences such as improper pregnancy preparation, early or late pregnancies and supported reproductive therapies also contribute 25 to 30% of pregnancies ending in premature deliveries.[4] Dissimilar pregnancy-related difficulties upsurge the danger of premature deliveries with the features of undermined cervix which opens before time, uterine delivery imperfections, premature births in past times, infectivity of genitourinary tract or infectivity of membranes carrying amniotic fluid in mother's womb, pregnant mothers malnourishment in the ante natal or post natal, pregnancy induced hypertension and albumiunria which progress after the 5th month of antenatal period and early membranes separation. The additional influences that enhance the threat for premature labor consist of : early primigravidae below sixteen years and elderly multigravidae of more than thirty five year, racial predominance of the United States of American blacks, absence of care in pregnancy, poor's with lower education, lesser income with low profile jobs and consumption of tobacco products, usage of narcotics or CNS stimulants dependence drugs.[5]

The characteristic features of preterm neonates are small size with excessively large head, shriller looking, less plump appearance because of absence of adipose tissues, lanugo wrapped on more parts of body surface, hypothermia due to deficiency of deposited fat in the body, strenuous tachypnea, feeding complications due to absence of sucking reflexes, enlarged clitoris in female neonates, neuromuscular tone not as good as term babies and fewer movement than forty weeks normal new born , in male neonates soft undersized scrotum with absence of ridges and congenital absence of descend in testes, lenient, stretchable ear cartilage and slender, soft, glossy skin with visible veins below skin.[6]

Anthropometric measurements by gestational age [7]

Gestational age	**Weight in Kg**		**Length in cm**		**Head circumference in cm**	
	Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
40 weeks	**3.6**	**3.4**	**51**	**51**	**35**	**35**
35 weeks	**2.5**	**2.4**	**46**	**45**	**32**	**31.5**
32 weeks	**1.8**	**1.7**	**42**	**42**	**29.5**	**29**
28 weeks	**1.1**	**1.0**	**36.5**	**36**	**26**	**25**

Birth weight of the child is more specific indicator than the biological immaturity which is the chief concern in deciding future health related development in preterm babies. Full term neonatal mortality rate is much lesser than the preterm neonatal mortalities and more than 50% of death among neonates is due to prematurity.[8] Since preterm babies are born too soon their lungs, liver, eyes and CNS do not work properly. This can result in serious difficulties such as infection in the blood stream, hypothermia, hypoglycemia, hyperbilirubinemia, intra ventricular bleeding respiratory distress syndrome etc., after they are born. Only few preterm neonates face serious medical problems but they will be forced to face many acute and chronic medical diseases in later life. Preterm babies delivered too early will face more serious medical problems than the babies delivered in the late preterm period. Few difficulties may be congenitally detected, whereas many progress only in late life[9]. Quality and skilled nursing care with combined effects of preventive, promotive, curative, rehabilatative medical treatment will save enormous number of sick preterm babies. Since the preterm neonates are delivered too early they get only lesser protection by uterus and the extra uterine external environment will be exposed to them earlier in life which will become an additional threat to their health. Hence, the most personalized intensive care is needed to help them to face massive developmental challenges as they enter the world.

Medical treatment of premature infants should be performed in 3 steps

1. Immediate neonatal resuscitation in the delivery room

All newborn infants should be measured and resuscitated as necessary according to the hospital guidelines. Prior groundwork of both equipment and personnel is critical for success. Resuscitation should contain clearing of the airway, proper head positioning and provision of warmth, drying the baby, suitable stimulation and assessment of breathing, heart rate, and colour. In preterm neonates born at 24 to 36 weeks' gestation, postponing cord clamping for 30 to 120 seconds is accompanied by less need for transfusion, circulatory stability, less intraventricular haemorrhage, and lesser risk for necrotizing enterocolitis. Many premature infants will necessitate respiratory support proximately after delivery, as they manifest signs of increased work of breathing (e.g., nasal flaring, retractions), apnoea, or cyanosis. Distribution of respiratory support can be accomplished via oxygen administration, positive pressure ventilation (PPV) by mask, CPAP or bag-mask-valve, or intubation. Premature infants require smaller face masks and endotracheal tube sizes and can suffer severe long-term significances from excessive ventilation or hyper-ventilation connected with aggressive bagging. Once the neonate has been sufficiently resuscitated it should have systematic physical examination by using the New Ballard exam and it should be commenced to enable estimation of gestational age and identification of any potential abnormalities (e.g., dysmorphic signs, congenital defects). The degree of prematurity in most cases directly associates with the extent and severity of acute medical conditions.

2. Subsequent management[10]

Management of acute medical problems universally connected with premature birth should be addressed in consultation with a neonatologist once effective resuscitation and stabilization have happened. Active treatment of severe diseased conditions at the beginning state which are associated with preterm such as tachypnoea, septicaemic infections, impaired glucose metabolism disorders, malnutrition, hypothermia and cardiovascular diseases is important. Each preterm neonate should be appraised cautiously and managed separately with individual care.

3. Treatment of preterm neonates after stabilizatioin and changed to the neonatal intensive care unit

Mother's pregnant record, blood grouping & Rh typing, congenital malformations in fetus scanning, mothers HIV status , group B beta hemolytic streptococci infection , chicken pox and Australian antigen (HBsAg) screening, time difference between membrane rupture and labour, meconium staining of liquor amni, fetal sufferings inside uterine cavity and spinal or general anesthesia given to mother during labour should be noted. In stable preterm infants kangaroo mother care improves patient outcomes and parent-infant bonding. It shortens hospital stay by more breast feeding and establishing close contact between mother & baby skins.

So effectual neonatal care can speed up growth and survival of neonates. Accessibility of sophisticated high technology has helped in the care of preterm and sick neonates, but technology should not become an obstacle to the communication, compassion and anxiety of the treating team and the family[11]. Premature birth places them in a most unnatural environment and forces them to adapt to much different array of stimuli and circumstances than that of the womb. Preterm babies in NICU are touched recurrently as part of the necessary caring for treatment and nursing care. They frequently come across this form of touch upsetting and troubling. Also, preterm neonate is unprotected to abundant stressors in NICU with noisy atmosphere, high voltage illumination, take serum for various investigations and invasive diagnostic events. Thoman. E stated that the physiological and environmental features push the preterm neonates to the poorly organized states which could be measured by the cues like less quiet sleep, high arousal of cry, poor feeding and struggling to gain weight, as these variables also important factors that lessen the survival rate of the child. Prolonged or vigorous cry may complicate the neonatal adaptation because it blocks deoxygenated blood flow through the IVC and re-establishes fetal circulation with in the heart. Due to this very less pure blood passed into the systemic circulation via foramen ovale resulting in hypoxia and unstable heart rate is inevitable.

The adjustments in physiological activities and psychosocial behavior should be synchronized by preterm babies soon after birth.[12] When the preterm neonates are placed in NICU after birth, where the environment has no clearly marked diurnal time in terms of loud noise, high illumination or in care giving actions, it affects the preterm neonate's biorhythms that impacts sleep regulation. This ultimately leads the preterm neonates to the state of self- disorganization. Also tiny preterm neonates may require specialized feeding procedures because they are too immature to suck well. This invariably affects bonding and nutritional status which ends up in lowered weight and increased risk of developing failure to thrive in preterm neonates.

A condition of relaxation possibly will facilitate the preterm neonates, capacity to normalize their behavioral condition even with the harmful environment stimuli in the NICU.[14] A state of relaxation may facilitate the preterm neonate's, ability to regulate their behavioural state organization despite the noxious environmental stimuli in the NICU. Neonates, even the sick and tiny seem to benefit from nurturing stimulation derived from the human contact. Since preterm neonates are born before critical aspects of brain development are completed, their experiences after birth have the potential for influencing the subsequent brain development. The brain responds to stimulation in two different ways: presence of stimulation facilitates the formation of connections between neurons, and the absence of stimulation results in selective cell death. The stimulation experienced by preterm neonates may contribute to physiological and behavioural improvement which helps in their anatomical maturity of all the systems.

Touch has the unique effects on the human organism. All neonates including the smallest and sickest need loving human contact.[13] Stressors can have negative effect on the neonate's immune systems, where the tactile stimulation can be favorable since it reduces tension and improves immune system. 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 sensations that take part a significant responsibility in the maturity of the infant. The skin has intimate contact with the Central Nervous System (CNS).

Massage is the language of touch. Massaging babies has been a key factor of child rearing practices in several customs; mainly in India[15]. Touch is one of the essential human needs. Touch is the first sense that develops in human and it may be the very last to fade. Touching induces oxytocin, the "bonding hormone / the hormone of love and attachment," which is prominent for lowering tension, decreasing blood cortisol and rising a sense of faith and protection that's renowned for reducing stress, lowering cortisol levels and increasing a sense of trust and security. "Hugs strengthen the immune system," "The gentle pressure on the sternum and the emotional charge this creates activates the Solar Plexus Chakra. This stimulates the thymus gland, which regulates and balances the body's production of white blood cells, which keeps you healthy and disease free."Infants and children who endure a deprivation of touch normally experience behavior abnormality in the later years. Reaction to tactile stimulation has been observed by ultra sound as early as on the eight week of completed conceptual age. Most of the fetal body is responsive to touch by 15 weeks of gestation. Hence, touch is believed to be the first sense of embryo**.** Tactile verge is very low in the preterm infant, although touch of any kind is considered to be therapeutic. Skin generates a lot of sensation. When the skin is gently and knowingly stimulated through touch, which in turn stimulates the receptors where the information travels along the nerve network to the brain reaching the co-ordinating system. The effect on the whole person is instant.

Stroking or massaging the preterm neonates makes a delightful contact and afford them with the state of satisfaction and improves affection[13]. Researchers have confirmed that preterm neonates getting usual care in the health facilities had tachycardia and hypoxia. During massage, it has been reversed. They got normalization of heart rate and increasing blood oxygen saturation signifying that the massage had the qualities of calming and soothing.

Massaging is the logical exploitation of body soft tissues as the principle to stabilize those tissues and consists of physical procedures that comprise constant or variable pressure application or making different body movements.[16] Falling into the standard variety for dimension is an excellent beginning for a child below one year, signifying high-quality health. Usage of lubricant in massage therapy reduces the friction between the surfaces in the premature neonate. In order to choose appropriate lubricant- availability, cost, and safety need to be considered. Among all the lubricants, coconut oil and safflower oil have been most commonly mentioned in literature about infant massage therapy. Tactile stimulation (A type of massage therapy) is thus an intervention that may be useful in premature neonates and newborns with low birth weight because it enhances child development, including brain, physical, emotional, mental and social development.

Studies showed that tactile stimulation (massage therapy) along with auditory stimulation (music therapy) is more effective than tactile stimulation alone because music is a skill variety whose standard is resonance and calm. Auditory stimulation has been used as a curative energy for centuries. [(18)] Song and music alleviate diseases of the mind (Aesculapius). Music exaggerates the feeling and controls the nature of a person (Plato). It affects the character and is a power that purifies the sensation of feeling (Aristotle). Harp instrument was played by David to relieve King Saul from bad spirit in Biblical era. Mental patients were treated by playing music by Hippocrates around 400 B.C. Music rooms were constructed by Arabians in thirteenth century for management of ill health individuals. In the USA, the natives were practicing medicine and they were frequently engaged in chants and dances as a method of curing diseased persons.[17] During the World War I & II, European musicians played music to reduce the pain & sufferings in those affected by war injuries like lacerated wounds, fractures and those who were affected by psychiatric problems in England.

Listening to music starts inside the womb. Sound was heard for the first time when the fetus reached sixteenth week of its gestation encircled by liquor amni.[19] Hence, it is believed that the second sense of human is hearing. It hears maternal cardiac pulsations which are going up and down, external music, person's discussions and surrounding sounds. Thus, it is also one among the basic human needs.[20] Fetus hears music. Babies identify and utter a first choice for music they experienced in the uterus. Around 20 weeks of gestational age the auditory system of the fetus is completely well-formed. Auditory stimulation for preterm babies is classically aimed at assimilating and raising the babies' acceptance and enhancing the power and pace of sucking, in order to encourage development in babies. Auditory stimulation is a process involving personal relationships between two persons in which the treating person brings into play all the features of music to aid patients to recover or preserve their wellbeing. Persons belonging to different age groups practice music therapy to recover from their illness involving sensory problems, growth disorders, learning disabilities and psychological problems. It increases learning abilities, builds self admiration, decreases tension, improves bodily exercise and assists a congregation of all behaviors leading to positive health.

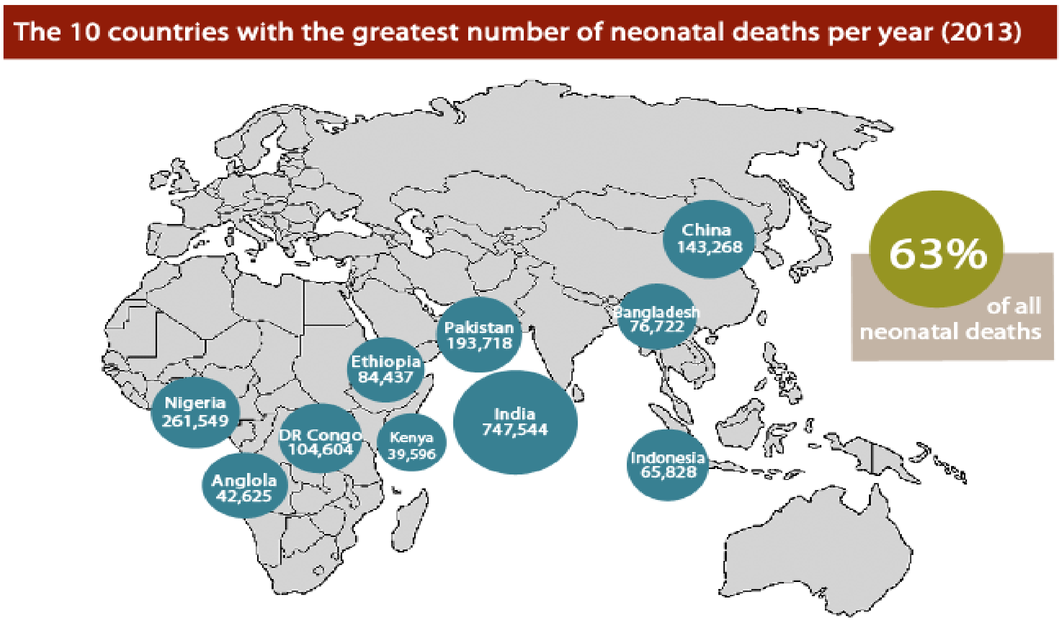
Playing specially selected music raga that is soothing, like a lullaby that support one's senses, is Neelambari.[21] This is a raga that is associated with relaxation, peace, and slumber. This raga brings forth piety, devotion, and maternal instincts in one's heart . Any kind of tune can be played in 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 Neelambari characterizes 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. Some other positive effects of listening to good music include reassuring and distracting from problems. When the preemies first arrives in the NICU he or she is encircled by unfamiliar sounds and lies alone on a rigid, motionless mattress. Nurses working in the NICU play a vital role in providing an individualized complete care which includes tactile and auditory stimulation to prevent neonatal morbidity and mortality.

1.2 SIGNIFICANCE AND NEED FOR THE STUDY

Preterm birth, defined as childbirth occurring at less than 37 completed weeks or 259 days of gestation, is a chief contributing factor of neonatal mortality and morbidity and has long-term adverse significances for health.[22, 23, 24] Compared to normal full term neonates, the preterm neonates expend an huge energy expenditure to maintain normal equilibrium of all the systems frequently in less than ideal circumstances because preterm babies have greater chance of getting respiratory distress ,cerebral palsy, dyslexia and sensory deficits equated with the babies born at full term. The diseased pattern connected with preemies frequently goes to future life, causing in huge bodily, mental and financial costs.[25,26]

The rate of premature birth about the world is increasing fast. Prematurity contributes to 28% of all preterm neonates death in the first week of life though most of the early preemies mortality are due to congenital malformations. [27] In developing countries preterm deliveries are very common compared to 5% to 7 % in developed countries. [28] 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 own country. In 2010, India ranked first in the world in giving birth 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%[29]. Globally, India accounts for the maximum number of newborn mortality. Newborn mortality estimated in India during the year 2011 was **8,76,000** accounting for 30% neonatal deaths globally and 53% of under-five mortality in India. [27]



Source: The UN Inter-agency Group for Child Mortality Estimation, 2014

The above figure shows that India has high neonatal death. Due to this, India is facing a high challenges in newborn health care than any other countries in the world. As India is taking care of neonatal diseases in better way, neonatal mortality is still a serious problem in building up a increasing percentage of under-5 deaths.

When we compare the states among India, [29] Jammu & Kashmir has the highest distinction of top with 82.1% neonatal mortality in the deaths of the children under one year followed by Maharashtra (78% neonatal mortality), Himachal Pradesh (77.5% neonatal mortality), Punjab (74.2% neonatal mortality), West Bengal (74% neonatal mortality), Rajasthan (73.4% neonatal mortality) and Madhya Pradesh (70.8% neonatal mortality). Tamil Nadu (16 %) neonatal mortality ranked among the best states in India in terms of human development, still it needed to reduce its infant and maternal mortality rates. In **Tamil Nadu** around 20 per cent of women go for pre-term birth.[101] According to WHO survey 2012 the major causes of neonatal mortality were prematurity (15%), pneumonia (13%), birth asphyxia (10%), diarrhea (9%) and neonatal sepsis (7%). Dr J Kumutha, secretary of NNF, Tamil Nadu chapter said, "Neonatal infant mortality rate (babies aged less than 28 days) is 24 per 1,000 and the infant mortality rate (below one year) is 17 per 1,000. Dr.M K C Nair, national president of the National Neonatal Forum (NNF) reported that newborns aged from one day to one week are more prone to mortality. "Term, premature and low weight babies are more vulnerable to mortality, because neonatal care poor in Tamil Nadu. [30]

Thus, the health of premature babies is undoubtedly one of the most significant health challenges facing the developing countries especially in India. A preterm birth is never simply a medical problem. Because preterm infants are born before critical aspects of anatomical and physiological developments are completed.

DEVELOPMENTAL IMMATURITY UPSETS AN EXTENSIVE RANGE OF COMPLICATIONS IN THE ORGAN SYSTEMS

Lungs and Respiratory System[31]

Gas exchange is the principal function of the lung. The breathing movements of the fetal originate at 10 weeks of gestation. In the lung development, in and out amniotic fluid breathing is the vital for the inspiration. The movements of the fetal breathing tends to be inconsistent and happen only up to 30 weeks of gestation (30 to 40%). In immature lungs (pulmonary hypoplasia) there was a failure of the movements of the fetal breathing and/or deficiency in and out amniotic fluid breathing which can be incompatible with extra uterine life. The lungs create surfactant by nearly 30 to 32 weeks of gestation that helps to keep alveoli open. Infants breathe with their terminal bronchioles and primitive air sacs due to the scarcity of alveoli if they born earlier than 28 to 30 weeks gestation. In the near term delivery, even the breathing was more continuous and regular, transient apnea was common due to undeveloped regulatory systems.

Respiratory Distress Syndrome [32,33]

RDS has the prevalence of 24,000 infants / year. It commonly occurs in 80% infants born before 27 weeks of gestation. The main cause of RDS is surfactant deficiency. The occurrence of respiratory distress syndrome raises with lowering gestational age although respiratory distress is smaller amount in the newborns born at gestation age of 33 to 36 weeks and is occasional in -term infants, with a 5% death rate . Immediately after birth, preemies with respiratory distress syndrome progress fast breathing, mild bluing skin color, grunting and reduced breath sounds. Due to this preemies need more work for breathing. As consequences of stiff lungs, respiratory failure occurs due to fatigue, hypoxia, apnea or alveolar air leakage which needs high positive pressure aeration.

Bronchopulmonary Dysplasia and Chronic Lung Disease (CLD) [33]

The Chronic Lung Disease that occasionally develops respiratory distress syndrome in preterm neonates is the bronchopulmonary dysplasia. These are slowly progressive lung disorder that develops due to inflammation, partial healing and scarring of the upper and the lower airways including alveoli. It is connected with growth and neuromaturation hitches during infancy. The main cause of broncho pulmonary dysplasia and chronic lung disease is the lung prematurity and the secondary causes including high positive pressure O_2 saturation, inflammation and infection triggers all subsidize to lung injury. [34, 35] Two studies had been conducted in preterm infants in which one study concluded that the O_2 and ventilator requirement were increased in the babies who was treated with steroids for longer duration. In the another meta analysis study of 40 RCT studies concluded that the systemic steroids in preterm neonates increases the gas exchange, shortening days of mechanical ventilation and a decrease the incidence of broncho pulmonary dysplasia or chronic lung disease but adverse effects including impaired glucose metabolism, hypertension and failure in growth. and development increases in preterm. [36,37]

Apnea[38,39]

Preterm neonates respiration cessation for twenty seconds or more, occasionally complemented by decrease in heart rate. Prematurity of respiratory control is the main problem of cessation of respiration and decrease in heart rate bradycardia, occasionally preemies have obstructive apnea. They necessitate continuous watching but generally respond quickly to moving stimulation. Positive-pressure breaths may seldom given to make them starts breathing again.

Preterm apnea was treated by number of modalities of management techniques. Methylxanthines is the principal drug used in the management of apnea in preterm neonates. Both caffeine and theophylline are successful, but caffeine has decrease adverse effects toxicity.[40.]

Gastrointestinal System[41]

The gastrointestinal tract with its principal function of digestion and food absorption also deals with the endocrine and immune function which have been regulated by the nervous system. Embryologically GI tract develops at the age of fourth week of gestation and the gastic part and enteric part are developed completely by 20 weeks of gestation[42,43.] After 15 weeks of gestation, the intestines were increase in twofold length and became 275 cm at term. At 9 weeks of gestation, intestinal absorptive cells ,endocrine and immune roles begin. At the 7 to 12 weeks of gestation, taste buds formation done. Since specified cells are not completely functional in preterm neonates their was a lack of digestive nutrients .

Necrotizing enterocolitis (NEC) is the inflammation and injury to the mucosa lining of bowels of sudden onset which further causes damage of the small or large intestines functions in preterm neonates. Incidence is 3% in preemies delivered before 33 weeks of gestation and in 7% of preemies with birth weights lees than 1,500 grams. [44,45,46] It spontaneously develops within two weeks of birth and presents as abdominal swelling, digestive complications including poor feeding, signs of hypotension, sepsis and shock. Antibiotics treatment of affected preemies with bowel rest.

Significant disease can develop stricture, surgical intervention will correct this leading to fruitful enteral feeding. Extensive GI tract involved neonates are critically ill and resection and anastomosis surgery will cure it but malabsorption are common even after they have recovered. Occasionally, leaving small part of intestine will affect growth and development. Long-term morbidities are failure to thrive, malabsorption syndromes, poor nutrition, liver failure and surgical procedures includes ileostomy & colostomy which require prolonged parenteral nutrition, and multiple hospitalizations.

Gastro esophageal reflux (GER)[47] Gastro esophageal reflux presents as frequent regurgitation which is common in preterm neonates and full-term infants. It affects growth and health of the preterm neonates and infants. Medical management includes H_2 blockers or protein pump inhibitors which in turn raises susceptibility to infection via the GI tract and GI motility have also been increases by the prokinetic compounds. The effectiveness and safety of these medicines were not yet established, but rarely surgery correction may be necessary mainly in babies with severe broncho pulmonary dysplasia or chronic lung disease.

Skin

Skin, develops at 6 weeks of gestation and it is a significant barrier between the fetus and the environment.[48,49] It plays important roles in temperature regulation, fluid balance and the prevention of bacterial, fungal or viral infections. The skin of preemies is normally viscous and also it will be injured quickly due to incredible fluids loss during touch and it does not give an sufficient obstruction to infection. Those preemies who was born before 26 weeks of gestation increases the risks of infection with a barrier ointment and the skin is also unptotective.

Infections and the Immune System [50]

Preemies have unripe immune systems that are incompetent at acting against the bacteria and viruses causes infections. The most dangerous infections in preterm infants include pneumonia, meningitis, sepsis and urinary tract infections. Neonates exposed to these infections at delivery or later via unripe skin or GI tract or lungs which deficit in mature immune function.

Cardiovascular System [51,52,53]

By the beginning of 4 weeks of gestation he primitive heart beats starts to develop and ends its maturation at the end of 6th week. Most of the fetal blood flow through the ductus arteriosus and bypasses the lungs. The ductus arteriosus normally closes after birth, air enters into the lungs when its enlarges and blood is redirected from the right heart via the lungs it returns to the left heart and pumped out to all parts of the body. PDA may spontaneously close in the first week of life or if it persists ,increases the risks of intraventricular hemorrhage, necrotizing enterocolitis, broncho pulmonary dysplasia or chronic lung disease and death.[54,55] The drug of choice for PDA is Indomethacin and it has adverse effect of hypotension in pretermneonates. Normal saline is administered to support blood pressure regulation. Physiological doses of hydrocortisone was given in refractory hypotension in preterm neonates.

Hematologic System [56,57]

Due to the inhibited hematopoiesis for 6 to 12 weeks after birth, anemia of prematurity is develops as an amplification of the physiological anemia of babies. It is multifactorial and include the less endurance of RBC in preterm neonates, loss of blood from frequent blood samples and a greater necessity for red blood cells with growth. Preterm neonates often needs RBC transfusions and the sickest and severe premature neonates needs multiple blood transfusions.

A meta-analysis of a number of RCT studies concluded a marked reduction in the number RBC transfusions is necessary after the admin of recombinant human erythropoietin and iron

Auditory System and Hearing [58]

At the end of 6 weeks of gestation ear starts to develops and ends its maturation by 20 weeks of gestation. An auditory brainstem-evoked responses sound reaction can be ascertain in fetuses born at 23 and 24 weeks of gestation in preterm infants . There is a 10- to 50-fold increase risk in preterm hearing problems due to infections, immaturity, asphyxia, ototoxic medications, and hyperbilirubinemia.

Ophthalmic System and Vision [59,60]

The functions of the optic system starts too early in the preterm neonates. In preterm neonates blinking & the papillary constriction in reaction to light occurs by 24 and 30 weeks of gestation age respectively. The differentiation of visual patterns developed at 32 weeks of gestational age in the preterm infant. Myopia, amblyopia, optic nerve atrophy, strabismus, cortical visual impairment and cataracts are severe ophthalmologic complications of immaturity. Angle closure glaucoma, phthisis, retinal detachment are rare and late ophthalmologic problems in preterm neonates. ROP is associated with severe broncho pulmonary dysplasia or chronic lung disease and intraventricular hemorrhage. Treatments of ROP is by abnormal peripheral vessels ablation with cryotherapy and laser therapy. An 0.4% children with gestational age of 27 to 32 weeks had severe visual impairment or blindness.

Central Nervous System [61,62,63]

In preemies, the areas which are most susceptible to injury includes the para ventricular white matter and the vascular germinal matrix. Auto regulation of cerebral blood flow is the most important cause for this pathology. Ischemia injury due to decreased blood flow and odema subsidize to CNS pathology in the preterm neonate. The most general signs of CNS injury in preterm neonates includes are intraventricular hemorrhage, intra parenchymal hemorrhage and white matter injury including periventricular leukomalacia.

Vitamin E injections reduced the incidence of IVH in preterm infants, but the adverse effects are very severe with this vitamin resulting in high sepsis incidence and the risk of intraventricular hemorrhage with high doses. The prophylactic drug of choice for IVH is Indomethacin and usage of it in first few hours after delivery decreases the incidence of IVH.[64] The most important adverse effect of Indomethacin is hypotension in preterm neonates especially in preterm boys. Other adverse effects includes necrotizing enterocolitis, renal complications, and gut perforation.

Complications for Near-Term or Late-Preterm Infants

Wang ML et.al.,[66] studied the complications of near term infants. The result showed that 37% of the complications were due to sepsis, 10 % were due temperature stability, 16 % were due to hypoglycemia, 29% were due to respiratory distress and 54 % were due to jaundice. The study concluded that preterm infants and the full-term infants discharge from the hospital were delayed to the poor feeding.(76% and 29% respectively). Adequate and appropriate neonatal care could prevent the neonatal mortality and morbidity rates.

NICU is an atmosphere of sensory bombardment which included continuous noise, recurrent handling, intrusive invasive procedures, distress of sleep wake cycles, numerous care takers etc. [65] The preterm infants admitted in NICU experience over motivation when procedures, an average of 40 to 140 times per day are performed. This may result in preterm neonates developing sensory overload. The liquid darkness shatters into colorful, warm, muscular cradle of the uterus is replaced by hands attaching electrodes, changing diapers and pricking feet for blood samples. For the neonate, these events can be more disruptive. In the NICU preterm neonates who are repeatedly subjected to painful, intrusive procedures develop touch aversion- the association of human touch with pain and exposed to noisy monitor sounds develop noise aversion- the association of human voice with over noise. These neonates cry uncontrollably, squirm away, move vigorously arms and legs and recoil when touched – knowing that pain will soon follow with voice. Since the senses of touch and hearing are highly developed in utero, even the very immature preterm neonates have acute tactile and auditory sensitivity. Since preterm neonates lack tolerance for these overstimulation along with physiological and anatomical maturity, various intervention strategies such as tactile, auditory and communication skills are to be used along with intensive care for better growth and development and also to avoid immediate and later complications. A holistic approach; tactile and auditory stimulation recognizes that our physical , mental, feelings and strength of mind are all be integrated and indivisible constituents of a complete individual. Tactile stimulation is a natural and almost instinctive way to care. The release of oxytocin into the body is best promoted by tactile stimulation. In both males and females, the harmone Oxytocin which is a neurotransmitter has synthesised by dorsal lobe of hypophysis [68] Once it is released into the blood stream it cannot re-enter due to the blood brain barrier; instead, it affects certain brain functions. It stimulates a coordinating and adaptive system which control centers of the brain. The physical, mental and psychosocial qualities are influenced as soon as the oxytocin hormone discharge into the circulation. The digestive system in the body is controlled by the hormone oxytoxin . More nutrients are absorbed in the stomach and the intestines efficiently by increasing the quantities of different digestive juices and hormones which in turn favor digestion .The hormone of flight and fight vasopressin action has also influenced with the oxytoxin level in the blood.

Cortisol level in the blood and saliva were decreased due to the massage therapy. It also decreases arginine vasopressin, a hormone responsible for the raise in cortisol level in the blood.[69] The number of WBC and lymphocytes are increases by massage therapy thus enhances the immune system. ACTH level were decreased by light massage therapy by stimulation of the release of oxytoxin. Massage improves the bonding, improves sleep pattern, stimulate circulation, improves digestion, facilitates food absorption, results in faster weight gain and leads to reduction in the infants level of stress hormone improving the immune function· Massage or touch therapy is a natural and almost instinctive way to care. The lymphatic and blood circulation is increased by massaging which in turn moves fluids throughout the body. Rich quantities of energy were liberated to cells due to massage and optimum health has been achieved. It has two kinds of responses: a. Pressure and movement in the body tissues are influenced due to the mechanical response and b. Nerves in the body are stimulated due to the reflex response.

Massage can assist in to augmenting joint movements by reducing the thickness of the connective tissue and aid to free constrictions in the fascia.[68] Massage facilitates to liberate linkages, splits scar tissue and lessens inflammation. Because of this massage can aid to renovate variety of movement to stiff joints. It increases the tone of the muscle and sense of balance, decreasing the bodily pressure put on bones and joints. It lightens restrictions, muscular rigid, hardness and contractions in the muscles. Massage raises elasticity in the muscles owing to loosen up of muscles. Massage augments circulation of blood into the muscle and thus bringing more oxygen and nutrients. This decreases muscle weakness and tenderness and it supports quick elimination of toxins and desecrate products from the muscle. Due to its mechanical action, massage can increase blood flow to all parts of body and thus helps the flow of venous blood return to the heart, expand blood vessels aiding them to promote functions highly and make an improved blood flow, release of more oxygen and nutrients to all bodily cells and to take away toxins and CO_2 is accelerated via the venous system. Massage aids to lower blood pressure for a shorter duration because of the dilatation of capillaries, lowering of the heart rate because of the relaxation and decrease of ischaemia in coronary and all peripheral blood vessels. It decreases oedema in the body by improving lymphatic flow and the taking away of waste from the system and regular massage aid to make stronger the immune system owing to raise in the WBC levels in the blood. It excites sensory receptors: this can either exite or pacify nerves owing on the techniques applied. Massage also excites the parasympathetic nervous system, aid to help lighten up and lowering tension. It aid to decrease pain by the discharge of endorphins which excites mood. It increases dermal circulation, raises nutrition to the tissues and promotes cell rejuvenation, raises formation of sweat, aids to expel urea and desecrate products through dermal, expands blood vessels of the peripheral capillaries helping to get better the skin's colour, increases skin elasticity, raised sebum formation, aids to increase the skin's flexibility and thus prevents infection. It intensifies respiration and increases lung capability by soothing any rigidity in the respiratory muscles. Massage decreases respiratory rate owing to lesser excitement of the sympathetic nerves. It improves peristalsis in the large intestine aiding to reduce colic & constipation and endorses the action of the parasympathetic nerves thus activates the digestive process. It improves urinary excretion owing to the raised blood and lymphatic circulation. It decreases strain and nervousness by lightening up both mind and body, forming a feel of well-being and improved confidence, encourages body alertness, increases physical image and simplifies emotional disturbance by relaxation.

The principal form of human communication is the touch sensation.70 The neurophysiologic growth and development of premature children are improved by the excitement of different varieties of massage therapy for longer duration. It raises vagal action which stimulates the synthesis of gastric juice and insulin and in turn improving food absorption and promotes increase in weight in premature babies 10. Minimal temperature changes have occurred in light touch in contrast with the more significant changes that occur in stronger massage therapy.11 The primary consisitent physiological parameter supported by the tactile stimulation in premature babies is the gain in weight.

In Scafidi study [71], 21% gain in weight was found in massaged preterm infants with mean gestational age of 28 weeks and birth weight of 1700 grams who had received massage for forty five minutes with fifteen minutes in three sessions per day. Kelmanson et al concluded that the massaging for a period of eight months would promote good qualities of sleeping pattern, minimal awakening, onset of sleep quickly, higher activeness during day time and had more Brazelton Behavior Assessment score in preterm neonates with lesser than thirty six weeks gestational age and birth weight of less than 2500 grams. In another study of preterm neonates, high scores were observed in orientation and mature habituation. In another study of preterm infants with mean gestational age of thirty weeks, the physiological parameters including stress behavior, cry were reduced in those who had received moderate pressure therapy for five days. Grimacing and clenched fist stress behaviours were reduced in the babies who had received oil massage. The maternal infant interaction and bonding were improved by massage treatment.

Auditory stimulation improves oral feeding among premature neonates.[72] Pre term infants who had trouble in oral feeding found high feeding rates considerably with the aid of pacifier activated lullaby (PAC) system . The sensory input and expressive reaction were more influenced by the higher integration of mind and body by music. Due to this, the alternate neurological pathways got activated which in turn favoured the behavior changes, increased respiration, reduced BP, increased CO_2 level, decreased heart rate and loosened up muscles. The secretion of the stress hormone cortisol was decreased with the counterpart increase of body's natural good hormones endorphins during the stimulation by music or auditory stimulation. The synchronization between the muscle movements and the beat were increased during the babies listening to rhythmic music. Their motor skills have also been increased when the motion becomes further standard and well-organized. Entrainment may reduce sleep; lighten up reaction if the music has a relaxed, constant beat.

Auditory stimulation is the aid of music to stimulate relaxation, encourage restoring health, improving psychological functioning and generating an overall wisdom of wellbeing. It brings positive changes in the mood, promotes emotional intimacy with parents and family and reduces stress and anxiety. The right type of music helps a person healthy; relaxes him physically as well as mentally by soothing the nerves. In brain music excites the discharge of endorphins, decrease ACTH levels in blood and raises phenyl ethylamine discharge.[73] Neural impulse activated by stimulating music can elicit ANS responses which lighten up in muscle tone, neural signal occurrence and pilomotor & pupillary reflexes. A condition of relaxation may smooth the progress of the child capability to control their behavioral state organization regardless of the harmful ecological stimulus in the NICU. Music has diverse consequences on the human being. The calming, relaxing music aids to attain an alpha wave neurological condition which commences a circumstance of relaxed responsiveness.

There is evidence that preterm neonates exposed to music may have raised feeding rates, shortened hospital inpatient days, decreased heart rate, improved gain in weight, profound sleep and more acceptance of stimulation [74,75.] Growth and maturity of preterm babies are very favorable by stimulation of music therapy. Music typically conducted in Neonatal Intensive Care (NICU) benefits the premature infants : 1) Live or pre recorded music is efficient in supporting respiratory normality and increasing blood O_2 levels and lower the newborn suffering. Since the preterm neonates have susceptible and undeveloped way of sensing, music is frequently acted upon in a calm and organize surroundings, moreover in the type of recorded or live music, in which live songs have better concern. 2) Promotes Healthy Sucking Reflex: While feeding, the rhythm of the music helps movement and support strong sucking feature. Preterm neonates are competent to synchronize the significant twin means of breathing, sucking and swallowing by promoting sucking patterns, thus supporting development and gain in weight. This effective management makes babies shorten hospital stay. 3) Multimodal Stimulation (MMS) helps the premature infants discharged from the NICU sooner. It consists of the uses of music, massage and ophthalmic excitation that aid in preterm neonates maturity. MMS aid preterm neonates sleep and save essential energy needed to quick weight gain. 4) Music therapy masks unnecessary acoustic excitements and promotes a peaceful situation that decreases the obstacles for more danger or malfunction neonates. NICU noise influences mother-child relationship which leads to setback the contacts between mother and their preterm babies. It produces calm and quiet surroundings for mothers to converse and use up occasion with their preterm neonates in ventilator therapy. 5) In treatment, singing lullabies support to help relaxation and lowering heart rate in preterm babies. By making the preterm neonates quiet & peaceful, music therapy permits them to conserve their caloric expenditure which forms a firm situation for development and maturity. These techniques increase sleep excellence, promote sucking and improve nourishing behaviors in turn aid in the maturity of the neonates in NICU. Auditory stimulation by singing increases the levels of O_2 in blood for preterm neonates in ventilator higher than maternal words only. This method supports elevated O_2 in blood for lengthy phases of moment in time.

Auditory stimulation is given by using exact raga 'NEELAMBARI' through which singing 'LULLABY' helps to relieve stress, induces sleep and growth.[21] In the Karnatic system of music, the Neelambari raga has the characteristic to persuade sleep & sleep enhancing features.[13] Music is able to elicit many ideas and emotions at the same time. *Raga* neelambari is closely associated with lullabies. The Tamil word for lullaby is "thalattu", or "tongue rocking." Vocables, "*araro ariraro*," symbolize the motion of rocking a child. *Raga neelambari* is mostly used as a lullaby[16.] It has been reported that music is an excellent distracter and relaxant.

From above it is observed that TACTILE and AUDITORY STIMULATION, promotes weight gain, increases appetite, improves sucking behavior and thermoregulation, positive effects on neurobehavioral pattern, enhances mother to child bonding and induces sleep to the infants, which helps the preterm neonates to improve the health status of term infants and decreases the mortality and morbidity rate. There are studies that have proved that the stay in hospital is significantly reduced by tactile and auditory stimulation. 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. Moreover in the southern part of our country not many studies were conducted in this aspect. Thus, the investigator was interested in conducting a study to test the effectiveness of tactile and auditory stimulation on physiological parameters. Hence, the researcher has undertaken this study.

1.3 STATEMENT OF THE PROBLEM

A study to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates admitted in selected hospitals at Nagercoil.

1.4 OBJECTIVES

1. To assess the pre and post intervention physiological parameters among experimental group of preterm neonates who had tactile & auditory stimulation.
2. To assess the pre and post intervention physiological parameters among control group of preterm neonates.
3. To evaluate the effectiveness of tactile & auditing stimulation on physiological parameters among preterm neonates.

4. To find out the association between the physiological parameters after tactile & auditory stimulation & selected demographic variables such as gestation weeks, age, sex, birth weight of the baby, APGAR score and mode of delivery.

1.5 HYPOTHESES

1. The mean post test physiological parameters of the preterm neonates in experimental group who received tactile & auditory stimulation will be significantly higher than their mean pretest physiological score.

2. The mean posttest physiological parameters of the experimental group who received tactile & auditory stimulation will be significantly higher than posttest physiological parameter score of the control group.

3. There will be significant association between physiological parameters after tactile & auditory stimulation among preterm neonates and their selected demographic variables such as gestational weeks, age, sex, birth weight APGAR score and mode of delivery.

1.6 OPERATIONAL DEFINITIONS

1. **Tactile Stimulation/ Massage therapy**

It is one of the early neonatal stimulation therapies in which the investigator will squeeze, press and use circular movements on the neonate's skin from leg to face with the hand by using 5ml of coconut oil for 10 minutes, twice a day.

a. **Feathering** is a very gentle, light gliding of the fingers down any part of the body signaling the completion of a massage sequence. This light finger movement sedates all the nerve endings that have been stimulated and is the main hand movement in massaging babies.

b. **Vibrating or pulsing** may be used after all other forms of massage are applied on the palms and soles. Place thump finger on the neonates palm or sole; Rock with gentle motion so that the hands barely move, but cause an interior vibration to the whole body.

c. **Effleurage** is a firmly flowing gliding stroke by sweeping of the field. The effleurage movement is responsible for increasing the blood circulation and lymphatic flow. It can eliminate fatigue by improving waste removal and increases nutrition to the tissues being treated as well as relaxing the muscles.

2. Auditory stimulation / music therapy

It is the method in which the investigator makes the child hear a ***lullaby music***, which is based on ***Neelambari raga*** by 'tab' for 10 minutes along with tactile stimulation.

a. A soothing song **, Lullaby music** is generally sung to babies prior to sleep with the aim of pacing the progression of sleep.

b. In the Karnatic system of music, the Neelambari raga have the characteristic to persuade sleep & sleep enhancing features.

3. **Preterm neonates**

Babies who are born earlier than thirty seven completed weeks of gestation (up to thirty six weeks or <259 days). In this study, preterm neonates are babies who are born after 30 weeks and before 37 completed weeks of gestational age with birth weight above 1 kg and below 2 kg.

4. **Physiological parameters**

This includes the following vital parameters:

Axillary Temperature: - The degree in which the intensity of baby's body heat is measured at the center of axilla by a thermometer for 3 full minutes. Normal axillary temperature is 36.5 to 37.4 ^{0} C.

Respiratory rate: The rapid movement of chest during the act of breathing is counted for one full minute. Normal respiratory rate is 30 to 60 breaths per minute.

Heart rate: - The pulsation of the heart as the heart pumps an amount of blood passing from left ventricle into the aorta is monitored by pulse oxymeter. Normal heart rate is 120 to 160 beats per minute.

Oxygen saturation: - The amount of oxygen bond to hemoglobin in the blood is expressed as a percentage of the maximal binding capacity and is measured by pulse oxymeter. Normal oxygen saturation is 90 to 96%.

Apneic spells: - It refers to the cessation of breathing for 20 seconds with Bradycardia. Normally apnea should be absent.

Weight: - It is a quantitative measurement of the total body's heaviness, which can be checked by using digital infant-meter in kilograms. Normal birth weight of the preterm neonate is 750 gram to 2500 gram; it will be reducing initially & then slowly increasing. At end of 15 days of age it will reach the birth weight.

In this study birth weight of preterm neonate is referred to as the birth weight of 1000 gram to 2000 gram.

Sleeping pattern: It is the overall observable manifestations of the bio physiological activities of preterm neonates that are directly or indirectly related to the routine care and routine care with tactile & auditory stimulation.

Feeding skill: It is described as sucking & swallowing skills of the preterm neonate, which incorporate with emptying of mother's breast or fullness of stomach & deep quiet sleep.

Effectiveness: It is defined as something brought about by a cause or agent. In this study it refers to the outcome of tactile & auditory stimulation in maintaining physiological parameters. It is the difference between the mean posttest physiological parameter score of experimental and control group.

Nursery or NICU (Neonatal Intensive Care Unit): It refers to the area where the preterm neonates will get intensive special care.

1.7 ASSUMPTIONS

1. The basic needs of all newborns irrespective of their gestational age and birth weight are warmth, touch, love, safety and security.
2. Promoting the physiological & behavioral well being of preterm neonates will improve their health status.
3. Music enables the child to acquaint with listening skill.

4. Regular massage provides occasion for the mother to be closely familiar with the child body language and rhythm of statement.

5. High risk newborn babies need maximum optimal care by their care givers.

6. Nurses play an important role in initiating the interaction with high-risk neonate admitted into the neonatal care units.

1.8 DELIMITATIONS

The following delimitations are set for the study

1. Sample size is confined to 120
2. Preterm neonates admitted in NICU at Kanya Kumari Government medical college Hospital were selected.
3. Preterm babies with the birth weight of 1000 gram to 2000 gram were included.
4. preterm neonates who were born between 28 to 36 weeks of gestation were included.
5. The preterm neonates whose age is between 10 to 24 days were included.

1.9 PROJECTED OUTCOME

The study will help the nurses to understand the importance of tactile & auditory stimulation in maintaining physiological parameters of preterm neonates. The findings of the study will encourage the nurses in the NICU to include tactile & auditory stimulation as a routine intervention in the management of preterm neonates.

The outcome of the study will help the primary health care workers to include tactile & auditory stimulation as an intervention for babies born before 37 weeks in the rural area.

1.10 CONCEPTUAL FRAMEWORK [76-78]

The conceptual model adopted to this study was Earnestine Weidenbach, the helping art of clinical nursing theory developed in the year 1967 and it was updated in January 31, 2012. This theory described as a system of conceptualization was invented to some purpose. This prescription theory is situation producing, which may be described as conceptualizes both a preferred circumstances and the direction by which it is to be brought about.

Weidenbach helping art of clinical nursing theory is made up of 3 factors or concepts as follows:

a. The **central purpose,** which the nurse distinguish as important to the meticulous control.

b. The **prescription** is directive to activity, which will most likely lead to for the fulfillment of the central purpose. A prescription may designate the extensive common deed suitable to accomplishment of the essential perception as well as propose the type of performance required to bring out these deeds in agreement with the essential function. It has 3 types of controlled deed.

   i. Equally implicit and concur upon deed. (Beneficiary and investigator).

ii. Recipient – directed action. (ways in which to be carried out) and

iii. Practitioner – directed action. (Practitioner carried action).

The **realities** are the instantaneous conditions that manipulate the realization of the essential function. Widenbach define **5 realities.**

i. The **agent**: Agent is the investigator.

ii. The **recipient**: The patient who is experiencing problem.

iii. The **goal**: It is the desired outcome the investigator wishes to achieve.

iv. The **means:** Comprise the activities and devices through which the practitioner is enabled to attain her goal.

v. **Framework**: The social organizational and professional environment.

Nursing Practice

Based on her theory it has 3 components.

1. Identification of the patient's need for help

2. Ministration of needed help and

3. Validation of action

In this study, the central purpose is to maintain the physiological parameters which refer to weight, temperature, heart rate, respiratory rate, oxygen saturation, feeding skills, crying spells and sleeping duration among preterm neonates.

Prescription is to give tactile and auditory stimulation to maintain physiological parameters among preterm neonates. The voluntary actions are as follows:

a. Get ethical clearance end permission from the institutional authorities.
b. Get consent from the parents.
c. Set ready the lullaby that is based on Neelambari raga by recording it in the Tab or mobile phone.
d. Test the hypersensitivity by applying coconut oil on the selected preterm Neonates forearm just half an hour prior to the tactile and auditory stimulation.
e. Keep the Tab or mobile phone at the left side of the child's cradle to play the recorded lullaby that is based on Neelambari raga.
f. Do pretest assessment before giving tactile and auditory stimulation.
g. Give tactile stimulation along with auditory stimulation for 10 minutes twice a day for 5 consecutive days as per the prepared manual.
h. Do post-test assessment after giving tactile and auditory stimulation on the 3^{rd} and 5^{th} day.

Reality is the situation in which the investigator provides treatment (intervention). The 5 realities are,

a. **Agent** : Agent is the investigator
b. **Recipient :** The recipients are preterm neonates.
c. **Goal :** Maintain physiological parameters.
d. **Means:** Application of tactile and auditory stimulation to the preterm neonates.

e. **Framework:** Neonatal Intensive Care Units at Kanya Kumari Medical College Hospital.

Nursing Practice

In the identification phase, the investigator assesses the physiological parameters by using the prepared tool. In ministering the needed help, the investigator applies tactile and auditory stimulation to maintain the physiological parameters.

WIDENBACH'S HELPING ART OF CLINICAL NURSING THEORY

CENTRAL PUPOSE: To maintain physiological parameters

⇩

IDENTIFICAION: Identification on physiological parameters (pre-test) by using

1. Demographic data: gestational age, sex, birth weight, mode of birth, type of feeding, oxygen administration and APGAR score.

    i. Observation Check List and
    j. Structured Interview Schedule

⇩

MINISTRATION OF NEEDED HELP

⇩ ⇩

EXPERIMENTAL GROUP	CONTROL GROUP
Administration of tactile and auditory stimulation along with routine care.	Only routine care

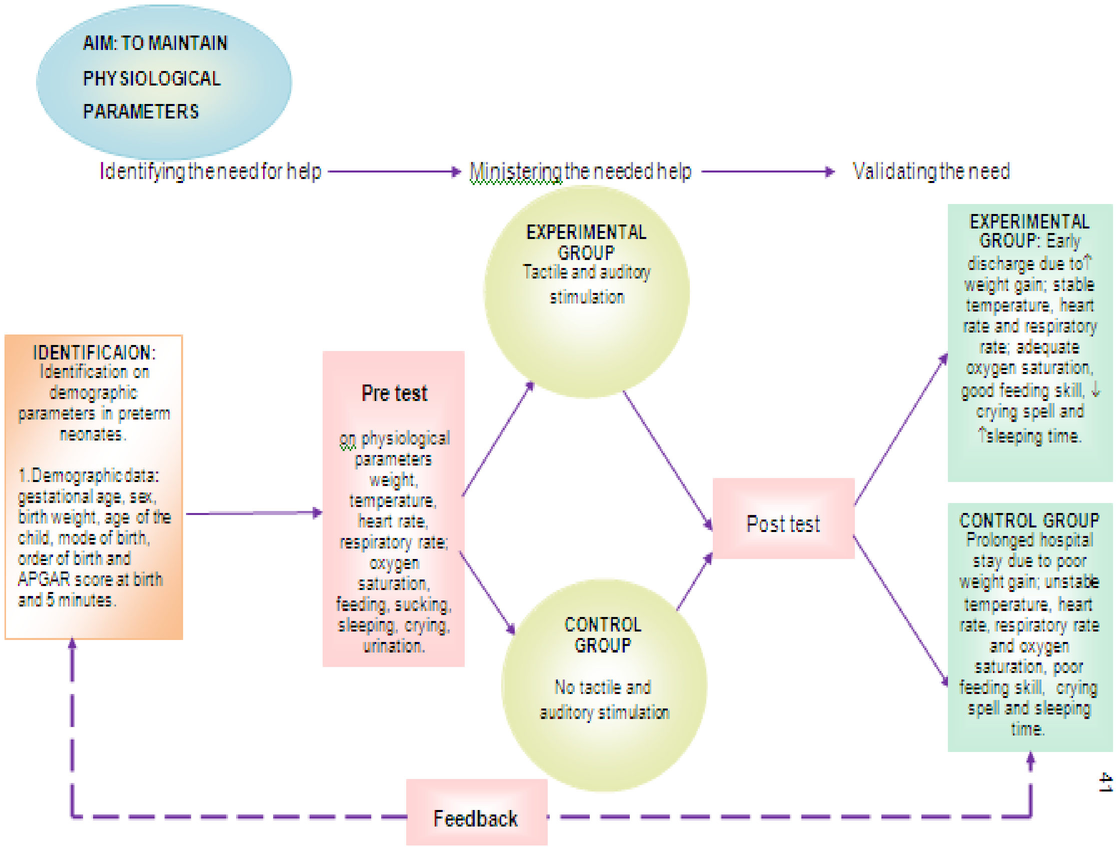
⇩ ⇩

VALIDATION : Post test assessment to both groups on the 3rd and 5th day by using the same tool which was used in the pre-test

⇩ ⇩

EXPERIMENTAL GROUP: Early discharge due to↑ weight gain; stable temperature, heart rate, respiratory rate; adequate oxygen saturation, good feeding skill, ↓ crying spell and ↑sleeping time.	CONTROL GROUP Prolonged hospital stay.

Fig.No. 1.1 MODIFIED ERNESTINE WIEDENBACHS HELPING ART OF CLINICAL NURSING THEORY (1967)



Summary

This section has compact with the background, necessitate the study, declaration of the problem, aims, prepared definitions, assumptions, hypotheses, delimitations and conceptual framework.

REVIEW OF LITERATURE

Review of literature is traditionally understood as a systematic and critical view of most important scholarly literature on the particular topic. Review of literature is defined as a broad, systematic, comprehensive, in-depth and critical review of scholarly publication, unpublished scholarly printed materials, audiovisual materials and personal communications.[79]

This chapter reveals the literature review that provides a foundation on which new evidence is added and usually conducted before the data are collected. Researcher generally undertakes a literature review to familiarize him about the topic under study, it is presented under the following headings:

1. Literature related to preterm neonate
2. Literature related to management and care of preterm neonate
3. a. Literature related to massage therapy and tactile stimulation

   b. Studies related to massage therapy and tactile stimulation
4. a. Literature related to music therapy and auditory stimulation

   b. Studies related to music therapy and auditory stimulation
5. Studies related to tactile and auditory stimulation

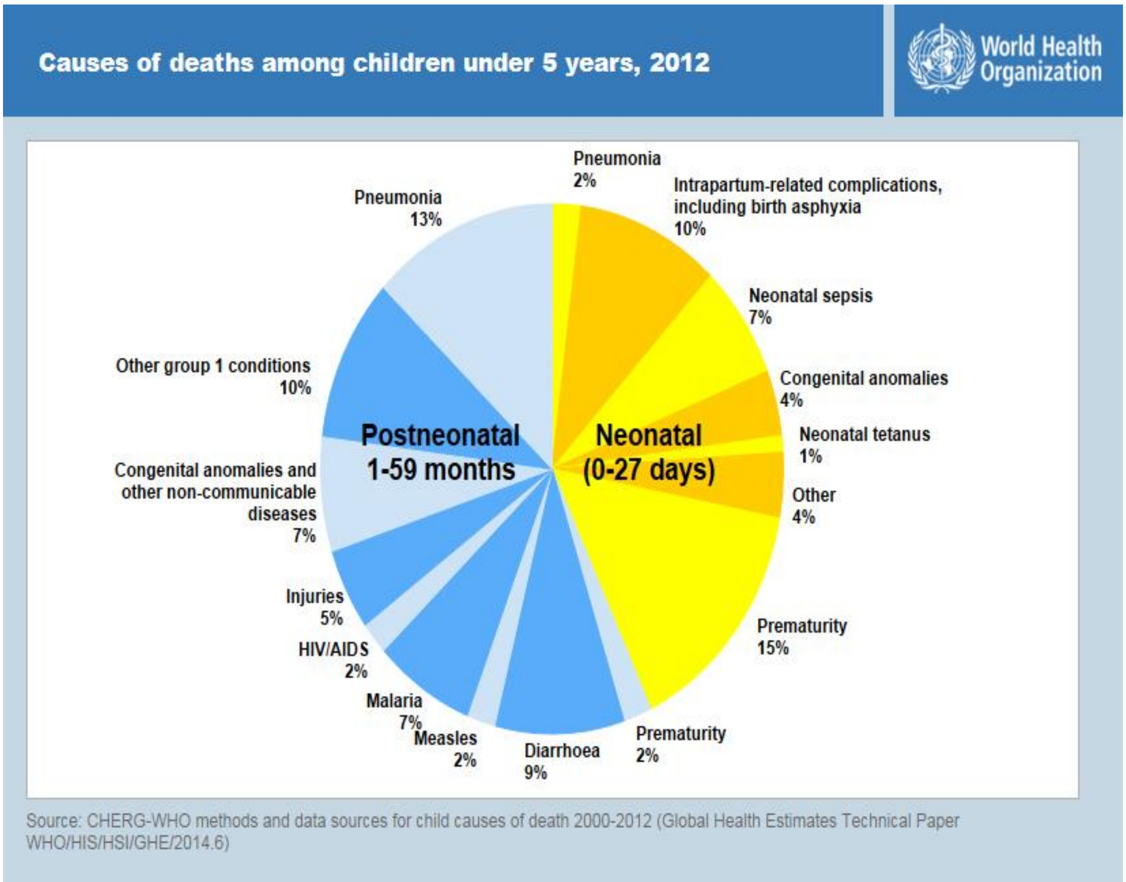
2.1 LITERATURE & STUDIES RELATED TO PRETERM NEONATES

"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:[80]

- 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 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. [80]

According to National Vital Statistics Report, 2012

Tamil Nadu – Infant Deaths						
	2008-09	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**Apr'13 Dec**
Infant deaths within 24 hrs of Birth	**0**	**1827**	**1541**	**1528**	**1554**	**744**
Infant deaths between 24 hrs to 4 weeks of Birth	**10359**	**9323**	**7503**	**5915**	**8137**	**3587**

CATEGORIES OF PRETERM INFANT[82]

Preterm infants were classified into 3 groups as follows:

1. Extreme preterm infants: These are preterm neonates with gestational age 24-30 weeks, birth weight between 500 and 1,500 grams and widespread among 0.8-1.0 % of live newborns. In the neonates of gestational age of < 27 weeks, the growth and maturity are not accomplished particularly. The death rate is raised and needs extra ordinary management to reduce it.

2. Moderately preterm infants: Preterm babies with gestational age between 31 and 36 weeks with birth weight of 1.5 kg to 2.5kg .It have been 6-7 % incidence among live neonates. In the neonates of gestational age of < 36 weeks, the growth and maturity

are not accomplished. Curing would be expected with efficient treatment. Death rate has been reduced after 2 months in life.

3. Borderline or slightly preterm infant: Preterm babies with gestational age between 36 and 37 weeks with birth weight close to 2.5kg or > 2.5kg. It has been 16% incidence among live neonates. They are at a gestational age of 36-37 weeks with birth weight close to 2,500 grams or more, and widespread among 16 % of live newborns. The premature babies in this group have feature of term infants. In the late premature stage, premature births are very common.

CAUSES AND RISK FACTORS OF PRETERM BIRTH[83]

The causes for pre-term births include diabetes, hypertension, maternal stress and infection. Factors such as improper pregnancy planning, early or late pregnancies and assisted reproductive therapies also contribute to preterm birth. In "Vitro Fertilization centers" 25 to 30% of pregnancies culmination with premature deliveries. Antenatal mother's crises amplify **the risk of premature** deliveries:

- Cervical incompetence - A fragile cervix that starts on to open before time.
- Uterine Congenital abnormalities.
- Past history of premature birth.
- Amniotic membrane infections or recurrent urinary tract infection in ANC mother.

- 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 other drugs including cocaine or amphetamines.

CHARCTERISTIC FEATURES: [84]

Less Body Fat: Plumpness is a distinctive peculiarity of full-term neonates. A premature neonate may have very petite body fat. This makes the neonate look very skinny. The neonate will not weigh practically the amount of a full-term neonate. This weight range fluctuates, but a distinctive full-term baby weighs not less than 3.175 kg at birth. The former the baby reaches, the lesser the number will be on the measurement.

Skin Qualities: Premature neonates who are born between 30 and 32 weeks are expected to have reedy skin as a consequence of the inadequate body fat, elucidate the Walk of Dimes. The ribs may be easy to see beneath the skin. Irrespective of the neonate's natural skin tenor, the tissue may seem red. The skin is habitually wrinkled.

Hair: Very premature neonates have no hair at all. They have less lanugo, or fine fur that concealment an infant’s body commencement around week 24 or soon after. A premature neonate who reaches closer to term may have hair all over the body including the head.

Sealed Eyes: The eyelids are sealed until the 26th week of gravidness. At that moment, the lids open on their own, illuminating eyes and occasionally eyelashes, states the Walk of Dimes. A baby born proceeding to the 26th week will linger to have closed eyes.

Movement: The movements of a neonate born between 29 and 32 weeks may seem jerky as an alternative of smooth. Neonates born earlier than these weeks may not move much at all. The arms and legs may continue in an outspread position from the deficiency of muscle tone. Around the 35th week, a premature neonate has insufficient muscle tone to acquire into the fetal position, similar to that of a full-term newborn.

Sucking to consume may be problematic due to a neonate's poor muscle tone. The cries of a premature neonate are often frail.

Poor Development: Additional signs of a premature neonate include signals that development has not completed. Particularly the lungs are the last parts of the body to mature. A premature neonate is frequently delivered oxygen to sustain life until the lungs finish developing. The genitals may be small or immature in a preterm neonate. In proportion to other parts of the body, the infant's head is probable to seem long and irregular.

THE PROBLEM

Every year, ten lakhs neonates die owing to problems of premature deliveries. Most of the stayers have a life span of infirmity, especially learning difficulties and acoustic-visual abnormalities. Though complications does not occur in all preterm neonates being born prematurely they would have been facing short-term complications and long-term complications in their later life. Babies born too early would have to face many complications compare to babies born nearing full term. These complications were also more dependent on the birth weight of the preterm babies.

SHORT-TERM COMPLICATIONS [85]

These complications were usually happened during in the first 7 days of life which may include,

- **Breathing problems:** Immature respiratory system plays a very important role in respiratory problems like acute respiratory distress syndrome due to surfactant deficiency, chronic bronchopulmonary dysplasia. Apnea was also common in preterm neonates.

- **Heart problems:** The ductus arteriosus normally closes after birth, air enters into the lungs when its enlarges and blood is redirected from the right heart via the lungs it returns to the left heart and pumped out to all parts of the body. PDA may spontaneously close in the first week of life or if it persists, increases the risks of intraventricular hemorrhage, necrotizing enterocolitis, broncho pulmonary dysplasia or chronic lung disease and death.

The drug of choice for PDA is Indomethacin and it has adverse effect of hypotension in preterm neonates. Normal saline or blood transfusion.is administered to treat hypotension and support blood pressure regulation . Physiological doses of hydrocortisone was given in refractory hypotension in preterm neonates.

- **Brain problems.** Intraventricular hemorrhage is very common in early preemies. Spontaneous absorption would have happened in most of the neonates without or small impact . Larger hemorrhage occurs in very rarely resulting in irreversible brain problems. Hydrocephalus commonly develops in bigger hemorrhages and will persist for many weeks often requires surgical correction.

- **Temperature control problems.** Since preemies have no or less amount of fat they are more prone for temperature related problems. Hypothermia occurs in many preterm neonates resulting in hypoglycemia and respiratory problems. It may also lead to low birth weight babies because there will be more energy utilization to correct this hypothermia instead of energy expenditure for growth. Hence, most of the preterm babies require warmer or incubator to maintain body temperature and thus reduce energy expenditure for hypothermia correction.

- **Gastrointestinal problems.** Normally preterm babies have immature gastrointestinal systems by which they are more prone to get gastro intestinal pathologies in early neonatal life. The most common among them is necrotizing enterocolitis (NEC) in which the lining mucosa of intestinal bowels which will get frequent injuries while the preemies takes food supplementations. This will be less common in preterm babies who would take breast milk exclusively in early neonatal life than others.

- **Blood problems.** The most common blood related problems in preterm neonates includes anaemia and infant jaundice. Anaemia results from greater drop in RBC in first month of life and usage of more blood lab tests results in lowering red blood cell count. Infant jaundice occurs because preterm babies have excess amount of yellow-colored pigment (bilirubin) in their blood.

- **Metabolism problems.** Hypoglycemia is a very common metabolic problem facing by preterm neonates in their early months of life. It results from smaller stores of glycogen and preemies immature livers have problem in converting stored glycogen into glucose.

- **Immune system problems.** Mostly preemies have underdeveloped immune system. Due to this they are more prone to get infection. When the bacterium multiplies excess in the bloodstream, it will cause septicemia which in turn leads to shock or multi organ failure and death.

LONG-TERM COMPLICATIONS [86,87]

In the later life, preterm deliveries will lead to many health problems. It includes,

Cerebral palsy: Postural movement disorder with excessive muscle rigidity or posture abnormalities resulting from infection or injury to developing brain or due to inadequate blood flow to brain during labour.

Impaired cognitive skills: Preterm babies lag behind in the developmental milestones including school age and learning disabilities when compared to the counterpart full term babies.

Vision problems. The most common and dreadful ophthalmic complication of premature birth is retinopathy of prematurity (ROP). When retinal detachment occurs due to this problem and if it will be unnoticed, leads to impair vision and cause blindness.

Hearing problems. Hearing loss is a very common acoustic problem in preterm neonates in later years of life. All preemies should undergo screening for ear problems before they get discharged from hospital.

Dental problems. Dental problems including delayed tooth eruption and improper teeth alignment occur in preterm babies in later years of life.

Behavioral and psychological problems: Early Preterm babies will get common attention-deficit/hyperactivity disorder (ADHD) , a behavioral or psychological disorder in late life . However, more recent research suggests that at least for late preterm babies the risk of ADHD may be the same as it is for children who were born at full term.

Chronic health issues: The most common long term complication of preterm neonates includes infections and feeding problems. In many preemies, asthma is more likely to develop or persist for lifelong .Sudden infant death syndrome (SIDS) is also more likely to get in preemies during infant period .

More than 3/4th of premature neonates can be protected with possible, economical care. WHO reported that 1/10 neonates are born pre-term; however, deaths can be circumvented with better obtainability of low-priced managements. Every year, fifteen million neonates are delivered too early and ten lakhs will die whereas many others are incapacitated. But many of these premature births and deaths are avoidable, according to the first report into the worldwide scale of the problem.[19]

CHALLENGES OF CARE:

The premature neonate's mortality danger is higher than full term neonate. It books for more than 50 % of mortality amongst preemies. They can stay alive if they get complete hospital treatment with extraordinary nursing care. The modification to extra uterine life offers an additional threat to the premature neonate since they came out of mother's womb earlier than full term babies. They came to extra uterine life with bodily functional restrictions which causes short term and long term complications. The smaller size neonate will face more difficulties in later life. Every preterm neonate offers a challenge to the NICU nurses. Their definite bodily desires are effectively taken care of by NICU nurses with accepted strength of concern mandatory and pertain proficient skills of nursing accelerated to support with their great effort·

IMPACTS OF THE NICU ENVIRONMENT ON PREMATURE NEONATES[88]

Stress: Stress would be developed in the NICU by all diagnostic and therapeutic procedures done at the NICU by medical and paramedical staff. It is also be produced by the sound and lights. Sometimes pain and pathological processes also produce stress in NICU. This causes delay in healing and recovery processes. Due to this growth, physiological maturity and CNS organizational development are affected in preterm babies.

1. Noise:

NICU has 2 different types of noises. (1) Continuous or background noise (2) High pitch noises which are overlays on these continous noisees a. NICU environmental optimum sound level is in the range from 50 to 98 dB. Noises in the NICU cause conscious level ,anxiety, crying, increased heart rate, increased intra cranial pressure decrease oxygenation and tension behavioral responses. Background noises or high pitch noises with 120 db or more may obstruct preemies' capability to distinguish speech and vital premature steps in language attainment. The majority of the noise came from medical and nursing procedures and discussions between them.

2. Light

Arousing effect on CNS has been caused by NICU lighting .Other adverse effects of lighting include low O2 saturation, tachycardia, tachyponea , energy loss, higher incidence ROP and raised ICT which cause significant reduction in the growth and maturity in preterm neonates.

Negative touch:

Leeper in his studies found the magnitude, frequency and duration of hypoxemia curve shows marked decrease during the activities of aspiration by suction, changing neonates positions in NICU and arterial blood O2 & CO2 analysis and it causes negative impact on growth and development of premature neonates.[22] The negative physiological responses include apnea, decrease PaO2, tachycardia, tachypnea, increase intracranial tension. Repeated negative touch also disturbs sleep, causing decreased weight gain.[23]

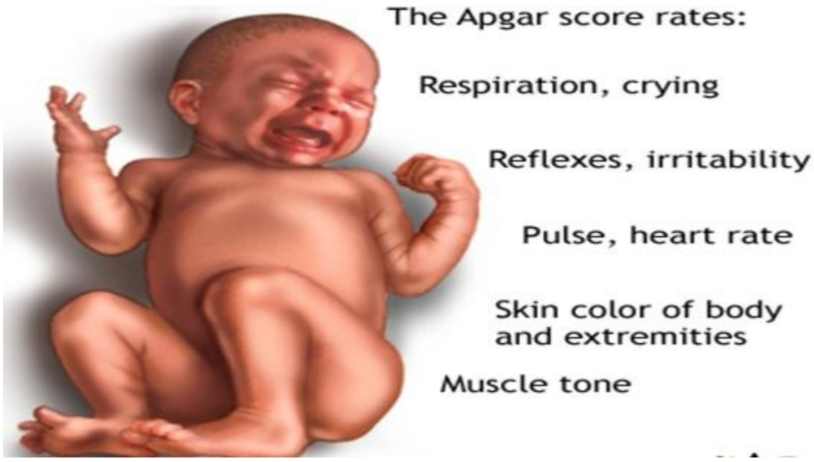
2.2 LITERATURE RELATED TO ASSESSMENT AND MANAGEMENT & CARE OF PRETERM NEONATE:

- **General Assessment**
- **Gestational Age Assessment**
- **Management**

GENERAL ASSESSMENT:

Initial clinical assessment: [88]

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 (**A**ppearance, **P**ulse, **G**rimace, **A**ctivity, **R**espiration). 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. Virginia APGAR, M.D. (1909-1974) introduced the APGAR score in 1952.



At one and five minutes after your baby is born, the attending health care provider will assess five vital areas of newborn health. The APGAR score uses measures of 0, 1, or 2 for each category, with the best possible total score equaling 10.

The APGAR scoring chart

Factor	**Score 0**	**Score 1**	**Score 2**
Heart rate	No heart rate	Below 100 beats/min	Above 100 beats/min
Breathing	No breathing	Slow and irregular	Good
Muscle tone	Limp and loose	Some flexing of arms and legs	Actively moving
Reflexes	No reflex responses	Grimaces or frowns when reflexes are stimulated	Vigorously cries when reflexes are stimulated
Colour	Blue and pale	Body is pink but hands and feet are blue	Entire body is pink

PHYSICAL EXAMINATION: [90-95]

The examination can be performed in the nursery. The area should be warm and quiet, and should have good lighting. The examination includes:

I. Observation of the infant's general appearance including his/her body position at rest, body movement, color, and respiratory effort.

II. Body measurements (ie, weight, length, and head circumference) and vital signs.

III. Examination of individual body parts and organs.

I. **General appearance**: Observe the appearance of the undressed infant in the resting, non -stimulated state. General inspection should include the following:

- Determination of gender.
- Identification of any deformation (eg, metatarsus adductus) or malformations (eg, cleft lip)
- Determination of the state of fetal nutrition (sub cutaneous fat)
- **Assessment of respiratory effort** – Abnormal respiratory movements include rapid breathing, nasal flaring, use of accessory muscles were noted. The respiratory count should be conducted over a full minute to account for the variable breathing rate in the neonate.
- **Assessment of position and movement** − The intrauterine position of the fetus reflects the neonates posture as soon as after birth. A normal infant

moves all the extremities symmetrically. Deviation of posture or abnormal movement may be an indication of birth injury or deformation due to intrauterine positioning.

- **Assessment of color** − A normal infant appears pink. Acrocyanosis, a bluish appearance of the hands, feet, and perioral area, is common in the first few days after delivery. However, central cyanosis, which is seen best on the tongue and mucous membranes of the mouth, suggests hypoxemia.

- **Measurements**: The infant's weight, length, and head circumference should be measured and recorded. Average birth weights differ for male and female infants. At 40 weeks gestation, the average weight is 3.6 kg (2.9 to 4.2 kg) for males and 3.5 kg (2.8 to 4.0 kg) for females.

Chest circumference normally is within two cm of the head circumference. It shows the lung growth. The length is measured from the top of the head to the bottom of the feet, with the legs fully extended. At 40 weeks gestation, the average length is 51 cm (48 to 53 cm).

Vital signs — Vital signs should be recorded every 30 to 60 minutes during the transitional period (first four to six hours of life) and then every 8 to 12 hours subsequently. Normal routine vital signs for the newborn infant include:

- Temperature measured with the thermometer in the axilla of 36.1 to 37°C (97 to 98.6°F) in an open crib.

- Respiratory rate of 40 to 60 breaths per minute, which should be counted over a full minute.

- Heart rate of 120 to 160 beats per minute.
- Blood pressure can be measured using a neonatal size blood pressure cuff in infants with suspected cardiovascular or renal abnormalities.

Skin — The skin should be inspected for abnormal pigmentation, macular stains or hemangiomas, congenital nevi.

- Milia are white papules due to retention of keratin and sebaceous material in the pilaceous follicles.
- Erythema toxicum consists of white papules approximately 1 to 2 mm in size on an erythematous base.
- Mongolian spots typically appear as congenital blue-grey, greenish-blue or brown pigmented macules with indefinite borders. The diameter of the lesion may be 10 cm or more. The lesions are results of the delayed disappearance of dermal melanocytes. Although they usually are located on the buttocks and over the base of the spine, these skin lesions can appear anywhere on the body
- Nevus simplex seen in upper lip, middle of the forehead, or the nape of the neck.
- Nevus flammeus, or port wine stain, is a low flow capillary malformation that can occur anywhere on the body. It may or may not be a benign finding in the newborn.
- **Head -** Inspection of the head includes noting the size and shape of the head and the presence of abnormal hair, scalp defects, unusual lesions or

protuberances, lacerations, and abrasions or contusions. The fontanelles should be palpated, preferably with the infant in the sitting position.

Face — The face is examined for symmetry. Facial palsies and asymmetric crying facies are most obvious when the baby is crying and may go unnoticed in the quiet or sleeping baby.

Eyes —The examiner should note the position and spacing of the eyes, symmetry of the eyes, width of palpebral fissures, eye color, appearance of the sclera and conjunctiva, condition of the eyelids, pupillary size, and eye movement.

- Spacing − Hypertelorism, an abnormally wide interpupillary distance, is associated with a large number of syndromes including Apert syndrome (Acrocephalo syndactyly type I) and trisomy 13.

Upward slanting from the inner canthus is typically seen in infants with Down syndrome, whereas down slanting palpebral fissures are characteristic of Treacher Collins and Apert syndromes, and narrow short palpebral fissures in DiGeorge syndrome.

- Eye movement − Although asymmetric eye movement is common in the first month of life, asymmetric movement may be an indication of an abnormality within the brain or to cranial nerves III, IV, or VI.

- Pupils − Pupils should be assessed for their shape and reaction to light and may be suggestive of a syndrome, such as renal coloboma syndrome or CHARGE syndrome.

- Red reflex − An ophthalmoscopic examination should determine whether or not a red reflex is present in all neonates. The red reflex test is performed observing both eyes of the infant through an ophthalmoscope with the ophthalmoscope lens power set at "0" at a distance approximately 18 inches away from the infant. A normal red reflex emanates from both eyes and is symmetric in character without evidence or opacities or white spots.

Ears —The ears are inspected for their position, size, and appearance. Inspection for branchial cleft cysts (which may be located in the preauricular area and along the line anterior to the sternocleidomastoid in the neck), sinuses, preauricular skin tags or pits, or dysplastic features.

Mouth —Assessment of the interior of the mouth includes examination of the gingiva, tongue, palate, and uvula. The following findings are commonly seen in the neonate: Epstein's pearls, mucocele, ranula , frenulum linguae, ankyloglossia.

- Natal teeth usually are primary mandibular incisors. Although they most commonly occur as an isolated finding, natal teeth may be associated with a variety of syndromes, such as chondroectodermal dysplasia (Ellis-van Creveld syndrome), pachyonychia congenita, Sotos syndrome, and Hallerman-Streiff syndrome. Treatment may involve observation, smoothing of the incisal edge (to prevent potential discomfort during breastfeeding and ulceration in the floor of the mouth), or extraction. Extraction should be considered if the teeth are not well secured and may be a potential aspiration risk, or if they pose problems with feeding

- Clefts of the soft or hard palate may be visible by inspection.

Neck — The neck should be assessed for abnormalities, such as masses, decreased mobility, or excessive skin.

Masses — Neck masses in the newborn infant may be differentiated by their location and include the following: Cystic hygroma, Branchial cleft cysts, Hematomas may be the cause of masses in the lower portion of the neck.

- Thyroglossal duct cyst or enlarged thyroid .

Breast —If the nipples appear to be widely spaced, measurement of the distance between the nipples should be compared with available normative data. In general, an internipple distance that is >25 percent of chest circumference is considered wide-spaced.

GESTATIONAL AGE ASSESSMENT: [96,97]

Gestational Age Assessment is defined as the estimated gestational age of a newborn. The New Ballard assessment score is suitable to assess the stage of maturity of neonates from gestational age of 20 weeks to 44 weeks.[24] For neonates < 26 gestational weeks, the examination sooner than twelve hours after birth is done. For neonates > 26 weeks of gestation, the gestational age calculation is done within 96 hours of birth (Ideal time- 48 hours of birth). This calculation statistics is vital since it is directly proportional to the possibility of problems during the neonatal period. Low scores associate with prematurity and the high scores associate with post maturity[25.]

The constituents of the neuromuscular assessment are,

1. Posture

2. Square window

3. Arm recoil

4. Popliteal angle

5. Scarf sign

6. Heel to ear.

1. Posture: Posture of preterm neonates are assessed by the degree of flexion at the extremities. If the preterm neonate is having lesser gestational age then it shows mild degree of flexion at arms and leg in contrast to the term babies having more flexion at the arms and legs.

2. Square window Assessment: It is done by grasping the forearm of neonate with one hand and gently flexes the wrist towards the inner arm, restricting the rotation at the wrist. The angle at which the hand meets the wrist is measured. Term neonates shows 0-degree angle and preemies have less wrist flexibility with have more flexion angle at wrist.

3. Measure arm recoil: Both forearms are flexed and hold for five seconds .After five seconds of flexion, the arm and the hands are extended straightly at the side of the newborn. Now remove the hands and permit the arms to recoil which mean the returning of flexion of arms. A term neonate shows full flexion than the less flexion by preterm neonates. The arm recoil score is determined by the angle of flexion at elbow.

4. POPLITEAL ANGLE: The neonates' thigh against the abdomen is pressed. Then popliteal angle is measured behind the knee at the popliteal fossa at the angle of resistance while the movement of leg towards the head. Term neonates are having 90-degree angle with less flexibility in contrast preterm neonates straightens to 180 degree.

5. Assess the scarf sign: It is the resistance met while crossing the neonate arm over the body to the opposite side of the neck by grasping the neonates hand .Before crossing the midline resistance occurs in term infant while in preterm neonates elbow would cross midline .

6. Assess heel to ear: This is done by moving heel toward his head (near ear) with keeping gluteal region with touching the surface. The degree of extension of the leg is measured at the point of resistance. Resistance would be more for the term neonates almost at the starting point of the movement compare to preterm neonates which meet very less resistance at the end point of touching the ear by heel.

Physical maturity

The components to assess the physical maturity include skin, lanugo, plantar surface, breast, eye/ear, and genitals. Assessment is done based on scores for these parameters.

Skin: The skin of the preterm neonates is translucent and friable compared to the full term neonates who are leathery, cracked, and wrinkled. Also skin should be assessed for the veins, peeling and transparency.

Lanugo: It is the very finest hairs in the body of preterm neonates which are born after the mid of third trimester. It is not developed before mid of third month and also absent in post term neonates.

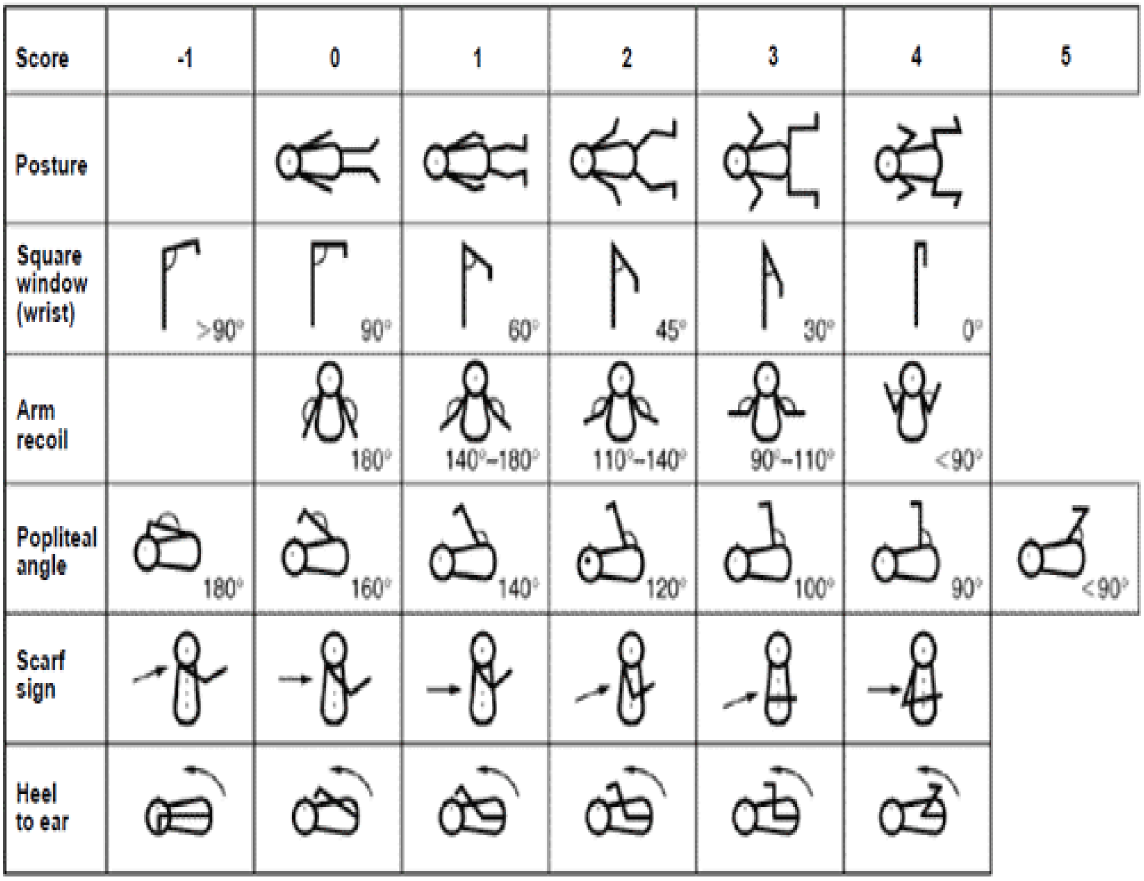
Plantar surface: The plantar surface of preterm neonates has thin red markings and absent in the extreme preterm neonates. In contrast, the plantar surface of full term neonates shows plenty of creases.

Inspection of the breast: The breast bud and the areola parts are assessed for the physical maturity assessment. In preterm neonates, the breast bud is absent in contrast to the full term neonates whom have elevated areola with breast buds 3 to 10 mm in diameter.

Eye/Ear: Assessment of the preterm neonates has shown soft cartilage with less curved pinna in contrast to the term neonates having curved pinna with firm cartilage. Ear recoil is also used to assess the physical maturiry of preterm neonates. Fused eyelids are also a feature of preterm neonates.

Genitals: In males, the genitals of premature neonates show smooth, flat scrotum with no scrotal rugosity and sometimes with undescended testes in contrast to term neonate with rugae and palpable testes in scrotum . In females, the preterm neonates have clitoris larger than labia majora and minora in contrast to term neonates whose labia and minora are larger than clitoris.[26]

Neuromuscular Maturity



Physical Maturity

Skin	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth, pink; visible veins	Superficial peeling and/or rash; few veins	Cracking, pale areas; rare veins	Parchment, deep cracking; no vessels	Leathery, cracked wrinkled
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	
Plantar surface	Heel-toe 40-50 mm: –1 <40 mm: –2	>50 mm, no crease	Faint red marks	Anterior transverse crease only	Creases anterior ⅔	Creases over entire sole	
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola, 1–2 mm bud	Raised areola, 3–4 mm bud	Full areola, 5–10 mm bud	
Eye/Ear	Lids fused loosely: –1 tightly: –2	Lids open; pinna flat; stays folded	Slightly curved pinna; soft; slow recoil	Well curved pinna; soft but ready recoil	Formed and firm, instant recoil	Thick cartilage, ear stiff	
Genitals (male)	Scrotum flat, smooth	Scrotum empty, faint rugae	Testes in upper canal, rare rugae	Testes descending, few rugae	Testes down, good rugae	Testes pendulous, deep rugae	
Genitals (female)	Clitoris prominent, labia flat	Clitoris prominent, small labia minora	Clitoris prominent, enlarging minora	Majora and minora equally prominent	Majora large, minora small	Majora cover clitoris and minora	

Maturity Rating

Score	Weeks
-10	20
-5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

Treatment approach [98 - 107]

Treatment of premature infants should be executed in 3 steps:

- Immediate resuscitation and stabilization of the infant after birth
- Initial consultation and recommendation to a NICU, as postponements in transfer can affect neonatal outcomes
- Updating the parents with respect to the present health status of the newborn and the need for transfer to specialized care.

Where probable, it should be organized for very low-birth-weight infants to be born at a highly specialized hospital, commonly designated as a level III hospital.

A. Immediate Neonatal Resuscitation in the Delivery Room

All newborn infants should be assessed and resuscitated and they are compulsory according to local guidelines. Prior groundwork of both equipment and personnel is critical for success. Resuscitation should comprise clearing of the airway, proper head positioning, and provision of warmth, drying the baby, appropriate stimulation, and assessment of breathing, heart rate, and colour. In preterm neonates born at 24 to 36 weeks' gestation, suspending cord clamping for 30 to 120 seconds is connected with less need for transfusion, circulatory stability, less intra ventricular haemorrhage and lower risk for necrotizing enterocolitis (NEC). Numerous premature infants will demand respiratory support soon after delivery, as they are evident signs of increased work of breathing such as nasal flaring, retractions, apnoea, or cyanosis. Distribution of respiratory support can be accomplished via supplementary oxygen, positive pressure ventilation by mask, CPAP or bag-mask-valve, or intubation. Premature infants need smaller face masks and endotracheal tube sizes and can suffer severe long-term consequences from extreme ventilation or hyper-ventilation connected with aggressive bagging. Only after the infant has been sufficiently resuscitated it should have a detailed physical examination using the New Ballard exam to facilitate estimation of gestational age and identification of any potential abnormalities. The degree of prematurity in most cases directly correlates with the extent and severity of acute medical conditions.

B. Subsequent management

Management of acute medical problems frequently connected with premature birth should be addressed in consultation with a neonatologist, once efficacious resuscitation and stabilization have occurred. Active treatment of severe diseased conditions at the beginning state which associated with preterm such as tachypnoea, septicaemic infections, impaired glucose metabolism disorders, malnutrition , hypothermia and cardiovascular diseases is important. Each preterm neonate should be appraised cautiously and managed separately with individual care.

C. Once the preterm neonate become stable and or shifted to NICU, the information which helps in supplementary preemies treatment are mother's pregnant record, blood grouping & Rh typing, congenital malformations in fetus scanning, mother's HIV status, group B beta hemolytic streptococci infection , chicken pox and Australian antigen (HBsAg) screening, time difference between membrane rupture and labour, meconium staining of liquor amni, fetal sufferings inside uterine cavity and spinal or general anesthesia given to mother during labour . In stable preterm infants kangaroo mother care improves patient outcomes and parent-infant bonding. It shortens hospital stay by more breast feeding and establishing close contact between mother & baby skins.

1. EXTREME PREMATURITY: GESTATIONAL AGE <28 WEEKS [3]

This sub-group displays the greatest morbidity and mortality associated with premature birth. Therefore, early consultation with a neonatologist to maximize delivery of care and enable early transfer is critical. Management of these babies needs meticulous attention to delivery room resuscitation methods and subsequent treatment.

1.a. Ventilatory support and oxygen

These infants have the uppermost danger for displaying pulmonary failure due to essential lung prematurity. Ventilator may be essential instantaneously due to sudden cessation of breathing(apnoea) spells , inadequate oxygenation , chest wall indrawing , cyanosis , increased respiratory rate and a progressive increase in the quantity of supplemental oxygen to relieve desaturations after birth. Sufficient moderate aeration is very important to decrease the possibility of diseases connected with more tidal capacities. If the babies require continous positive pressure in the mask then it should be achieved by nasal O_2 support in addition of ryles tube for gastric decompression. Endotracheal tube (ETT) position must be confirmed by x-ray chest, directly visible through vocal cards, breath sounds auscultation by both sides. ETT with size 2.5mm and depth (6 + weight in kg = cm at lip) for weight less than 1` kg is very important. One should take effort to control baro or volutrauma once ventilator is used. Volume targeted ventilatory modes decrease length of ventilation and risk of broncho-pulmonary dysplasia. Nasal CPAP started in the delivery room instead of intubation and surfactant in infants younger than 28 weeks is currently an option and such a strategy has shown to decrease duration of mechanical ventilation and the need for corticosteroids for broncho-pulmonary dysplasia (BPD). No increase in adverse effects is noted in the CPAP group and the primary outcome of death or BPD is similar in both the CPAP and the intubation group. Oxygen is weaned based on targeted oxygen saturations (usually 91% to 95%). Saturation targeting <90% in preterm infants is associated with increased mortality.

Surfactant insufficiency due to prematurity is treated with exogenous surfactant management. ETT position should be confirmed before surfactant application to avoid pneumothorax or disproportionate delivery of surfactant to one lung or the other. Succeeding ventilator adjustments after surfactant management to overcome the delivery of too many tidal capacities are connected with more observance.

1.b. Hypothermia

Hypothermia is particularly predominant effect to raise heat expenditure from convection, evaporation and radiation. A radiant warmer, the use of plastic caps, infant blankets, trans-warmer pad help to reduce hypothermia. Normal temperature is between 36.5°C and 37.7°C.

1.c. Hypoglycaemia

Avoidance of hypoglycaemia (blood glucose 2.5 mmol/L or [<45 mg/dL]) is critical and can be accomplished by giving IV fluid 10% dextrose without additional electrolytes at 80-100 mL/kg/day. Feeding is frequently postponed until shift to NICU is accomplished, so that preliminary cardiopulmonary stabilization can be completed. Normally preterm babies have immature gastrointestinal systems by which they are more prone to get gastro intestinal pathologies in early neonatal life. The most common among them is necrotizing enterocolitis (NEC) in which the lining mucosa of intestinal bowels which will get frequent injuries while the preemies take food supplementations. This is less common in preterm babies who would take breast milk exclusively in early neonatal life than others.

1.d. Vascular access

Owing to technical problems in attaining and sustaining peripheral access with the possible need for drugs that need unshared IV access because of incompatibility, numerous lumen mid IV access with umbilical vein or percutaneous central venous access is often essential. Umbilical or peripheral arterial access may be compulsory for monitoring of blood pressure. Heparinisation of the fluid infused through umbilical arterial and percutaneous venous catheters with a heparin concentration of 1 unit/mL decreases the likelihood of occlusion with thrombosis.

1.e. Hypotension

Hypotension is managed by neonatologist since poor neurodevelopment has least ability to auto regulates cerebral flow of blood (CBF). Mean arterial pressure of 30 mmHg is needed for normal CBF perfusion. Intra ventricular haemorrhage (IVH) is caused by swings in blood pressure. Dobutamine improves cardiac output and increases poor perfusion. Prostaglandin infusion maintains ductal patency in ductal dependent congenital heart disease.Hydrocortisone is used in Vasopressor resistant hypotension.

1.f. Infection

Preterm deliveries are caused by concurrent infection and timely antimicrobial treatment against gram+ve and gram –ve coverage with gestational age appropriate dosing by neonatal consultant recommendations will prevent birth of preterm child births.Positive blood cultures should be treated with antibiotic treatment for 10 to 14 days and if the culture is negative antibiotics can be stopped.

1.g. Recurrent apnoea

Recurrent apnoea will be treated by Methylxanthines for neonates with < 34 weeks of gestation. Caffeine preferred for methylxanthine because of safety profile. Caffeine should be discontinued for >34 weeks infants and if apnoea persists 5 to 7 days.

1. SEVERE PREMATURITY: GESTATIONAL AGE 28 TO 31 WEEKS

Medical conditions related to extreme prematurity are less severe and may even be absent. These infants need specialized care, and early neonatal consultation should be attained, with subsequent transfer to a NICU after stabilization.

2.a. Ventilatory support and oxygen

As gestational age increases, the possibility of severe respiratory distress requiring delivery room intubation decreases in the absence of other factors such as sepsis or severe perinatal depression. Many of the infants require CPAP only with minimal exposure to supplemental oxygen. Gentle PPV may be required in some infants. High oxygen exposure (100%) has risk of retinopathy or chronic lung disease and should not be given. Increasing 10% increments FiO2 should be given if 40% oxygen fails to produce response in infants. Oxygen is weaned based on targeted oxygen saturations (usually 91% to 95%). Saturation targeting <90% in preterm infants is associated with increased mortality. If intubation is necessary, the recommended ETT size is 3 mm and depth (cm at lip) is 6 + weight in kg. Endotracheal tube (ETT) position must be confirmed by x-ray chest, directly visible through vocal cards, breath sounds auscultation by both sides. Surfactant treatment may be necessary and should be done with care after verification of ETT location, to avoid complications associated with increases in pulmonary compliance, such as pneumothorax.

2.b. Hypothermia

Prevention of hypothermia remains a very important issue. Trans-warmers or clear plastic bags are not commonly in use in this age group, as radiant warmer pre-warming in conjunction with drying is generally adequate immediately after delivery. After resuscitation, maintenance of normothermia can be accomplished using a radiant warmer. Normal temperature is between 36.5°C and 37.7°C.

2.c. Hypoglycaemia

The risk of hypoglycaemia remains more and necessitates early IV fluid management with the 10% dextrose only. The extra withholding enteral nutrition (electrolyte at 60-80 ml/kg/day is suggested until the infant has been safely transferred and fully assessed due to the risks of NEC. Normally preterm babies have immature gastrointestinal systems by which they are more prone to get gastro intestinal pathologies in early neonatal life. The most common among them is necrotizing enterocolitis (NEC) in which the lining mucosa of intestinal bowels which will get frequent injuries while the preemies take food supplementations. This will less common in preterm babies who would take breast milk exclusively in early neonatal life than others.

2.d. Vascular access

Central IV access may or may not be necessary, depending on the infant's clinical condition. Peripheral IV access alone may be adequate if appropriate introduction and escalation of enteral nutrition is tolerated.

2.e. Hypotension

Hypotension is a clinical possibility in this age group and should be managed in consultation with a neonatologist prior to transfer to an appropriate facility. The risk of IVH remains but is significantly reduced compared with the risk in the extreme prematurity group. Prostaglandin infusion maintains ductal patency in ductal dependent congenital heart disease. Hydrocortisone is used in Vasopressor resistant hypotension.

2.f. Infection

Sepsis is a clinical possibility in this age group. Appropriate antibiotics should be given and blood cultures obtained prior to administration. Positive blood cultures should be treated with antibiotic treatment for 10 to 14 days and if culture is negative antibiotics can be stopped.

2. MODERATE PREMATURITY: GESTATIONAL AGE 32 TO 33 WEEKS

Infants in this category experience less acute morbidity than those in the severe and extreme premature groups. These infants need specialized care and early neonatal consultation should be gained with subsequent transfer to a NICU after stabilization. Commonly encountered issues include hypoglycaemia and mild respiratory distress. Transient nasal CPAP may be required, but intubation and surfactant treatment are rarely necessary. IV fluids (10% dextrose without additional electrolytes) are often necessary to avoid hypoglycaemia in infants who are commenced on enteral feeding, as feeding must be very slowly advanced. An inability to maintain normothermia, 36.5°C to 37.7°C, remains an important possibility with this group and temperature management via a radiant warmer or isolette is important. Screening and treatment for suspected infection with antibiotics and management of hypotension may be necessary.

3. NEAR-TERM: GESTATIONAL AGE 34 TO 36 WEEKS

This group is least likely to manifest severe problems associated with prematurity.

The risk of respiratory distress demanding intervention is very low though, some infants may require momentary nasal CPAP, inability to maintain a normal temperature between 36.5°C and 37.7°C, when adequately wrapped. Treatment of infection with antibiotics or management of hypotension may be necessary. Management of infants between 35 and 36 weeks' gestation includes attention to their increased risk for jaundice.

Infants below 35 weeks' gestation may require feeding support and should be transferred to a NICU. Advancement of enteral feedings may be limited by the infant's ability to feed orally (especially in 34 weeks' gestation infants), necessitating transitional IV fluids to avoid hypoglycaemia. Infants between 35 and 36 weeks' gestation may do well clinically after delivery and can be sent to the newborn nursery with routine orders. However, they need to be watched more closely than term infants, as they may manifest feeding difficulties and associated hypoglycaemia due to prematurity, and may require admission to the NICU for supportive therapy.

NURSING CARE MANAGEMENT:

1. Carefully dry the neonate with pre warmed cloth.
2. Cover the preterm neonate with a pre-warmed blanket and dry cap on the head.
3. Ensure neutral thermal environment by keeping away from heat expenditure from convection, evaporation, conduction and radiation.
4. Administer supplementary O_2 till respiratory distress resolves.
5. Apply a pulse oximetry monitor and check the oxygen saturation level. It should be between 85% and 95%.
6. If hypoglycemia is doubted, immediately assess glucose level. If the glucose value is less than 40–45 mg/dL, breast feeding or formula feeding should be given immediately .Blood glucose level repeats within 30 minutes after the

feeding. If the hypoglycemia persist for the following instructions should be given:

a. Administer IV bolus of 2 mL/kg of dextrose 10% in water at a rate of 4–6 mg/kg/minute, which is 80 mL/kg/day immediately.

b. Blood glucose repeats after 30 minutes of bolus administration.

7. Blood glucose should be checked once in one to two hours till blood glucose level becomes normal.
8. Administer phototherapy, if the preterm neonate's bilirubin level increased
9. If the baby is stable:

    a. Implement kangaroo mother care (KMC) or skin-to-skin care. If KMC is not practicable, deliver a substitute heat source such as a radiant warmer.

    b. Encourage rooming in.

Feeding should be started as early as possible and if breast feeding is initiated it should be given once in 2-3 hours. If it is formula feeding it should be given once in 3-4 hours.

2.3 LITERATURE RELATED TO MASSAGE THERAPY AND TACTILE STIMULATION:

BRIEF HISTORY OF MASSAGE:

Infant massage is an age-old parenting practice used in many cultures such as Asia, Africa, Latin America and Eastern Europe. Mothers in India have been massaging their newborns since 3000 BC while the infant massage has taken hold in the West in the last 30 years only. Vimala McClure in her book of "Infant Massage: A Handbook for Loving Parents" stated that "For an infant, massage is much more than a deluxe, sensual experience or a type of physical therapy. It's a tool for maintaining a child's health and well-being on many levels."[108]

Neonatal massage therapy is the method of using tactile and kinesthetic stimulation through a range of massage strokes. Mild force stroking of the neonate's body is known to as gentle human touch (GHT) and is distinguish from neonatal massage. GHT has no long term advantages and shows adverse effects like "apnea, bradycardia, decreased oxygen saturation levels, and excessive energy expenditure through increased activity, avoidance behaviors, tachycardia, tachypnea, and hypoxemia".

THEORIES OF MASSAGE THERAPY:

Two main theories of massage have been studied. Perhaps the most commonly studied theory involves a technique developed by **Tiffany Field** at the Touch Research Institute in Miami, Florida. This protocol involves 3-5 minute phases. The first and third segments are tactile stimulation of systematic moderate pressure stroking, while the middle segment is kinesthetic stimulation of flexion and extension of the upper and lower extremities.

The **second theory** of massage is called auditory, tactile, visual, and vestibular (ATVV) multisensory intervention. This method uses not only moderate pressure strokes, but also natural maternal sensory stimulations. Vimala McClue popularized this theory; founder of Infant Massage USA Vimala's method is focused on total parent and infant interaction and following infant cues. This method of massage is not as structured by time segments as Field's protocol, but rather the basis of Vimala massage is providing moderate pressure strokes towards and away from the heart in six anatomical regions of the body: the face, upper limbs, thorax, abdomen, lower limbs, and back, ending with kinesthetic stimulation of gentle stretches of each limb.

BENEFITS OF MASSAGE:

There are many documented benefits of neonatal massage therapy. They are: increased weight gain, more effective sleep patterns, increased gastric motility, improve immunity, prevent skin infection, maintain thermo regulation, reduce stress, increase relaxation and enhanced development.

The Muscular System

Massage therapy relieves soreness, tension, and stiffness, improves muscle tone, increases flexibility and range of motion of joints, improves the flow of nutrients to muscles and joints, and accelerates recovery from fatigue and injury.

The Skeletal System

Massage therapy improves posture/body alignment, relieve stiff joints, decreases inflammation, increasing joint movement, releases joint strain and improves the circulation and nutrients of your joints.

The Integumentary System

Massage therapy improves skin tone by removing dead cells and improving circulation, regenerates tissue, helps to normalize glandular functions and stimulates blood flow to nourish the skin.

The Circulatory System

Massage therapy increases blood flow to tissues and organs , which can relieve much muscular and joint pain, increases the flow of oxygen and nutrients , increases the number of red blood cells, lowers blood pressure, reduces heart rate and eliminates metabolic waste.

The Lymphatic System

Massage therapy cleanses the wastes and toxic debris in the body, increases the circulation of lymph, stimulates the immune system (strengthens resistance to disease), reduces edema of the extremities (arms and legs), and removes lactic acid from fatigued and sore muscles.

The Respiratory System

Massage therapy develops respiratory muscles, regulates respiration, and promotes deeper and easier breathing.

The Nervous System

Massage therapy stimulates nervous system, boosting energy, calms the Nervous System (relaxing); massage may have a sedative, stimulating or an exhausting effect on the nervous system; it relieves restlessness and insomnia, relieves pain due to pinched nerves, decreases chronic pain and stimulates the release of endorphins.

The Endocrine System

Massage therapy helps the body to restore and heal itself, develops a restful sleep pattern and promotes appropriate levels of hormones.

The Digestive System

Massage therapy relieves constipation, relaxes the abdominal and intestinal muscles, eliminates waste materials and stimulates activity of liver and kidneys.

The Urinary System

Massage therapy stimulates the elimination of metabolic waste, cleanses the body of wastes and toxic debris in the body and increases kidney action to remove wastes of protein metabolism.

DEFINITIONS OF TACTILE STIMULATION:

"**Tactile stimulation**" is the first communication between infant and mother, who makes an infant begin to feel affection and love. Tactile stimulation is a way of conveying meaning that has been used since the beginning of mankind.[109]

Tactile stimulation is defined as systemic skin-to-skin therapy, which is the act of gentle, light stroking, and gentle touch which is significant for early physical growth, neurological and psychological development of human·

CONCEPT OR COMPONENT OF PROVIDING TACTILE STIMULATION FOR PRETERM INFANT

Concept of providing tactile stimulation for preterm infant is described as the components of tactile stimulation as they relate to facilitating adaptation or fostering mal-adaptation, which is determined by the varying afferent impressions on an individual's skin.

The component of tactile stimulation including 6 parts.

1) Duration, 2) location, 3) action, 4) intensity, 5) frequency and 6) sensation.

The details of each part are described as follows:

1. **Duration of tactile stimulation** refers to the length of time in tactile from initiation of the contact to cessation.

2. **Location of tactile stimulation** refers to the area of the body contacted by the person who is providing tactile stimulation and encompasse **three dimensions** as follows:

- **Threshold** is an individual's sensitivity to tactile stimulation. For preterm infants, face is extremely sensitive, but the back and arms are less sensitive.

- **Extent** is the number of areas of one's body, which are touched in relation to the number of areas available to be stimulated over the entire body surface

- **Centripetality** is the degree to which the trunk of the body is tactile stimulated rather than limbs.

3. Action of tactile stimulation refers to the rate of approach to a body surface with the connected amount of physical energy. P reterm infants usually need gradual and rhythmic action of tactile stimulation.

4. **Intensity of tactile stimulation** refers to the extent of indentation applied to the body surface by the pressure of tactile stimulation with effects by hyper excitability in the cortex.

5. **Frequency of tactile stimulation:** Frequency of tactile stimulation affects the biochemical, metabolism, gastro intestinal motility; granular, and changes in muscles. High frequency of tactile stimulation promotes increased emotional development.

6. Sensation of tactile stimulation refers to the immediate comfort or discomfort reaction of the skin to a tactile stimulation, with specialized reception and transmission to the brain.

HOW DO MASSAGE/ TACTILE STIMULATION WORK ON THE PRETERM NEONATE? [110]

Tactile stimulation is a natural and almost instinctive way to care. It is the best way to get oxytocin released into the body. Oxytocin synthesized by the hypothalamus and secreted by the dorsal lobe of the pituitary gland in both sexes, 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 neural reactions. It acts as a coordinating and adaptive system that links to the important control centers of 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 also works closely with vasopressin, which is important in the flight or fight mechanism. Massage decreases the levels of the stress hormone cortisol in blood. They also increase the number of lymphocytes, white blood cells that are part of the immune system.

Massage therapy enhances the bonding, improves sleep pattern, stimulates circulation, improves digestion, facilitates food absorption, results in faster weight gain and the infants level of stress hormone reduced as a result it improves immune function· Massage or touch therapy is a natural and almost instinctive way to care.

2.4 STUDIES RELATED TO TACTILE STIMULATION:

Field cconducted meta-analysis study[111], 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.[112] 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[113] 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 was given for 10 days . Results were analyzed .The two treatment groups gained significantly more weight compared to the control group (291.3 and 311.3 vs. 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[.114], 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.

Priya Singh Rangey and Megha Sheth,[115] studied massage therapy (MT) versus Kangaroo Mother Care (KMC) on weight gain and hospital stay in preterm neonates. Convenient random sampling was done and RCT study design was adopted .Data were collected from medically stable babies < 37 weeks gestation and birth weight < 2500 g at NICU ,V.S. hospital who were assigned into massage and KMC group. Massage Therapy and Kangaroo Mother Care was done for 15 minutes, thrice daily for 5 days. Pretest and posttest intervention on day 1 and after intervention day 5 were recorded. Data analyzed SPSS16. Results were analyzed .This study showed that both MT and KMC were equally effective in increasing body weight and decreasing hospital stay.

Zohreh ,Badiee1, Shiva Samsamshariat, et, al [116] did a study on massage effect on weight gain among premature infants. This randomized clinical trial was conducted on three groups of preterm neonates. First group received routine care and no massage, second group was massaged by their mothers and the third group was massaged by the nurse. Daily gain in weight, stay in hospital and fluid intake of infants were evaluated. Kruskal Wallis test and SPSS software were used for statistical analysis. The infants who received massage by a nurse had significantly additional weight gain compared to the other groups. Preterm babies who were massaged by their mothers also gained weight significantly more than the control group. The study revealed that the five days were enough for stable preterm infants to facilitate weight gain in neonate.

Field, Diego [117] conducted a study on moderate pressure massage and light pressure massage therapy on vagal activity and stomach motility in preterm infants. ECG on the infant's chest and EGG placed on the infant's abdomen measures vagal activity on the heart and vagal tone on the gastric activity. Results show that the moderate pressure massage group had significantly increased weight gain due to higher gastric motility and vagal nerve activity during and immediately after massage compared to the light pressure massage group.

Wheeden, Scafidi, [118] conducted a study on the effect of massage in preterm cocaine-exposed neonates. 30 neonates were randomly allocated to 15 in massage therapy group and 15 in the control group .Neonates whom were medically stable were included in the study. Massage was given for 15 minutes, 3 times a day for 10 days consecutively. Groups did not differ in caloric intake. Results showed that had 28% greater weight gain per day in the massage group more than the control group .This study also confirms that the postnatal complications and stress behaviors were significantly lesser in massage group than the control group and mature motor behaviors on the Brazelton examination were higher in the massage group.

Vickers, Ohlsson [110] did an RCT study to find out the effect of massage therapy on preterm neonates in the hospital nursery .60 neonates were included and randomly assigned into massage group and control group of 30 each. These neonates belonged to 30- 35 weeks gestational age, enteral feeding and showed no significant difference in caloric intake, anthropometric measurements (head circumference, weight) sex, birth weight and gestational age. Massage group had weight gain of 188.2 +/- 41.20 g/kg which is statistically significant gain ($P < 0.001$) than control group of 146.7 +/- 56.43 g/kg weight gain. Massage group neonates hospital stay of 15.63 +/- 5.41 days was shorter than the 19.33 +/- 7.92 days in the control group neonates which is also significant ($P = 0.03$). These findings were correlated with the vimala massage in nursery care preterm neonates.

Darmstadt, Saha et al[119] had a comparative study to find out the effect of massage therapy on weight gain and hospital stay in the preterm infants with an control group of same preterm cohorts without receiving massage therapy. Results confirmed that the massage group gained 5.1 grams daily weight gain and shorter the hospital stay by 4.5 days than the control group neonates. This study also came to the conclusion that the postnatal complications were reduced in the massage group infants.

Lee[120] conducted an RCT, cross-over study design on the effect of massage therapy on the energy expenditure in preterm infants. Out of 10 samples 5 were assigned into study (massage) group and another 5 were assigned into control group without massage therapy. In the 5 days the study group subjects were given massage therapy and in the remaining 5 days with another 5 subjects from the control group were transferred into the study group for massage therapy. During the massage therapy period, massage was 15 minute, thrice a day. The results showed that the energy expenditure was significantly lower in the study preterm neonates which showed that this lower caloric expenditure contributes to growth and weight gain caused by massage therapy.

Arora, Kumar[121] made an RCT study on oil massage effect on growth and neurobehavior in preterm very low birth weight neonates < 1500grams. The study subjects were randomized into 3 groups, first group massage with oil, second massage without oil, third group with no massage. Growth assessement by anthropometric measurement and neurobehavior assessement by Braselton's Neonatal Behaviour Assessment Scale was measured at regular intervals for 10 days intervention. Results reveal that weight gain in the oil massage group was 365.8 +/- 165.2g and in the massage group 290.0 +/- 150.2g and in the group without massage 285.0 +/- 170.4g .This study finding shows, that the weight gain was increased in massage with oil application among the preterm neonates.

Agarwal, Gupta et.al. [122] studied to assess the use and benefits of oil massage among infants in Assam. Full term born healthy infants (n = 125) and weighing more than 3 kg were included in this study. Five different groups belonging to massage with herbal oil, massage with sesame oil, massage with mustard oil, massage with mineral oil were given intervention for 4 weeks. The fifth group consisted of subjects without massage intervention. Results show that the anthropometric measurement (lenghth,MAC,MLC,weight) of the infants was more improved by the massage with different oil group than the group without massage therapy.

Lee [123] conducted a study to evaluate the effect of infant massage in respect to the weight, height, mother-infant interaction in normal infants. The aim of the study was to determine the auditory, tactile/kinesthetic (massage) and visual stimulation on weight, height and mother infant for 4 weeks. Result shows that weight and height were markedly increased and significant difference was exist between the two groups in mother-infant interaction which concluded massage improves both.

Massaro, Hammad et.al. [17] had a double blind RCT study in Iran , to evaluate the effect of coconut oil massage in preterm neonates . 73 Study subjects were randomly allocated into three groups. A nurse who was blinded to the study were collected the weight of the study subjects. The results show a greater difference in the weight gain in the intervention group with coconut oil than the massage without coconut oil and the control group. Hence, this study shows that the coconut oil massage increases weight gain in preterm neonates.

Field, Hernandez-Reif et.al[124] had a comparative study on the effect of moderate and light pressure massage on the organized behavior and weight gain in the preterm infants. 68 study subjects were randomly assigned into 34 subjects in to the moderate massage group and 34 in to light pressure group. Interventions were given for 15 minutes thrice daily for 5 days .Organized behavior consisted of physiological parameters including crying, active sleep, movements and stress behaviors (hiccupping) and they were documented for a 5 day period. Results reveal that organized behavior and weight gain were significantly higher in the moderate versus light pressure massage than the light pressure massage group. Thus, the moderate pressure massage therapy group exhibits higher vagal tone, lower heart rate, more relaxed and less awakened contributing to weight gain than the light pressure massage therapy group.

Emory, Redzepi et al [125] evaluated the effects of massage therapy on sleep/wake behavior & weight gain in the hospital based stable preterm neonates. Out of 32 study participants, 16 were randomly assigned into experimental study group with subjects of the mean gestational age of 30.1 weeks, mean birth weight of 1359g and another 16 were assigned into control group with mean gestational age 31.1 weeks and mean birth weight 1421 grams respectively. Massage therapy was given for 15-minute periods per day for 5 days as body stroking and passive limb movement. Results showed 53% greater daily weight gain in the massage group than the control group. Massage group shows less time sleeping and more alert during awake at the end of 5 treatment days.

Dieter et al**.** [126]**,** conducted a study to evaluate the effect of massage on sleeping pattern and weight gain in LBW infants in Russia. LBW in the age group of 2-8 months were included as the study participants. Study subjects were assigned into experimental and control group. Massage intervention was given for 15 minutes thrice daily for 10 days to the experimental group infants. Data were collected and analyzed. Results revealed 21-47% greater weight gain more in the experimental group subjects than the control group subjects. As regards sleeping pattern, the study group subjects snored less during sleep, had less waking-up at night for feeding and more alertness in daytime. Also another interesting finding in this study was the experimental group infants got 48% more weight gain than control infants in 5 days period of massaging.

Ancy Varghese [127] **c**onducted a study on touch therapy in weight gain and sleep awake pattern among preterm babies. A sample comprised 40 preterm neonates. Touch therapy was administered to the experimental group for 15 minutes twice daily for five successive days. A modified Als observational rating scale was used for data collection. Results revealed that there was significant weight gain (the mean difference of pretest and posttest weight gain score was 0.136) and sleep awake pattern (the mean difference of pretest and posttest sleep awake pattern was 3.3) after the administration of touch therapy.

Hae-kyung Lee, [128] studied the effect of massage in physiological and behavioral parameters among the premature neonates. Results show that the vagal tone was significantly higher in the experimental group preterm neonates which in turn led to more awakened state and motor activity in this group. Also massage group showed significant weight gain than the control group neonates. The results show increase in the physiological responses and behavioral scores of experimental group premature infants. NICU nursing staff can utilize massage to encourage child's proficiency to his surroundings positively and to offer developmental aid for normal preemies.

Agarwal, Gupta et al[129] conducted an experimental study to find out the effectiveness of tactile stimulation (massage with oil) on sleep pattern & growth among babies at G.T.B Hospital, Delhi. The data were collected from 125 full term born healthy infants with 6+/- 1week of age and with the birth weight > 3000g were a randomly assigned five different groups belonging to massage with herbal oil, massage with sesame oil, massage with mustard oil, massage with mineral oil were given intervention for four weeks .The fifth group consisted of subjects without massage intervention.The study tools were anthropometric Measurement; sleep pattern ; micro haematocrit; serum proteins, CPK and creatinine ; blood flow using color Doppler. The results revealed that massage improved anthropometric measurements including length, weight, MAC and MLC as compared to infants without massage and there were no changes in micro haematocrit, serum proteins, CPK, serum creatinine in control group.

Solanki, Matnani et.al. [130], conducted an RCT study in the infants in the Neonatal Care Unit. The aim of the study was to evaluate the effectiveness of safflower oil massage and coconut oil massage in massaged babies and to determine the blood level of triglycerides profile and fatty acid profile in post oil massage neonates .Study subjects were randomly allocated into three groups. First experimental group of safflower oil massage group, second experimental group of coconut oil massage group and third control group of oil massage group. Massage was done in each group 4times / day for 5 days. Gas chromatography was done in Pre and post intervention blood samples for triglycerides profile and fatty acid profile in the infants. Post oil triglyceride values and fatty acid profiles were significantly greater in both experimental groups than in oil massage control groups. Essential fatty acids (linoleic acid and arachidonic acid) were high in the blood of safflower oil massage group and saturated fats were high in the blood in the coconut oil massage group. From this study it we understand that the massage oil was absorbed in infants and used for nutrition in them.

Anjali kulkarni, Jaya Shankar kaushik, et al [131] studied forty preterm infants who were allocated into study group for whom massage therapy was given for 45 min/ day for 10 days. Massage therapy preemies gained 21% more weight than the control group infants. This study also reveals that early neonatal stress was reduced in massage infants in the experimental group and the tactile stimulation aided circulation and· strengthened muscles.

Ramasundari[132] conducted a pre experimental study in Maternity ward of the Om Sakthi Hospital, Krishnagiri, to appraise the effectiveness of massage therapy on health promotion of newborns. The convenience sampling technique was used. Pre and post assessment was done by using Brazelton's Neonatal assessment scale. The subjects were given massage with coconut oil all over the body except face for 20 minutes per day for 5 days. The result revealed that health promotion was achieved by applying massage therapy by crying spells reduced, feeding frequency increased and sleeping time increased.

Smith, Lux, et. al.,[133] conducted a study to find out the effectiveness of tactile stimulation on the variation in the human heart rate as the replacement assess of the progress sympathetic and para sympathetic nervous system. Massage therapy was given away for 4 weeks of hospitalization to improve heart rate variability (HRV) of preterm infants. The study was done with 21 medically stable male and female preterm neonates. Heart rate variability measurement was taken at sleeping hours and also after massaging the preterm neonates. Results revealed that massage therapy reduced tension in preemies by supporting progress in the autonomic nervous system. A massage therapy which exaggerated stroking of soft tissues by the movement of joints (flexion & extension) due to the application of moderate pressure increased HRV in male neonates only. HRV is a determiner of autonomic nervous system utility and evolution. Term newborns prove better heart rate variability, but premature neonates typically proved weakened heart rate variability and less response to tension environment. Heart rate variability in male preemies established the same effect just like full term neonates. 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".

Kim, Shin, et al[134] conducted a study to find out the effect of tactile stimulation on physiological parameters among stable preterm and full term neonates. The physiological variables applied in this study include weight, heart rate, vagal tone, O2 saturation, motor activities, behavioral states & distress. Measurements were taken ten minutes before and immediately after massage therapy. The results of the study revealed that the weight of the baby was expressively increased after massage. They also show that the scores for the physiological parameters including motor activity, vagal tone, and awake state were significantly higher in the experimental group than the control group preterm neonates. The study proved that the tactlie stimulation in preterm neonates would improve adequate physiological responses.

Fatima Aly, and Ghulam Murtaza[135] communicated a case report on Massage Therapy in Preterm Infants. In this case report preterm neonates with 30 weeks and 5 days of gestational age were selected and the preterm infant discharged at day 54 of life. The infant received parental whole body massage once per day for a minimum of 3 massages per week. The child seemed to have enhanced growth. This is the first study to examine the impending benefit of in-home parentally administered message therapy of a preterm infant. This case supports the hypothesis that in-home massage therapy may progress the long-term growth results of premature infants. The study revealed that massage therapy provided by this simple low-tech, low-cost, and low risk therapy should be seriously considered for premature infants.

Jocelyn Ang, Jorge Lua,[136] conducted an RCT to evaluate the effectiveness of massage therapy in immunological response among stable premature neonates. The immunological parameters included in this study for assessment were weight , frequency of infections, days of hospitalization, T lymphocyte and B lymphocyte cells, T lymphocyte cell subsets ,absolute Natural Killer cells and Natural Killer cytotoxicity. Sample size was 120 and 58 preterm neonates were randomly assigned into experimental group and 62 preterm neonates were assigned into the control group. Intervention was given for thrice daily for five days /week and continued for four weeks. Results show Natural Killer cytotoxicity and weight gain were increased more in the experimental group preterm neonates than the control group neonates. Other immunologic parameters frequency of absolute Natural Killer cells, frequency of infections, days of hospitalization, number of infections, and length of stay were not different between the experimental group preterm neonates and the control group neonates.

Guzzetta et al.,[137] studied massage therapy. In this study EEG delta band spectral value, Flash visual aroused potentials (FVEPs), levels of IGF-1, IGFBP3, were measured in the study preterm neonates before and after massage intervention for 12 days period. Results show that the steadiness in EEG delta band spectral value authenticated that massage may afford a protecting system and concur brain development**.** Further this study also confirmed 45% more behavioral visual acuity scores and 42.8 ms reduction in latency in the experimental group neonates concluding increase in the Flash visual aroused potentials (FVEPs) thus favors visual system maturation. This study also showed that increase in the IGF-1 and IGFBP3 has significant association with the retinopathy of prematurity. It also confirmed that the 5 day massage had greater impact in the preterm neonates in the experimental group for more than three months period.

Gonzetta made a study to find out the effect of massage therapy on the brain activities of preterm neonates. Study neonates were found to be 30 to 33 weeks of gestational aged and had massaged according to Field technique of 15 minutes each thrice daily for 5 days .Brain activity was collected by EEG recordings in both experimental group and in the control group. Results show that the brain activity behavioral cue increased and thus the massaged neonates had less time of transition from discontinuous to continuous activity like the mature brain waves. In contrast the control group neonates had larger degrees of shortening intervals between inter-bursts. This study revealed the mean reduction of time were 7 seconds between inter-bursts in the experimental group massaged infants compared to the inter-burst time of 2.8 seconds in the non massage control preterm neonates .

Procainoy, Mendes, et al139 made a prospective study on neurodevelopment outcomes among very low birth weight infants. RCT study was done with the sample size of 73 samples of mean gestational age of 32 weeks and birth weight between 750gms to 1500gms. Randomization was done and assigned into control group (skin-to-skin care only) and experimental group (skin-to-skin care and massage therapy). Intervention was done from 2 days to till discharge from the NICU and monitor until 2 years. Bayley scales of Infant Development were used for neuro development assessment . Psychomotor Development Index (PDI) and the Mental Development Index (MDI) measures were recorded in both the groups before and after massage. The results showed that both the PDI and MDI index were significantly higher in the experimental group neonates than the control group preterm neonates.

Karen Livingston, Shay Beider, et al,[140] conducted a RCT study to assess the massage versus standard of care in a Center for Newborn and Infant Critical Care (CNICC) and to implement the feasibility and safety of a parent-trained massage program for infants with medical conditions. Intervention of massage therapy and coaching given for 7 days and data were collected for 1 month. Result shows high levels of satisfaction and feasibility among caregivers for the implementation of massage in a level III academic center CNICC and this study also confirmed that the infants' safety based on physiological stability and no change in agitation/pain scores in the massage infants.

2.5 LITERATURE RELATED TO AUDITORY STIMULATION AMONG PRETERM NEONATE

Auditory stimulation is a process of communicative therapy in which a music therapist performs music with all its sides which include physical, emotional, mental, social, aesthetic, and spiritual. Music therapists primarily support customers to recover their health in numerous domains, such as intellectual functioning, motor skills, emotional development, social skills, and quality of life.

History

Music has been shown as a healing power for centuries. Aesculapius described that illnesses of the mind can be cured by using song and music. Music therapy was accomplished in biblical times, when David played the harp to rid the bad spirit from King Saul. As early as 400 B.C., Hippocrates played music to treat mental patients. In the thirteenth century, Arab hospitals delivered music rooms for the patients. In the United States, Native American medicine men regularly used chants and dances as a method of healing patients.[141] In the United Kingdom, musicians moved to hospitals and played music for soldiers suffering from war-related emotional and physical trauma.

Daniel Levitin said that the fetus hears the mother's heartbeat, music, conversations, and environmental noises.[142] At the age of one child recognizes and expresses a preference for music they were unprotected in the womb. The auditory system of the fetus is fully established at about twenty weeks of gestation. Music therapy for premature neonates is classically directed at integrating, and increasing the infant's reception for physical and auditory stimulation and at increasing strength and speed of sucking in order to promote growth. In recent studies, it has been found that music can be useful to newborns that are born prematurely. Music that is played or sung to a preterm neonates helps to slow the heartbeat and quiet breathing.

Benefits of music therapy: [143]

Music triggers relaxation response; thus it shows heart rate, respiratory rate; development of physical, sensory and cognitive skills, improves concentration and attention; increases self confidence, self esteem, personal insight and motivation; development of independence and decision making skills, enjoyment and improvement in quality of life, decreases stress, anxiety and tension; increases listening and self-management skills.

Exposure to classic music has beneficial effects :

- Pain relief
- Reducing blood pressure
- Music boosts immunity
- Music augments intelligence, learning and IQ
- Music calms, relaxes and helps to sleep
- Music increases memory performance
- Music increases concentration and attention
- Music increases physical performance
- Music increases body movement and coordination
- Music helps to work more efficiently
- Music diminishes stress and aids relaxation
- Music increases mood and decreases depression

How does music therapy work on preterm neonate? [141]

Auditory stimulation (Music) can energetically integrate mind and body, affecting emotional response, movement and sensory input. These outcomes in the modification of neurological pathways in the brain facilitate changes in behavior**,** improve respiration, lower Blood Pressure, improve Carbon-di-Oxide, reduce heart rate and relax muscle.

Auditory stimulation is the use of music to encourage relaxation, encourage healing, boost mental functioning and create an over-all sense of wellbeing. Music conveys positive changes in mood, stimulates emotional intimacy with parents and family and decreases stress and anxiety. The precise type of music helps a person healthy; physically as well as mentally relaxes by comforting the nerves.

2.6 STUDIES RELATED TO AUDITORY STIMULATION

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 [146] 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. [147,] 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[148] 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.

Amir Lahav [149] wanted to find out the effects of noise on heart rate in preterm infants. In this study the experimental group was unprotected to a recording of their mother's voice playing for 30 min daily all the way through their hospitalization. At 36 weeks corrected gestational age (CGA), all infants were unprotected to 10 s of an 85 dB white noise in a drowsy state and a 30 s recording of a female's voice in an active crying state.[150] The results revealed that in the drowsy state, the white noise stimulus motivated heart rate speeding up in both groups (p<0.01). However, in the crying state, the white noise stimulus motivated heart rate deceleration, which was more noticeable in the experimental group (p<0.01).

Litmanovitz Arnon , Shapsa et.al, [151] carried out a study to find out the effect of music therapy on behavior among preterm infant. In this study the infants receiving live music was equated with infants receiving recorded music or no music. The result revealed that the infant who received music therapy had significantly reduced heart rate and behavioral scores during the post treatment period. Live music comprised a lullaby sang by the female voice with frame drum and an additional harp. The same music was played by a tape recorder. Live music revealed significant benefits, whereas no statistically significant differences were found for the recorded music and control groups.

Live music is beneficial to preterm infants in the neonatal intensive care unit environment which was proved in the study by Arnon , Shapsa et.al· Music stimulation has been shown to deliver significant benefits to preterm infants. Thirty-one stable infants randomly received live music, recorded music, and no music therapy over 3 successive days. Environmental noise level was controlled. Each therapy was provided for 30 minutes. Heart rate, respiratory rate, oxygen saturation and a behavioral assessment were documented every 5 minutes before, during, and after therapy. The results of the study are 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·

Whipple[152] made an attempt to assess the effect of music-reinforced nonnutritive sucking on preterm, low birth weight infants experiencing heel stick. This study studied the physiologic and behavioral effects of music-reinforced nonnutritive sucking (NNS) for preterm, low birth weight (LBW) infants experiencing heel stick. Subjects of the study were 60 infants, age 32 to 37 weeks admitted in a neonatal intensive care unit. Infants were randomly allocated to one of three treatment groups: pacifier-activated lullaby (PAL), pacifier-only, and no-contact.. Behavior state and stress level were also more stable across time for the PAL group than the other groups, and patterns of changes in oxygen saturation, behavior state, and stress level indicate that music-reinforced NNS may facilitate return to homeostasis.

Doheny LHurwitz et al[153] evaluated the exposure to biological maternal sounds progresses cardiorespiratory regulation in extremely preterm infants. Fourteen preterm infants (26-32 weeks gestation) served as their own controls as we measured the frequency of adverse CREs during exposure to either Maternal Sound Stimulation (MSS) or Routine Hospital Sounds (RHS). MSS consisted of maternal voice and heartbeat sounds documented individually for each infant. MSS was delivered four times per 24-hour period via a micro audio system installed in the infant's bed. The study revealed that preliminary evidence for short-term improvements in the physiological stability of NICU infants using MSS

White-Traut, Nelson [154] studied the effect of auditory, tactile, visual, and vestibular intervention on length of stay, alertness, and feeding progression in preterm infants. Participants comprised 12 infants born between 23 and 26 weeks' gestation with normal head ultrasounds and 25 CNS-injured infants born between 23 and 31 weeks' gestation. Infants were randomly assigned to the control group (11 males, five females) or study group (seven males, 14 females) at 32 weeks' post conceptual age. ATVV intervention was administered to the study group for 15 minutes, twice daily for 5 days per week from 33 weeks of age until discharge. ATVV intervention facilitated increased alertness, faster transition to complete nipple feeding, and decreased length of hospitalization.

Cassidy JW. [155] carried out a study to assess the effect of decibel level of music stimuli and gender on head circumference and physiological responses of premature infants in the NICU. Subjects for this study (N = 63) were premature infants in the Neonatal Intensive Care Unit (NICU) between the gestational ages of 28 and 33 weeks. There was a significant difference ($p < .0001$) in average daily head growth across time, but this seem unrelated to the music condition as the same curvilinear trend (larger gain during days of treatment, smaller gain during baseline before and after treatment) was evident for control infants who did not listen to music. The results designate a significant ($p = .002$), but biologically unimportant, decrease in heart rate over the course of data collection. No differences due to gender were noted.

Standley [156] did a meta-analysis study on music therapy among premature infants in neonatal intensive care units (NICU). Premature females responded well to MT (d=.91) than males (d=.59). In the most recent study with randomized controlled trials contradictory music based multi-modal stimulation (MMS) versus the no contact in control condition. Where female MT infants were discharged an average of 15.7 days sooner than control females. Male infants getting MMS were discharged an average of 8.2 days sooner than control males.

Caine et al. [146] studied the effects of music on the nominated stress behaviors, weight, caloric and formula intake and length of hospital stay of premature and low birth weight neonates in a neonatal intensive care unit. Experience to the music stimulation had many positive effects on preterm infants such as improved daily average weight, formula and caloric intake, and significantly reduced total hospital stays and stress behaviors for the experimental group.

Standley[157] updated the meta-analysis study of music therapy on preterm infants. The purpose of the study was to provide an overview of developmental and medical benefits of music therapy for preterm infants. The design used to this study was meta-analysis. The main conclusion of this study was evidence-based NICU music therapy (NICU -MT) was highly beneficial with an overall large significant effect size (Cohen's d = 0.82). The results justify strong consideration for the inclusion of the following evidence-based NICU -MT protocols in best practice standards for NICU treatment of preterm infants: music listening for pacification, music reinforcement of sucking, and music pacification as the basis for multilayered, multimodal stimulation.

Malloy[158] studied the effects of taped recording of the maternal voice, an orchestra playing Brahms' Lullaby, and standard NICU care (control group). The infants selected were all born preterm or between 26–33 weeks of gestational age. The infants were unprotected to a recording of their mother speaking or a lullaby (stimuli presented at 70–75 decibels) for 5 minutes, every 2 hours and six times daily until their weight touched 1,844 grams. The authors found that the experimental group gained weight faster and they touched the weight selected for testing (1,844 g) faster.

A systematic review was done by Rabold, Stefanie [159] on the Effects of Music Therapy in the NICU on Behavior, Weight, and Length of Stay. Infants in the neonatal intensive care unit (NICU) were either ill or premature and in requisite of extra uterine support in order to grasp physiologic ripeness. Three databases were scanned to assess research studies fitting the inclusion criteria of behavior, weight, and length of stay. Thirteen articles met the inclusion criteria for the systematic review. Studies included randomized controlled trials, controlled trials, meta-analyses, and systematic reviews. The results proves that music therapy has a positive effect on behavior, weight, and length of stay. Some conflicting evidence was found in behavior studies and weight studies. The overall recommendation for both variables was to consider application. Length of stay had strong evidence on the positive effect of music therapy and is recommended as an intervention for infants in the NICU.

Gitanjali[21] stated that the raga Nelambari in the classical Indian Karnatic system of music is said to be able to encourage sleep and also have some sleep upholding qualities. This hypothesis was scientifically verified using sleep polysomnography with eight healthy subjects who listened to either Neelambari (test) raga or Kalyani (control) raga. There was no dissimilarity in sleep architecture or in subjective feeling of quality of sleep. The anecdotal references to the quality of sleep upholding effects of Neelambari probably reflect a conditioned response since most lullabies in South India are sung in Neelambari raga.

Joanne Loewy, Kristen Stewart et.al.[169], **c**onducted a study to appraise the effects of Music Therapy on Vital Signs, Feeding, and Sleep in Premature Infants. In this study three dissimilar types of music therapy interventions were given. 1) Live ocean disc whoosh sounds, 2) gato box rhythms, and 3) parent's sung lullabies. 272 infants from 11 hospital neonatal intensive care units (NICUs) were partaken and found that live music delivered by a certified music therapist could raise a premature infant's ability to feed, sleep, and self-regulate, while noise could have unwanted impact on growth and development.

Hartling , Shaik et.al.[148] studied the effectiveness of music for medical indicators among term and preterm neonates. Nine randomized trials from 1989 to 2006 were included. The effects of music were assessed during medical and surgical procedures such as circumcision, heel prick and for other indicators. According to the effects of this review music may have positive effects on physiological parameters and behavioral states and may reduce pain and upsurge oral feeding rates among the premature infants.

An open randomized controlled trial was done by Vianna et al [160] to find out an effect of music therapy among preterm infants. In this study two music therapists were systematically working with the mothers of preterm infants in the neonatal intensive care unit (NICU) of their institution. Sessions were held for 3 days a week for 1 hour and comprised four movements: verbal expression, music expression, lullabies and relaxation. The results showed significantly higher breastfeeding rate in the intervention group than in the control group. Higher breastfeeding rates were also shown at the 60-day follow-up visit.

Amini, Rafiei et.al[161] studied the effect of lullaby and classical music on physiologic stability of hospitalized preterm infants was assessed**.** The objective of this study was to assess and compare the influence of lullaby and classical music on physiologic parameters. The method used for this study was a randomized clinical trial with cross-over design. A total of 25 stable preterm infants with birth weight of 1000-2500 grams were studied for six consecutive days. The result showed that lullaby reduced heart rate ($p < 0.001$) and respiratory rate ($p = 0.004$). These effects prolonged in the period after the exposure ($p < .001$ and $p = 0.001$, respectively). The conclusion of this study was music can affect vital signs of preterm infants. This effect can possibly be related to the reduction of stress during hospitalization. .

Campbell Yeo , Johnston et al[162] studied a RCT trial to find out the effect of multi sensory stimulation on pain. In this study preterm twin infants received tactile, olfactory, and auditory stimulation and may affect pain reactivity. Mean PIPP scores were not different between groups at 30, 60, or 120 seconds. At 90 seconds, mean PIPP scores were higher in the co bedding group (6.0 vs 5.0, $P = .04$). Recovery time was shorter in the co bedding group compared with the standard care group, (mean = 75.6 seconds versus 142.1 seconds, $P = .001$). No significant adverse events were associated with co bedding. Adjustment for non-independence between twins and differences in baseline characteristics did not change the results.

Silva, Cacao et al [163] studied the physiological responses of preterm newborn infants submitted to classical music therapy. The results showed that there was a decrease in the heart rate after the second session of music therapy (paired t-test; $p=0.002$), and an increase at the end of the third session (paired t-test; $p=0.005$). Respiratory rate decreased during the fourth and fifth sessions (paired t-test; $p=0.01$ and 0.03, respectively). Regarding oxygen saturation, there was an increase after the fifth session ($p=0.008$).

Yildiz , Arikan [164] carried out a study to assess the effects of giving pacifiers to premature infants and making them to listen lullabies on their transition period for total oral feeding and sucking success. The result revealed that the highest sucking success was accomplished by infants in the pacifier group ($p < 0·05$) followed by the lullaby group ($p > 0·05$). These results demonstrated that giving pacifiers to premature infants and creating 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).

2.7 STUDIES RELATED TO TACTILE AND AUDITORY STIMULATION

Charoensri[165] investigated the use of classic music while massaging infants weighing 1,400 to 2,000 grams for 16 minutes twice a day for ten days. Their studies reported that there were also several disengagement behaviors and unstable heart rate and respiratory rate of preterm infants receiving baby massage combined with music. In conclusion, each type of tactile stimulation gives s e v eral benefits for growth and development of preterm infants.

Kanagasabai , Mohan et.al[166] studied the effect of multisensory stimulation on neuro-motor development in preterm infants. The objective of this study was to scrutinize the effect of Auditory, Tactile, Visual and Vestibular stimulus (ATVV) on neuro-motor development in preterm infants. The subjects recruited were fifty preterm infants born at 28-36 week with a birth weight ranging from 1,000-2,000g. They were randomized into a control group (n=25) and study group (n=25). The results revealed that the multisensory stimulated infants showed higher neuro-motor score ($p=0.001$) compared to the control group. The french angle components of INFANIB(Infant Neurological International Battery) including heel to ear ($p=0.016$) and popliteal angle ($p=0.001$) were statistically significant between the groups. The study demonstrated that multisensory stimulation appears to have a beneficial effect on the tonal maturation in preterm infants.

White-traut, Schwertz et al[167] did a study on salivary cortisol and behavioral state responses of healthy newborn infants to tactile-only and multisensory interventions. The results revealed that tactile-only group infants had the largest increase in cortisol levels, followed by control group infants. Infants who received the multisensory intervention showed a significant steady decline in cortisol. Asleep was the predominant state for all 3 groups and cry was minimal. The study shows that tactile-only stimulation may increase infant stress reactivity while the benefit of the multisensory auditory, tactile, visual, and vestibular intervention may be in the reduction of infant stress reactivity. Interventions appeared to have minimal effect on stress reactivity based on behavioral state.

Bellieni , Buonocore [168] assessed multi sensorial stimulation as analgesic and whether this effect is only due to oral glucose or sucking. It was a randomized prospective study. They studied 85 heel-pricks (5 per baby) accomplished for routine blood samples in 17 preterm infants (28-35 weeks of gestational age). The investigators applied random order in each patient for the five procedures described above and scored pain. SS and sucking plus oral glucose have the greater analgesic effect with respect to no intervention ($p < 0.001$). The effect of SS is statistically better than that of glucose plus sucking ($p < 0.01$). SS encourages interaction between nurse and infant and is a simple effective form of analgesia for the NICU.

METHODOLOGY

"Methods and procedures are really the heart of the research activities should be described with as much detail as possible and the continuity between them should be apparent"

Research methodology is a way to solve the problem systematically. It is a procedure in which the research starts from initial identification of the problem to final conclusion. Methodology of research organizes all the components of the study in a way that is most likely to lead to valid answer to the problems that have been posed.

This chapter deals with the methodology adopted by the investigator with an aim to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates. It includes research approach, research design, settings of the study, population, sample size and sampling techniques, data collection procedure, description of the tool and plan for data analysis.

3.1 RESEARCH APPROACH

Research approach is an umbrella that covers the basic procedure for conducting research.

A **quantitative research approach** was considered to be the most appropriate for 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.

Quantitative research is a formal, objective, systematic process in which numerical data are utilized to obtain information about the world. [87]

3.2 RESEARCH DESIGN

Research design is the overall plan for addressing a research question including specifications for enhancing the study's integrity. [88]

A True Experimental 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.

Group	**Measurement of dependent variable**	**Intervention on day 1 to day 5**	**Measurement of dependent variable on day 3 and day 5.**
Experimental group (E)	O_1	Morning :X_1 Y_1 Evening :X_2 Y_2 from day1 to day5	O_2 , O_3
Control group (C)	O_1		O_2 , O_3

X_1 - Tactile intervention to the experimental group in the morning.

Y_1 - Auditory intervention to the experimental group in the morning.

X_2 - Tactile intervention to the experimental group in the evening.

Y_2 - Auditory intervention to the experimental group in the evening.

O_1 - Assessment of the selected physiological parameters before giving tactile and auditory stimulation to both the experimental and control groups.

O_2 - Assessment of the selected physiological parameters in the experimental group (after giving tactile and auditory stimulation) and in controls (without tactile & auditory stimulation) on the 3rd day.

O_3 – Assessment of the selected physiological parameters in the experimental group (after giving tactile and auditory stimulation) and in controls (without tactile & auditory stimulation) on the 5th day.

Fig. No. 3.1 SCHEMATIC REPRESENTATION OF RESEARCH STUDY

Research statement: A study to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates admitted in selected hospitals at Nagercoil, Tamilnadu, India.

⇓

Research design:

Experimental Pre Intervention & Post Intervention control group research design

⇓

Setting: NICU and postnatal units of Kanyakumari Medical college hospital, Nagercoil, Tamilnadu, India

⇓

Population:

Target population - preterm neonates who were born between 28 to 36 weeks of gestation with a birth weight of 950 gm to 2000 gm.

Accessible population - 471 preterm neonates and admitted into the neonatal care units of Kanya Kumari Medical College Hospital, Nagercoil in one year.

Study population - 120 out of 471 neonates were selected by inclusion criteria and

⇓

RANDOMIZATION

⇓

Assigned to Experimental group(n=60) and control group(n= 60)

⇓

Coll**ection of data:** pre intervention done to both the groups. Intervention was given to the experimental group daily morning and evening for 5 consecutive days. Post intervention data were collected in both the groups on 3^{rd} and 5^{th} day. In control group routine care was given and data were collected on 3^{rd} and 5^{th} day.

⇓

Analysis and Interpretation ⇒ Communication of findings

3.3 VARIABLES

Variable is a measurable characteristic that varies. It may change from group to group, person-to-person, or even within one person over time. In this study three variables were identified.

1. Independent variable:

The cause variable, or the one that identifies forces or conditions that act on something else, is the independent variable

In the present study, the independent variable refers to Tactile & auditory stimulation on physiological parameters.

2. Dependent variable:

The variable that is the effect or is the result or outcome of another variable is the dependent variable (also referred to as outcome variable or effect variable).

In this present study the outcome dependent variable refers to physiological parameters such as weight, heart rate, temperature, respiratory rate, oxygen saturation, sleeping pattern, feeding skills & crying spells among preterm neonates.

Demographic variable:

Demographic variables are variables that denote the biographic characteristics of an individual. Demographic information provides data regarding research participants and is necessary for the determination of whether the individuals in a particular study are a representative sample of the target population for generalization purposes. Demographic variables are independent variables by definition because they cannot be manipulated.

In the present study, the demographic variable refers to the preterm neonate's biographic characteristics such as gestational age, sex, birth weight, type of feeding, APGAR score at birth and at the 5^{th} minute and mode of delivery.

3.4 SETTINGS OF THE STUDY

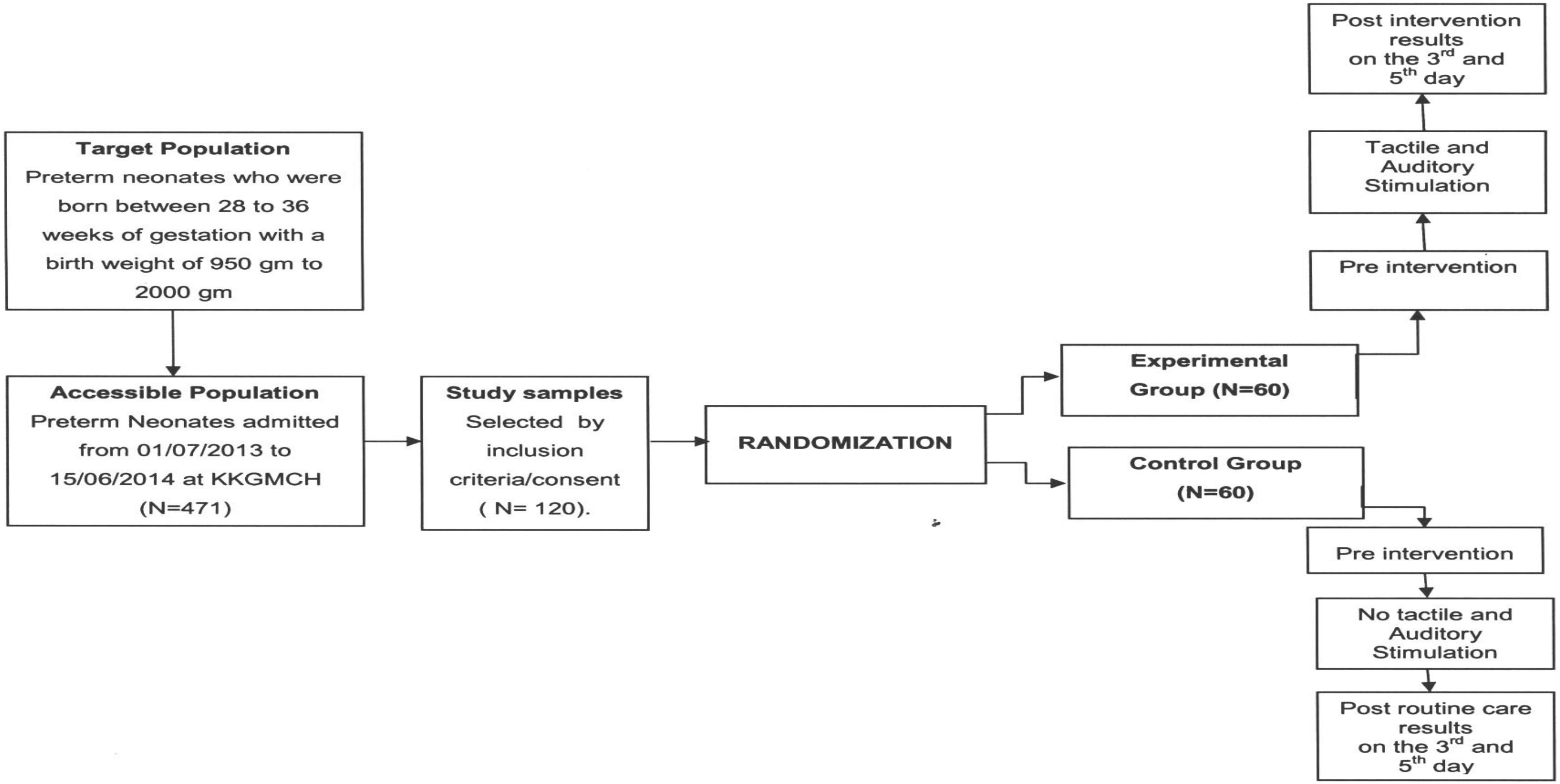
Research setting is the physical location and conditions in which data collection takes place in a study.

This study was conducted in the neonatal units of Kanyakumari Medical College Hospital, Asaripallam, Nagercoil, which is situated around 2 kilometers away from 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. The Neonatal Care Units are one of the best and busiest neonatal care units with latest equipments and monitors. Both inborn and out born neonates are admitted and cared from this unit. The average monthly inpatients in the NICU are 123; among them the preterm neonates are 41. The care of neonates is categorized into two levels (Level I and Level II).

Level I care - Care of critically ill neonates with major neonatal complications. Level II care - Care of neonates with mild to moderate risk.

Mothers of these neonates could be located next to the NICU and in the postnatal wards. The Kanyakumari Government Medical College hospital was selected for this study because of the availability of subjects and feasibility of conducting the study.

Fig. No. 3.2 Pictorial Representation of study



3.5 POPULATION

The entire population is the aggregate of cases in which the researcher is interested and would like to generalize the study results.

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 KanyaKumari Medical College Hospital, Nagercoil.

3.6 SAMPLING

Sampling is the process of taking a subset of subjects that is representative of the entire population. The sample must have sufficient size to warrant statistical analysis. This representative portion of a population is called a sample. If testing all the individuals is impossible, that is the only time we rely on sampling techniques.

In this study, all preterm neonates who got admission in NICU, Kanyakumari Government Medical College Hospital between 01/07/2013 to 15/06/2014 that fulfilled inclusion criteria and given consent were included as study samples.

Sample Size Calculation :

OpenEpi, Version 3, open source calculator

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:

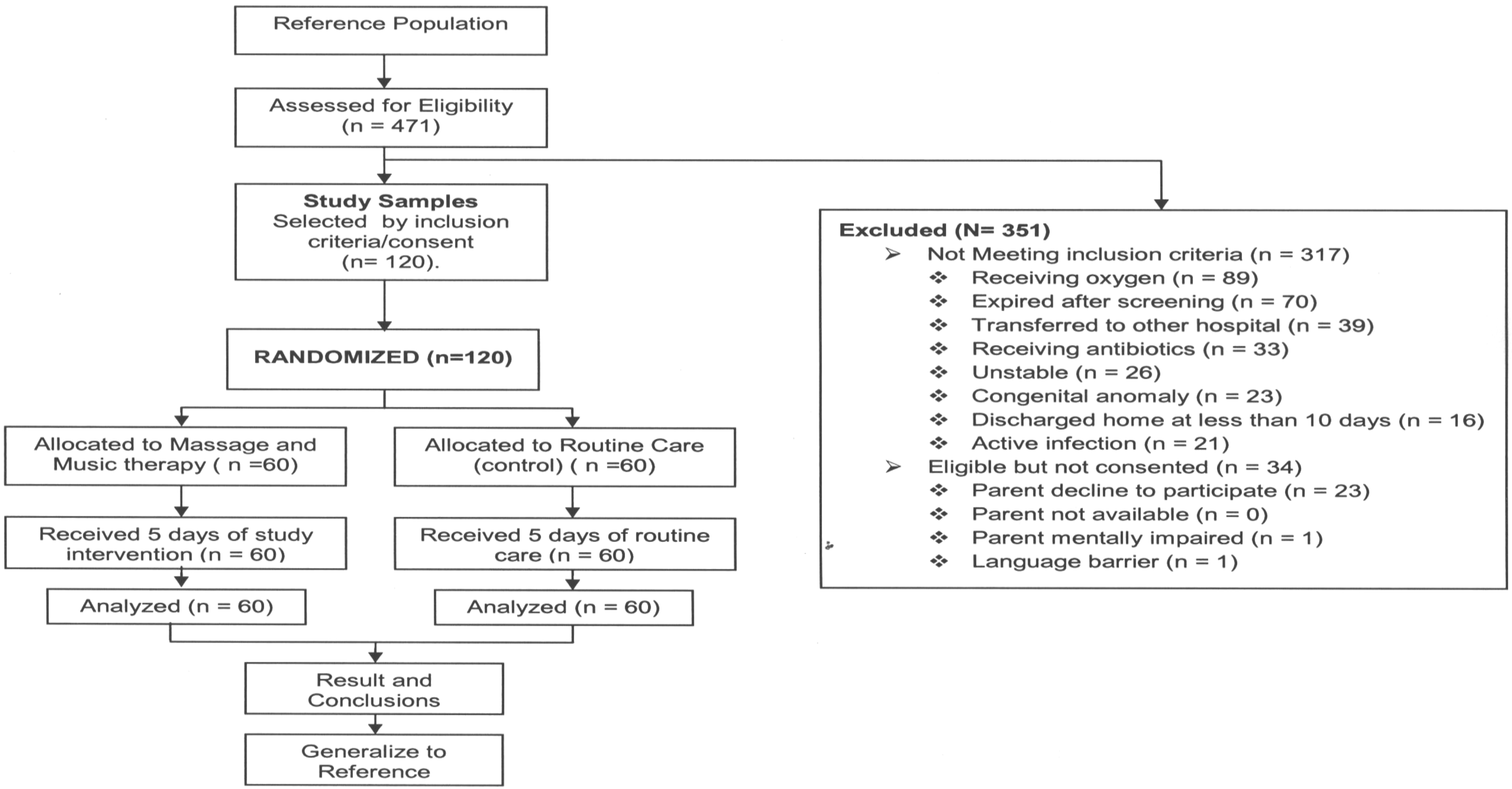
In this study, all subjects admitted in the NICU at Kanyakumari Govt Medical College hospital, Asaripallam were accessed for eligibility. Out of 471 admitted for one year from 01.07.2014 to 15.06.2014, 317 preterm neonates were excluded from the study after inclusion criteria and 34 eligible preterm 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 is the key to building representative samples.

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.

Fig: 3.3 Study flow diagram showing the sample selection



3.7 CRETERIA FOR 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:-

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

3.8 DEVELOPMENT OF THE TOOL

Data collection tools or instruments are the vehicle that could best obtain the data pertinent to the study and at the same time adds to the body of knowledge in the discipline. Data Collection tools are helpful because they provide a "picture" of your work environment.

The instrument used for this study consists of 3 parts. The first part was demographic variable, the second part was observation checklist and the third part was structured interview schedule.

The following sources were used for the construction of the tool.

1. Literature review
2. Consultation and discussion with nursing, medical, massage and music experts.
3. Personal experience and discussion with colleagues.

3.9 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 and at 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.

Weight: The electronic weighing machine (company name is phoenix, model number is NBY – 20 and it's accuracy is 10 gram) is used to measure the weight of the preterm neonate.

Temperature: An Auxiliary digital thermometer is used to measure the preterm neonate's temperature. A normal body temperature of a healthy preterm is in the vicinity of 37 degrees Celsius, which makes this value so special and important.

Respiratory rate:

The inspiratory and expiratory movement of the preterm neonate's chest is observed, counted and recorded for one full minute.

Heart Rate and Oxygen saturation: A pulseoxymeter (Novametrix Oxypleth- Y sensor system, item code-01031) is used to measure the heart rate and oxygen saturation of preterm neonate.

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

3.10 INTERVENTION

Tactile and auditory stimulation

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.

Preliminary Steps

1. Test the sensitivity by pour a small spot of oil by the baby's skin & wait a day to be sure no irritation appears.
2. Take a few deep breaths & ensure you are totally relaxed & prepare to spend some quality time with the child.
3. Make sure the finger nails are short and clean.
4. Remove any jewelers or rings that may interfere.
5. If you have long hair, tie it back & roll up any long sleeves.
6. Select a warm environment.
7. Avoid any harsh light. (A room which is dimly lit or filled with gentle sunlight is ideal)
8. Keep a towel or blanket close by for draping over the parts of the body not being massaged because newborn's body temperature can drop dramatically when undressed.

9. Take care of your posture. Kneel down if massage on a bed. / Leaning against a wall with your knees bent up. Lay baby on your legs (head at your knees and their bottom in your lap)
10. Check and record the vital signs.

CAUTION

1. Avoid

   -massaging over wounds and surgical site.

   -massage an infant who has a fever or a contagious disease

2. Take care not to massage on baby's abdomen immediately following a feed.
3. Do not

   -massage the baby's eyes and perineal areas.

   -massage your baby's spinal cord.

   -massage the baby at bath time as this can be over stimulating. So it is best to massage after the bath to allow the oil to be absorbed by the skin.

PROCEDURE

1. Spread a blanket or towel
2. Take massage oil in a non-breakable container.
3. Rub your hands together to warm the oil.

START WITH THE LEG

1. Always start from the legs, as this is least intrusive area.

2. Begin by holding on the baby's feet in your opposite hand (That is right foot in your left hand). Gently strike down the leg with your right hand and fingers. Begin at the top of the leg, moving down to the foot in one long, fluid stroke. Repeat 2-3 times.

3. Gently presses the thigh. Flex the leg slightly till the knee.

4. Use your thumb to press all over the bottom of the foot. The nerve endings which connect with other parts of the body get stimulated.

5. Massage your baby's heel firmly by using circular movements. (If there have been a lot of heel pricks to draw blood in case of hospitalization) This breaks up any left-over scar tissue & eliminates fear of having his / her heels touches.

TOES TO ANKLE

1. Stroke the top of the foot moving from the toes first & then to the ankles.

2. Make circles around the ankle with your thumb and forefinger.

3. Use your hands to roll the legs from knee to ankle.

4. Gently squeeze each toe with fingertips.

SHOULDERS AND ARMS

1. Use your fingers and thumb to form a ring around your child's arm.

2. Caress around the armpit and go down the length of the arm.

3. When you reach the elbow, take care as it is a sensitive area.

4. Give slow turning movement at the wrist.

5. Make circles around the wrist with your thumb and fore finger

6. Use your thumb to stroke your baby's palm and above the palm.

7. Repeat this several times.

STOMACH

1. Make your hands clockwise starting just below the ribs.

2. Massage stomach with circular movements by using your fingertips.

Note:- Take care not to massage the genital area.

CHEST

1. After finishing with tummy, move your hands towards the chest and place the hands at the center of baby's chest and sweep up and out over the chest.

BACK

1. Turn your baby around with face down.

2. Begin with slow large hand movement which starts with head, the neck, back and buttocks always in one direction.

3. Use soft strokes on your baby's shoulders and back. (Massage with your finger tips in circular movements.)

FACE

1. Turn your baby gently. Start a face massage without any extra oil.

2. Massage the forehead of the face by using the flat part of your fingers and stroke gently from the middle to outside along with the eyebrows.

3. Be very gentle with your thumbs lightly move along the bridge of the nose to move up to the forehead.

4. Make small circles on the face and jaw by using the finger tips of both hands.

5. Stroke both ears by using fingertips along the pinna from top to bottom

3.11 CONTENT VALIDITY

Validity refers to the degree to which an instrument measures what it supposes to be measuring. 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 Experts were Pediatric Nursing Professionals - 1, Maternity Nursing Professionals - 2, Medical & Surgical Nursing Professionals - 2, Neonatologist - 2, Pediatrician - 4, Community Medicine Specialist - 1, Biostatistician – 2, Music Therapist - 2 and Massage Therapist – 1.

The experts were requested to give their opinions and suggestions regarding the relevance, adequacy and appropriateness of the tool. Based on their opinions and suggestions the tool was finalized to do data collection.

3.12 RELIABILITY

Reliability is the degree to which an assessment tool produces stable and consistent results. It also defines the consistency of the results delivered in a test, ensuring that the various items measuring the different constructs deliver consistent scores.

Internal consistency: The degree to which all of the items on a test measure the same construct.

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**.**

Inter-rater reliability: For any research program that requires qualitative rating by different researchers, it is important to establish a good level of interrater reliability, also known as interobserver reliability. This ensures that the generated results meet the accepted criteria defining reliability, by quantitatively defining the degree of agreement between two or more observers.[91]

Inter-rater reliability: The degree to which raters are being consistent in their observations and scoring in instances where there is more than one person scoring the test results.

Split-half reliability is a type of internal consistency reliability. The process of obtaining split-half reliability is begun by "splitting in half" all items of a test that are intended to probe the same area of knowledge in order to form two "sets" of items. The *entire* test is administered to a group of individuals, the total score for each "set" is computed, and finally the split-half reliability is obtained by determining the correlation between the two total "set" scores.

The reliability of inter- rater method was obtained by using **Cohen's kappa formula** and split – half method was obtained by using **Crohnbach's α formula**.

The reliability obtained by inter rater method is as follows

Physiological parameters:

a. Weight: r = .705
b. Temperature: r = .658
c. Heart rate: r = .845
d. Respiratory rate: r = .736
e. Oxygen saturation: r = .622
f. Structured Interview Schedule: r = .746

The above scores show that the reliability of the tool was good. The internal consistency of the tool was achieved by using split half method, in which r = 0.95 and that is excellent.

3.13 PILOT STUDY

Pilot testing is the administration of the data collection instrument with a small set of respondents from the population. If problems occur in the pilot test, it is likely that similar problems will arise in full-scale administration. The purpose of pilot testing is to identify problems with the data collection instrument and find possible solutions. Pilot test is the trail administration of a newly developed instrument to identify flows and assess time requirements.

A pilot experiment, also called a pilot study, is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size (statistical variability) in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a full-scale research project.

A pilot study was conducted at Kanyakumari Medical College hospital, Asaripallam, Nagercoil, Tamilnadu from 25/05/2013 to 30/06/2013. The study was conducted among 20 preterm neonates who had been selected randomly from the preterm neonates who met the inclusion criteria and given consent during the above period. It was conducted in a similar way as the final data collection. The aim and purposes of the study were explained to the parents. Informed consent was obtained from them. Secrecy was assured to the parents and their full cooperation was got for data collection. Pilot study concluded that it was feasible, not time consuming and cost effective to carry out the procedure and there were no side effects observed while this procedure was carried out.

3.14 DATA COLLECTION PROCEDURE (n = 120):

For data collection, the written permission was obtained from the Dean, kanyakumari Medical College hospital, Nagercoil, Tamilnadu. As per Dean's direction formal permission was obtained from Head of the Department of Pediatrics and Resident Medical Officer prior to the data collection. The data collection was done from the beginning of July 2013 to mid of June 2014 till the eligible 120 samples have been reached.

In this study, all the preterm neonates who got admission in NICU of Kanyakumari Government Medical College Hospital between 01/07/2013 to 15/06/2014 and who fulfilled the inclusion criteria were selected. The aim and purposes of the study was explained to the parents. Informed consent was obtained from them. Secrecy was assured to the parents to get their full cooperation for data collection.

Randomization had been done in selected study samples of 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 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 had been selected.

Pre evaluation was done to preterm neonates in both the control and experimental groups soon after the selection. One drop of oil was poured over selected preterm neonate's forearm to find out the hypersensitivity. If after 30 minutes, they exhibited no hypersensitivity reaction, the warmer and monitors were put off .The probes should be removed and the baby covered with pre-warmed cloth. Articles which were necessary to give tactile and auditory stimulation near to the warmer (bedside) were arranged.

The body parts were exposed one by one as per the manual to give stimulation. The oil was pre warmed by rubbing it between the palms. Recorded lullaby with neelambari raga was played by the tab. Tactile stimulation was given to the following sequence for 10 minutes as per the prepared manual along with the auditory stimulation to the experimental group twice daily for 5 consecutive days.

1. Legs: from thigh to toes
2. Shoulder and arms: from shoulder to fingers
3. Abdomen: clock wise circular movement
4. Chest: from center of baby's chest and sweep up and out over the chest
5. Back: slow large hand movement which starts from head, neck, back and buttocks..
6. Face: Forehead, eye brows, bridge of the nose, cheeks, chin and pinna of the ear.

Post evaluation was done to both the control and experimental groups on the third and fifth day after giving tactile and auditory stimulation by using the same tool. I thanked the parents for their endurance and cooperation soon after the data collection.

Data analysis:

Data analysis is the systematic organization of research data and testing of hypothesis using those data. Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

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 was analyzed by using 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.

3.15 ETHICAL CONSIDERATION

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 before starting the data collection. Assurance was given to them that the secrecy of each subject would be maintained.

Summary:

ANALYSIS AND INTERPRETATION OF DATA

This chapter deals with the description of the sample, analysis and interpretation of data collected from preterm neonates regarding physiological parameters before and after giving tactile and auditory stimulation. The data were analyzed according to the objectives and hypotheses of the study. Data analysis was computed after transferring the collected data in to a coding sheet. The data collected were edited for completion and analyzed using SPSS version 20. A probability value of less than 0.05 was considered to be significant.

The data were organized, analyzed and presented in the following ways:

Section I:

- Frequency and percentage Distribution of samples based on their demographic characteristics in the experimental and control groups.

Section II:

- Distribution of preterm neonates in the experimental and control groups based on their assessment of physiological parameters
- Distribution of preterm neonates in the experimental and control groups based on their assessment of physiological parameters by structured interview schedule

Section III:

- Comparison of mean pre intervention Vs post intervention physiological parameter- weight among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- temperature among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- heart rate among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- respiratory rate among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- oxygen saturation among preterm neonates in the experimental and control groups.
- Comparison of mean post intervention 3rd day physiological parameter Score among preterm neonates in the experimental and control groups.
- Comparison of mean post intervention 5th day physiological parameter Score among preterm neonates in the experimental and control groups.

- Comparison of mean pre intervention Vs post intervention physiological parameter- duration of sleeping per day among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- sucking pattern among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- duration of sleeping per day among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- Duration of crying pattern among preterm neonates in the experimental and control groups.
- Comparison of mean pre intervention Vs post intervention physiological parameter- number of urination per day among preterm neonates in the experimental and control groups.

Section IV

- Association between post-test physiological parameter and selected demographic variable of preterm neonates.

SECTION – I

Table – 4.1.1 Frequency and percentage Distribution of samples based on the gender in the experimental and control groups:

GENDER	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
Male	30	51.7	28	48.3	58	100
Female	30	48.4	32	51.6	62	100
Total	60	50	60	50	120	100

Chi^2 Value – 0.133 df – 1 p – Value – 0.715

Table 4.1.1 shows the gender of the preterm neonates. Out of 120 preterm neonates 58 were males and 62 were females. In sex of the study participants in which 48.3 % were male and 51.7 % were female. Among these 58 preterm neonates 51.7 % were from the experimental group and 48.3 % in the control group. Among these 62 preterm neonates 48.4 % were from the experimental group and 51.6 % were from the control group. With degree of freedom 1 and 95% of confidence interval, the table value of Chi Square is 3.841. Since the calculated Chi square Value 0.133 was less than the table value and the calculated P value of 0.715 was more than the significance level of 0.05, there is no significant difference between sexes in the experimental and control groups.

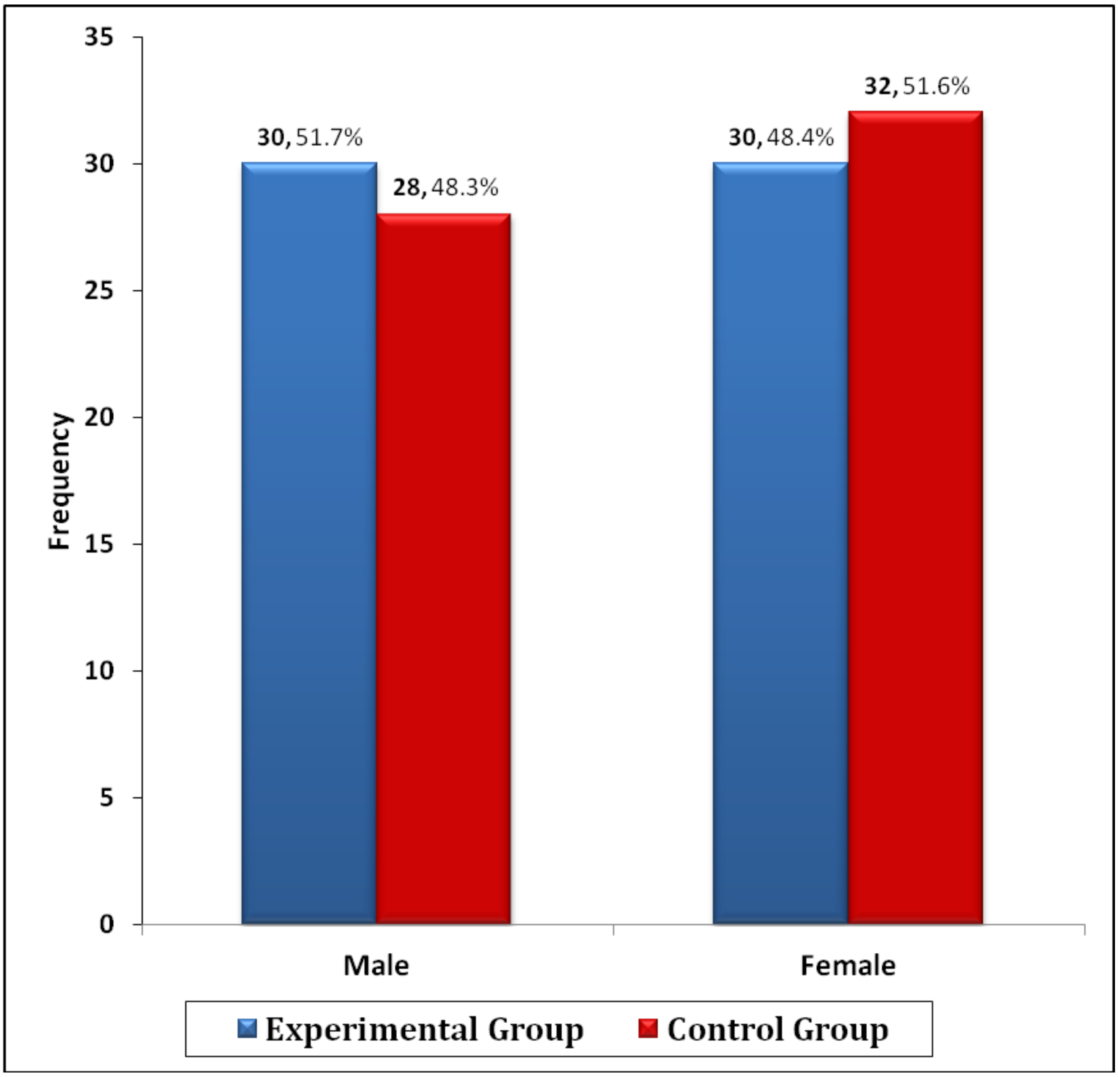


FIG 4.1: FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE GENDER

Table –4.1.2 Frequency and percentage Distribution of samples based on the religion in the experimental and control groups:

RELIGION	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
Hindu	25	49	26	51	51	100
Christian	33	52.4	30	47.6	63	100
Muslim	2	33.3	4	66.7	6	100
Total	60	50	60	50	120	100

Chi^2 Value – 0.826 df – 2 p – Value – 0.661

The data in table 4.1.2 shows the religions of the preterm neonates. Out of 120 preterm neonates 51 were Hindus, 63 were Christian and 6 were Muslims. In the religion of the preterm neonates 42.5 % were belongs to Hindu, 52.5% belongs to Christian and 5 % were belongs to Muslim. Among these 51 Hindu preterm neonates 49% were from the experimental group and 51% were from the control group. Among these 63 Christian preterm neonates 52.4% were from the experimental group and 47.6% were from the control group out of 120 preterm neonates. Among these 6 Muslim preterm neonates 33.3% were from the experimental group and 66.7 % were from the control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 0.826 was lower than the table value and the calculated P value of 0.661 was more than the significance level of 0.05, there is no significant difference between religions in the experimental and control groups.

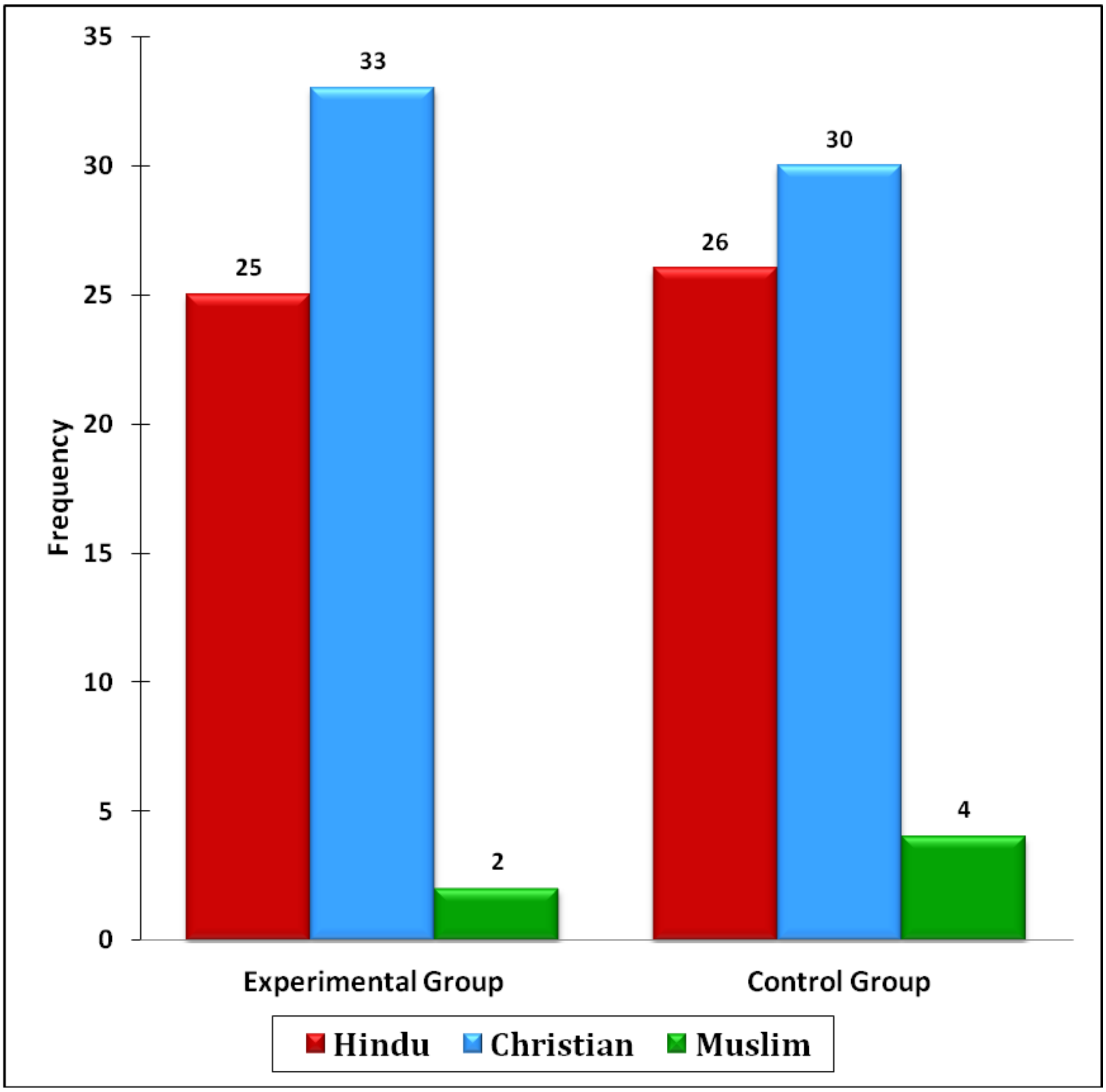


FIG 4.2 : FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE RELIGION

Table – 4.1.3 Frequency and percentage Distribution of samples based on the mode of birth in the experimental and control groups:

MOB	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
Normal Vaginal Delivery	19	42.2	26	57.8	45	100
Instrumental Delivery	2	28.6	5	71.4	7	100
LSCS	39	57.4	29	29	68	100
Total	60	50	60	60	120	100

Chi^2 Value – 3.845 df – 2 p – Value – 0.146

Table 4.1.3 shows the mode of birth of the pre term neonates. Out of 120 pre term neonates 45 were born by normal vaginal delivery, 7 were born by instrumental delivery and 68 were born by LSCS. Regarding mode of birth of preterm neonates 37.5 % were born by normal delivery, 5.8 % were born by instrumental delivery and 56.7 % were born by LSCS. In the 45 normal vaginal delivery 42.2 % were from the experimental group and 57.8 % were from the control group. Among the 7 instrumental deliveries, 28.6% were from the experimental group and 71.4% from the control group. In those 68 LSCS, 57.4% were from the experimental group and 42.6% were from the control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 3.845 was lower than the table value and the calculated P value of 0.146 was higher than the significance level of 0.05, there is no significant difference between mode of birth in the experimental and control groups.

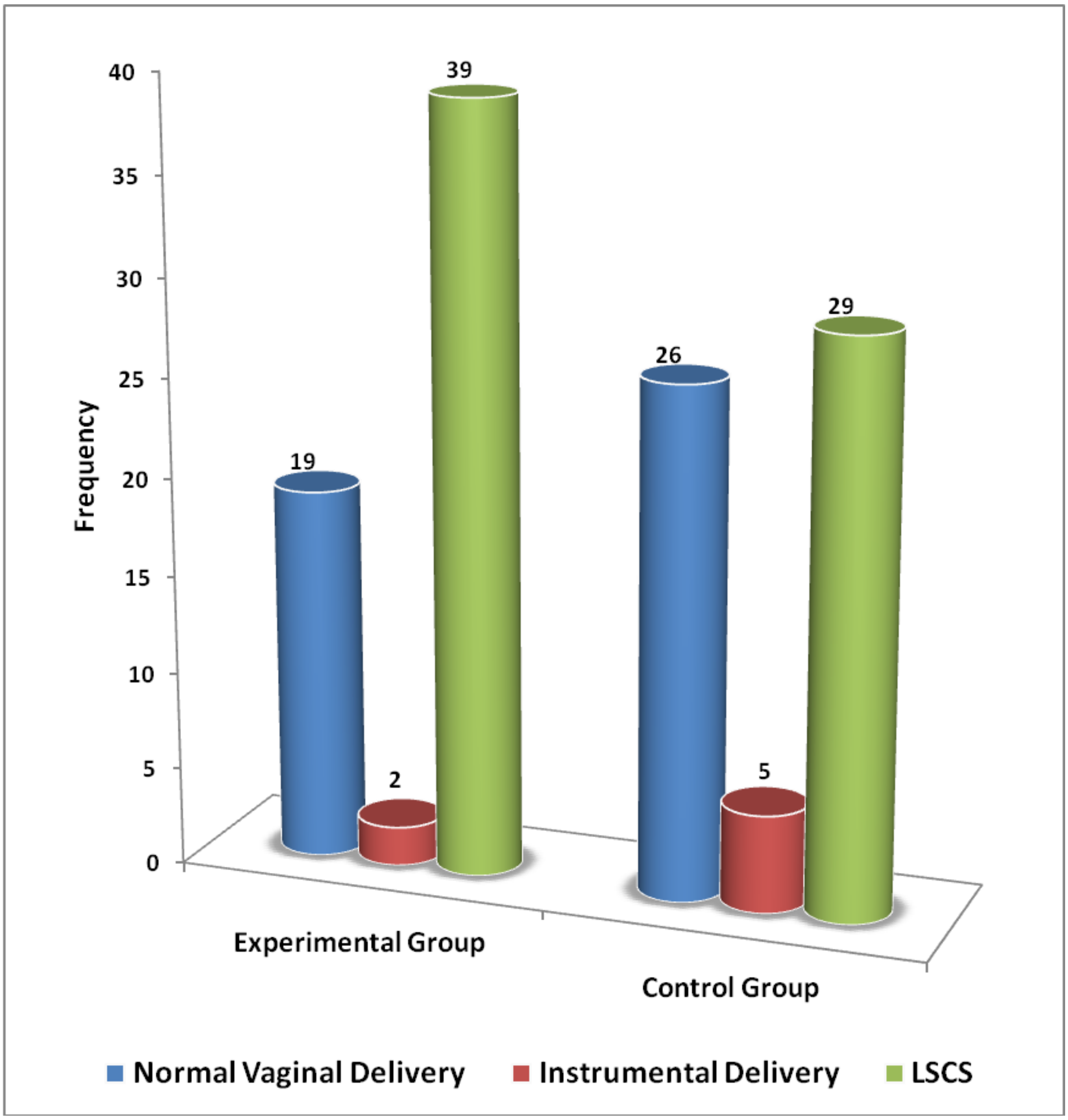


FIG 4.3: FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE MODE OF BIRTH

Table – 4.1.4 Frequency and percentage Distribution of samples based on the order of birth in the experimental and control groups:

OOB	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
First Order	28	54.9	23	46.3	51	100
Second Order	25	44.6	31	55.4	56	100
Third Order	1	33.3	2	66.7	3	100
Twins	6	60	4	40	10	100
Total	60	50	60	50	120	100

Chi^2 Value – 1.866 df – 3 p – Value – 0.601

Table 4.1.4 shows the order of birth of the preterm neonates. Out of 120 preterm neonates 51 were born by first order, 56 were born by second order, 3 were born by third order and 10 were born as twins. The birth orders of the preterm neonates 42.5% were 1^{st} order, 46.7 % were 2^{nd} order, 2.5 % were 3^{rd} order and 8.3 % were twins. Among the 51 first order preterm neonates 54.9 % were from the experimental group and 45.1 % were from the control group. Among the 56 second order preterm neonates 44.6% were from the experimental group and 55.4% from the control group. Among the 3 third order preterm neonates 33.3% belong to the experiment group and 66.7% belong to the control group. In those 10 twins preterm neonates 60% were from the experimental group and 40% were from the control group. With degree of freedom 3 and 95% confidence interval, the table value of Chi square is 7.815. Since the calculated Chi square Value 1.866 was less than the table value and the calculated P value of 0.601 was more than the significance level of 0.05, there is no significant difference between order of birth in the experimental and control groups.

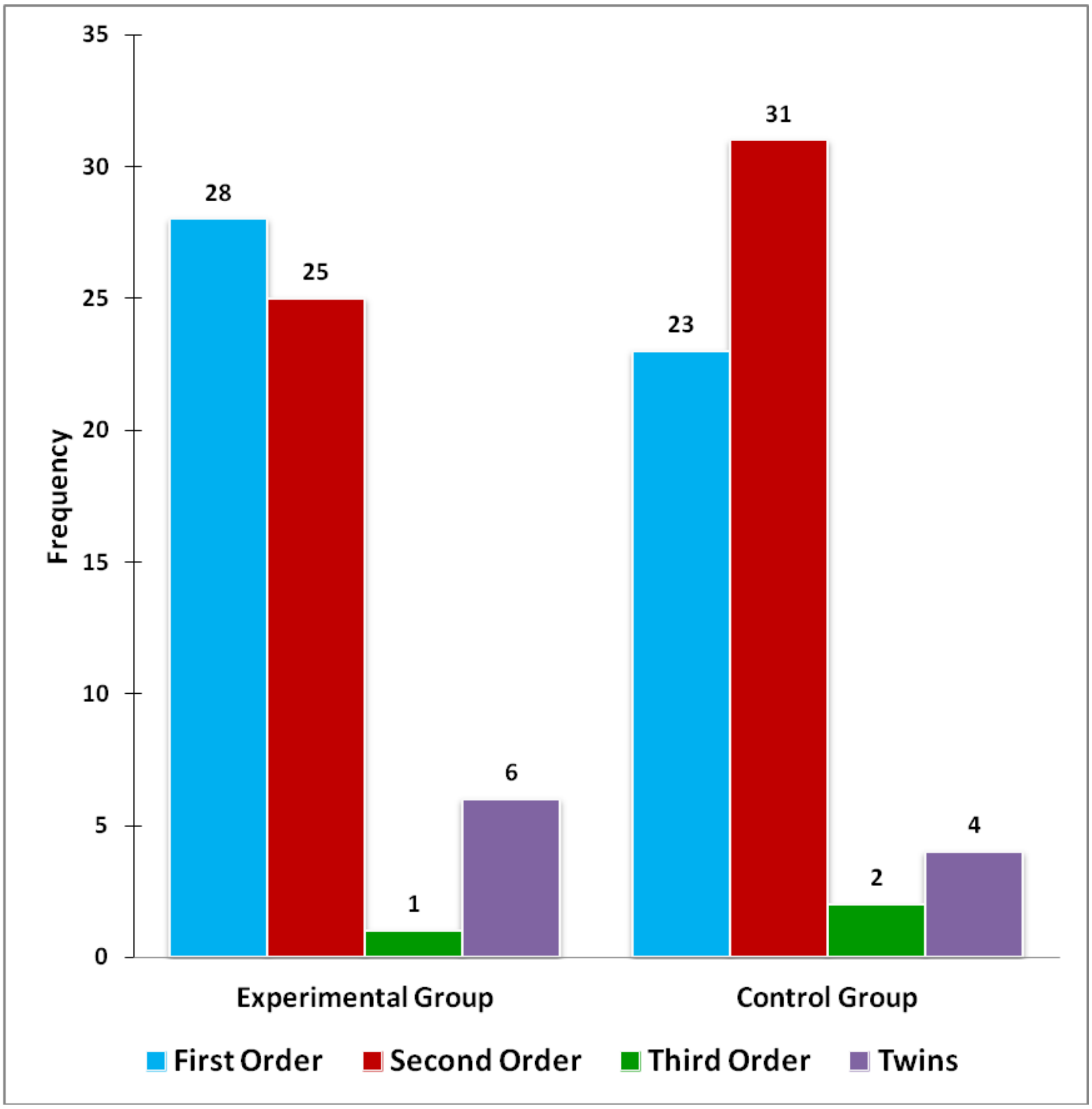


FIG 4.4 : FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE ORDER OF BIRTH

Table – 4.1.5 Frequency and percentage Distribution of samples based on the APGAR score at birth in the experimental and control groups:

APGAR @ Birth	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
5	12	54.5	10	45.5	22	100
6	19	42.2	26	57.8	45	100
7	22	53.7	19	46.3	41	100
8	7	58.3	5	41.7	12	100
Total	60	50	60	50	120	100

Chi^2 Value – 1.824 df – 3 p – Value – 0.610

Table 4.1.5 shows the APGAR score at birth of the preterm neonates. Out of 120 preterm neonates 22 had 5 /10, 45 had 6 / 10, 41 had 7 /10 and 12 had 8 /10. As regards of 22 preterm neonates 54.5% were from the experimental group and 45.5 % were from the control group. The APGAR score at birth 18.3 % had 5/10, 37.5 % had 6 /10, 34.2 % had 7/ 10 and 10 % had 8/10. Among the 45 preterm neonates 42.2% were from the experimental group and 57.8 % from the control group. Among the 41 preterm neonates 53.7 % were from experimental group and 46.3 % were from control group. Among the 12 preterm neonates 58.3 % were from the experimental group and 41.7 % were from the control group. With degree of freedom 3 and 95% confidence interval, the table value of Chi Square is 7.815. Since the calculated Chi square Value 0.610 was less than the table value and the calculated P value of 0.610 was higher than the significance level of 0.05, there is no significant difference between APGAR @ birth of preterm neonates in the experimental and control groups.

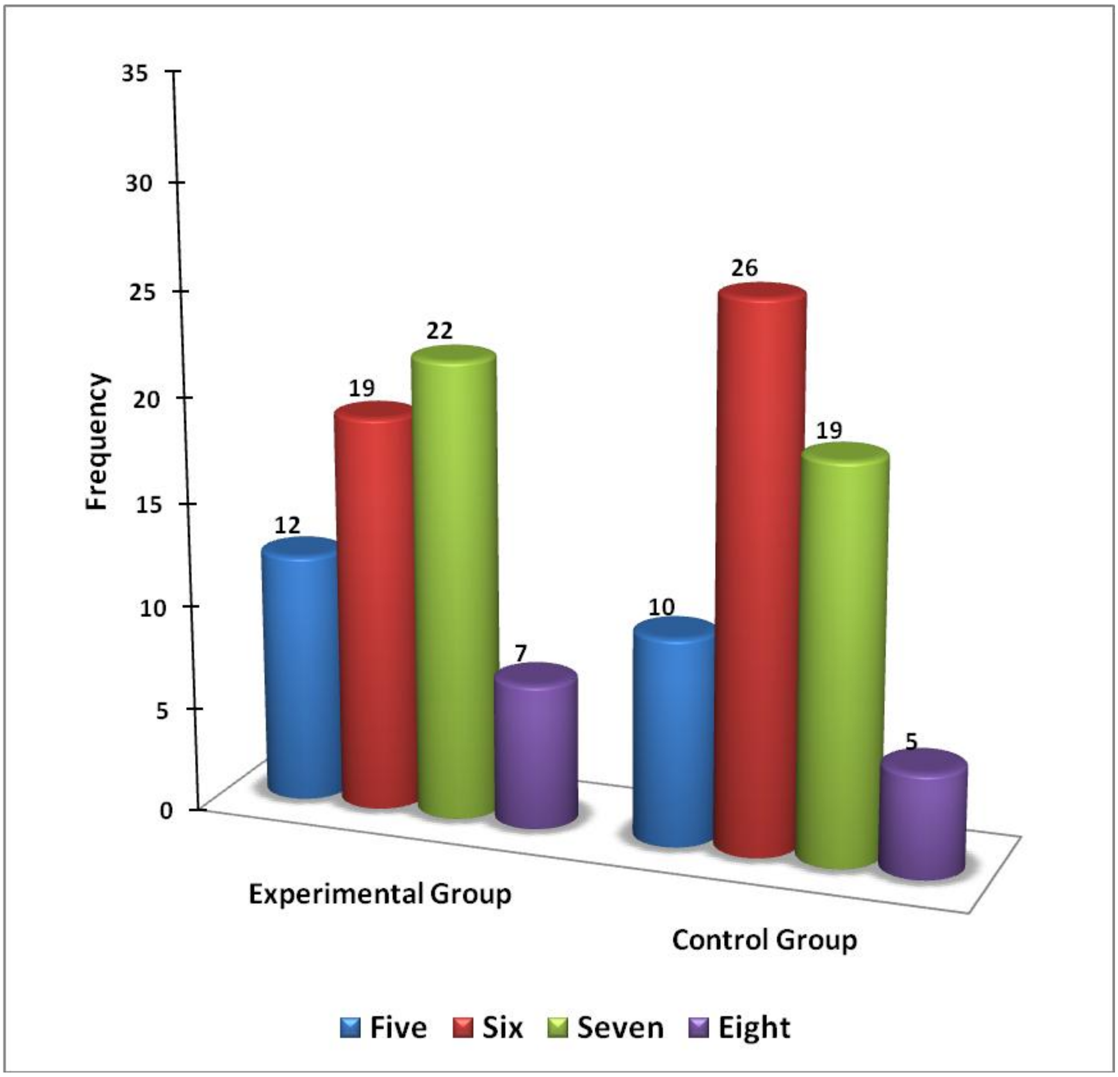


FIG 4.5 : FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE APGAR SCORE AT BIRTH

Table – 4.1.6 Frequency and percentage Distribution of samples based on the APGAR @ 5 minutes in the experimental and control groups :

APGAR @ 5 Minutes	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
7	32	46.4	37	53.6	69	100
8	23	56.1	18	43.9	41	100
9	5	50	5	50	10	100
Total	60	50	60	50	120	100

Chi^2 Value – 0.972 df – 2 p – Value – 0.615

Table 4.1.6 shows the APGAR score at 5 minutes of the preterm neonates. Out of 120 preterm neonates 69 had 7 /10, 41 had 8 / 10 and 10 had 9 /10. Among the 69 preterm neonates, 46.4% were from experimental group and 53.6 % were from control group. Regarding APGAR score at 5th minute 18.3 % had 7/10,40 % had 8 /10 and 41.7 % had 9/ 10. Among the 41 preterm neonates 56.1% were from the experimental group and 43.9 % from the control group. In those 10 preterm neonates 50 % were from experimental group and 50 % were from control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 0.972 was less than the table value and the calculated P value of 0.610 was more than the significance level of 0.05, there is no significant difference between APGAR @ 5 minutes of preterm neonates in the experimental and control groups.

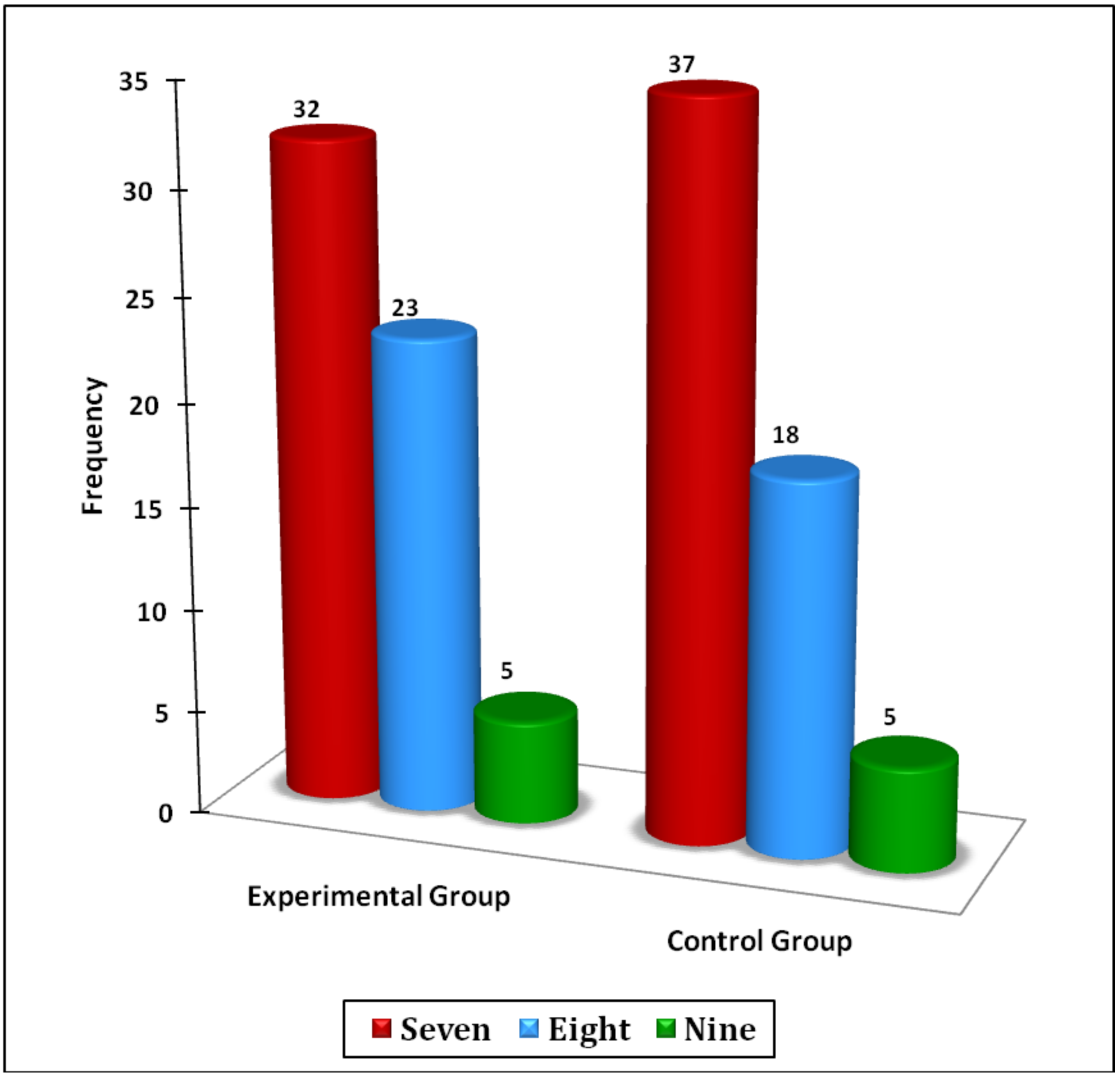


FIG 4.6 : FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE APGAR @ 5 MINUTES

Table – 4.1.7 Frequency and percentage Distribution of samples based on the gestational age in the experimental and control groups :

Gestational Age	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
28 – 30 Weeks	10	45.5	12	54.5	22	100
31 – 33 Weeks	23	47.9	25	52.1	48	100
34 – 36 Weeks	27	54.0	23	46.0	50	100
Total	60	50.0	60	50	120	100

Chi^2 Value – 0.585 df – 2 p – Value – 0.746

Table 4.1.7 reveals the gestational age category of the preterm neonates. Out of 120 preterm neonates 22 were between 28 to 30 weeks, 48 were between 31 to 33 weeks and 50 were between 34 to 36 weeks. Preterm neonates gestational age 18.33 % belong to the gestational age between 28 – 30 weeks, 40 % belong to the gestational age between 31 – 33 weeks and 41.67 % belong to the gestational age between 34 – 36 weeks. Among the 22 preterm neonates 45.5% were from the experimental group and 54.5 % were from the control group. Among the 48 preterm neonates 47.9% were from experimental group and 52.1 % from control group. Among the 50 preterm neonates 54 % were from the experimental group and 46 % were from the control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 0.585 was lower than the table value and the calculated P value of 0.746 was higher than the significance level of 0.05, there is no significant difference between gestational age category of preterm neonates in the experimental and control groups.

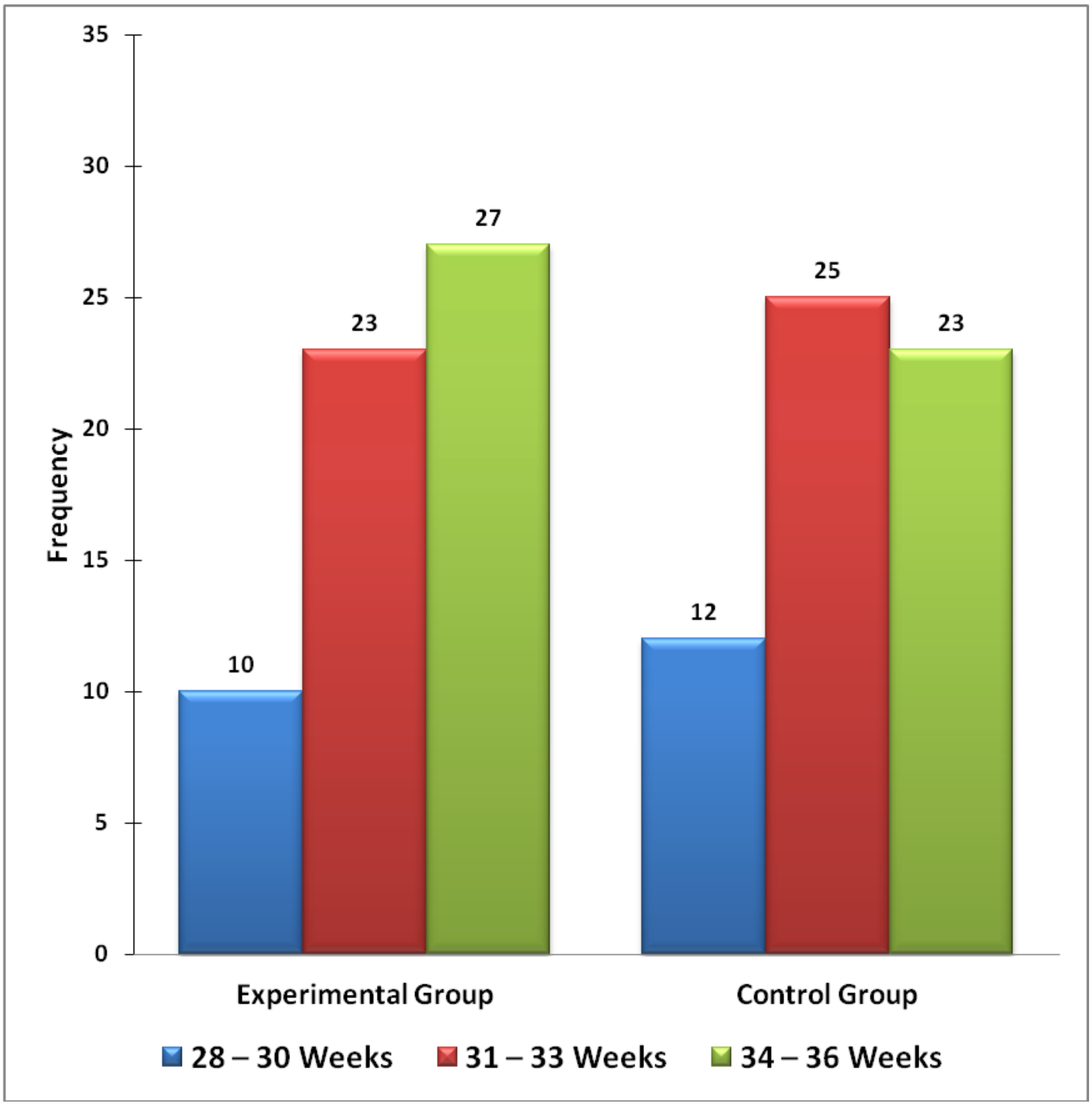


FIG 4.7: FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE GESTATIONAL AGE OF THE PRETERM NEONATES

Table – 4.1.8 Frequency and percentage Distribution of samples based on the age in the experimental and control groups:

Age Category	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
10 – 14 Days	26	48.1	28	51.9	54	100
15 – 19 Days	20	47.6	22	52.4	42	100
20 – 24 Days	14	58.3	10	41.7	24	100
Total	60	50	60	50	120	100

Chi^2 Value – 0.836 df – 2 p – Value – 0.658

The data in table 4.1.8 depict the age category of the preterm neonates. Out of 120 preterm neonates, 54 belong to 10-14 days category, 42 belong to 15-19 days category, and 24 belong to 20-24 days category. In the age of the preterm neonates 45 % belongs to the age group of 10 – 14 days, 35 % belongs to the age group of 15 – 19 days and 20 % belongs to the age group of 20 – 24 days. Among the 54 preterm neonates 48.1% were from the experimental group and 51.9 % were from the control group. Among the 42 preterm neonates 47.6% were from the experimental group and 52.4 % were from the control group. Among the 24 preterm neonates 58.3 % were from the experimental group and 41.7 % were from the control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 0.836 was lower than the table value and the calculated P value of 0.658 was more than the significance level of 0.05, there is no significant difference between age category of the pre term neonates in the experimental and control groups.

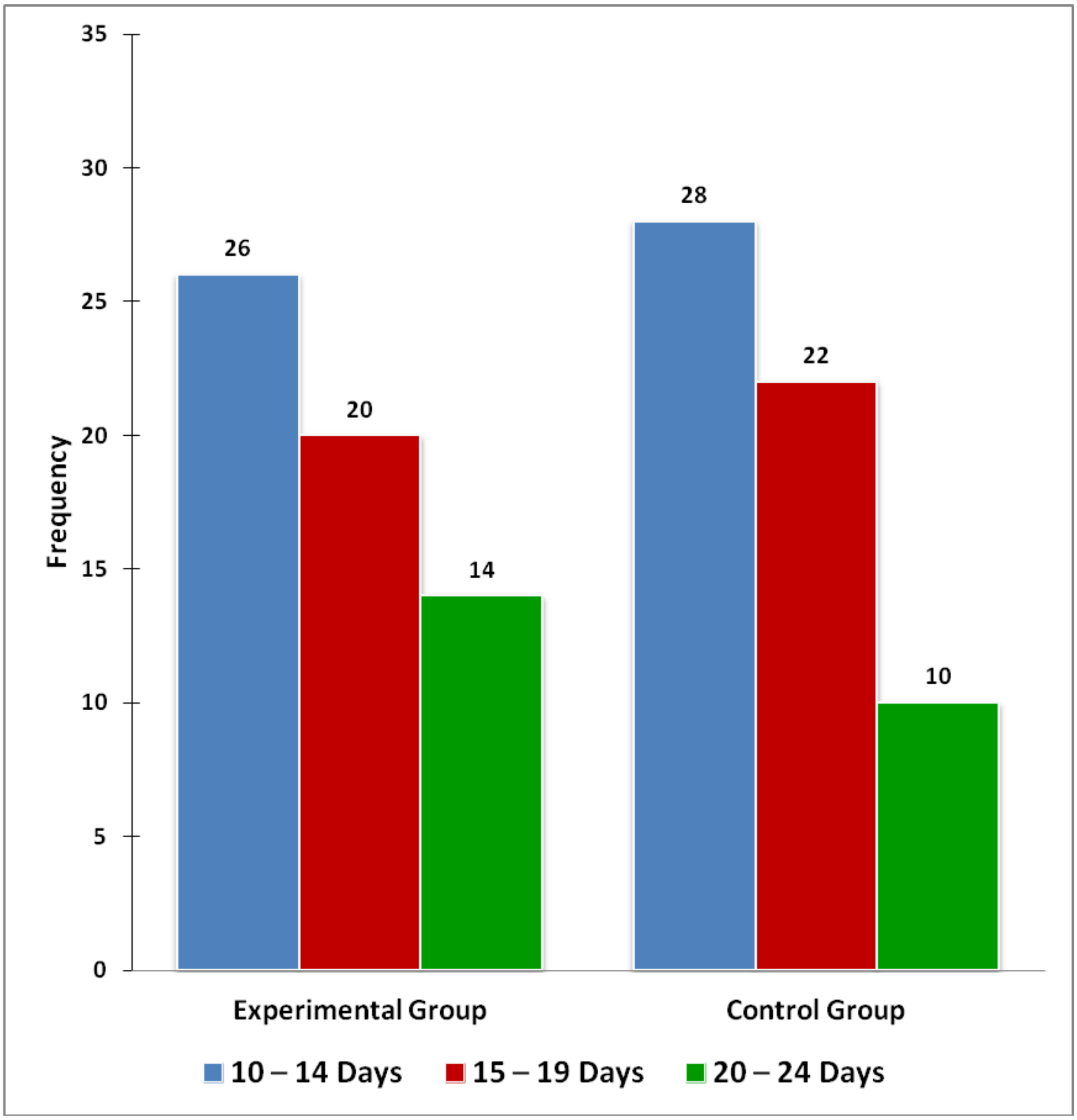


FIG 4.8: FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE AGE OF THE PRETERM NEONATES

Table – 4.1.9 Frequency and percentage Distribution of samples based on the birth weight in experimental and control groups:

Birth Weight Category	Experimental Group		Control Group		Total	
	F	%	F	%	F	%
1000 – 1300 grams	09	40.9	13	59.1	22	100
1310 – 1650 grams	25	52.1	23	47.9	48	100
1660 – 2000 grams	26	52.0	24	48	50	100
Total	60	50	60	50	120	100

Chi^2 Value – 0.891 df – 2 p – Value – 0.641

The data in table 4.1.9 clearly shows the birth weight category of the preterm neonates. Out of 120 preterm neonates 22 were between 1000 and 1300 grams, 48 were between 1310 and 1650 grams and 50 were between 1660 and 2000 grams. The birth weight of the preterm neonates birth weight 18.33 % were belongs to the birth weight of 1000 – 1300 grams, 40 % were belongs to the birth weight of 1310 – 1650 grams and 41.7 % were belongs to the birth weight of 1660 – 2000 grams. Among the 22 preterm neonates 40.9% were from experimental group and 59.1 % were from control group. In those 48 preterm neonates 52.1% were from the experimental group and 47.9 % from the control group. Among the 50 preterm neonates 52 % were from the experimental group and 48 % were from the control group. With degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated Chi square Value 0.891 was less than the table value and the calculated P value of 0.641 was more than the significance level of 0.05, there is no significant difference between the birth weight category of the pre term neonates in the experimental and control groups.

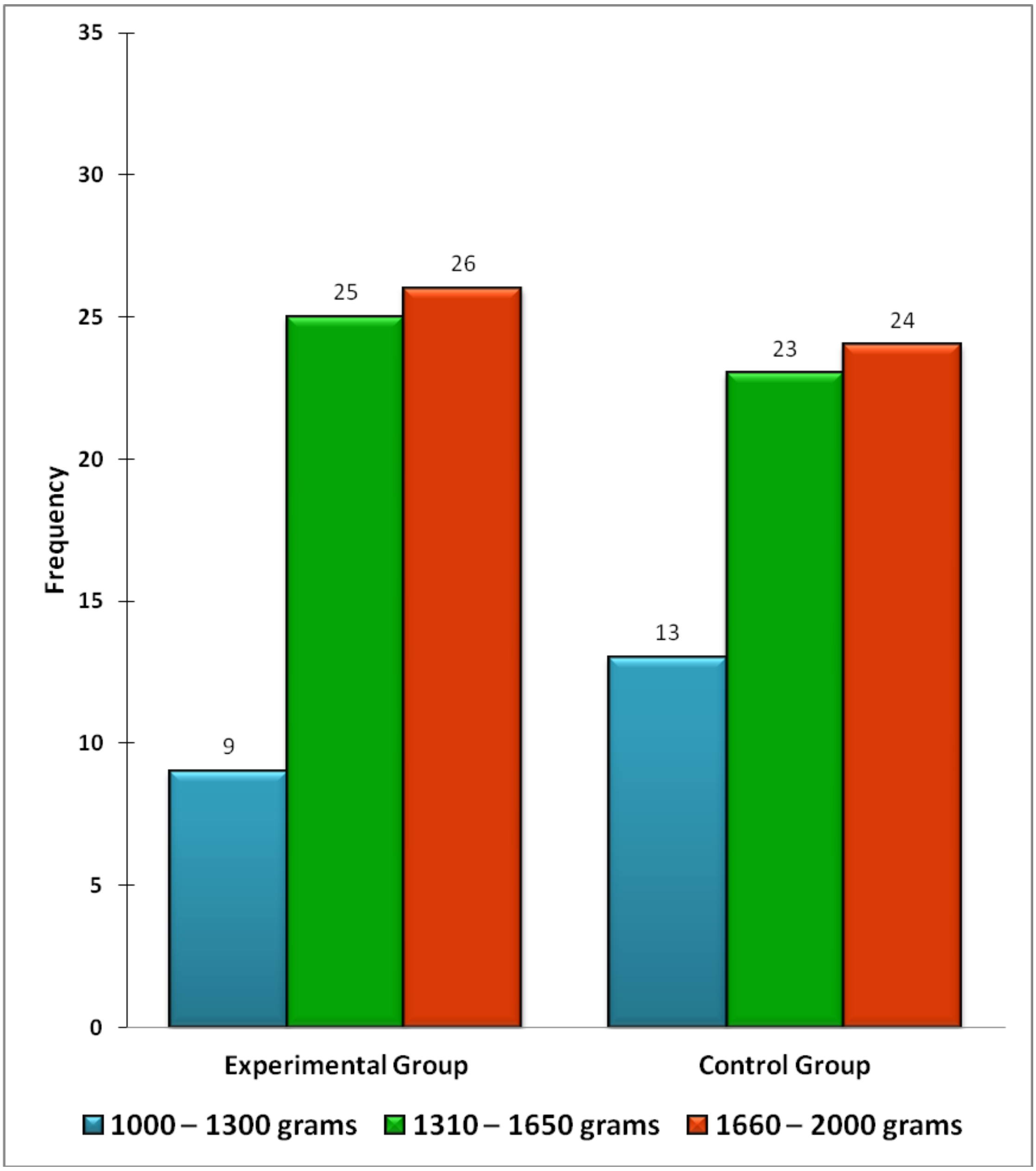


FIG 4.9 : FREQUENCY DISTRIBUTION OF SAMPLES BASED ON THE BIRTH WEIGHT OF THE PRETERM NEONATES

SECTION II

TABLE – 4.2.1 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

The data in table 4.2.1 display the means of the physiological parameter scores regarding weight, temperature, heart rate, respiratory rate and oxygen saturation of the preterm neonates during pre-intervention, post intervention on 3rd day and post intervention on the 5th day among the Experimental group.

With regard to weight, the mean value and standard deviation on the post intervention 3rd day and 5th day were1707.50 grams and 176.41; 1774.00 grams and

184.93 respectively which were higher than the pre intervention mean score and 1597.67 grams 173.90. It shows the exact mean weight gain on the 3rd and 5th day after receiving tactile and auditory stimulation were 109.83grams and 176.33 grams from pre intervention.

Pertaining to temperature, the mean value and standard deviation on the post intervention 3rd and 5th day were 36.83^0 Celsius and 0.08; 37.43^0 Celsius and 0.07 respectively which were higher than pre intervention score 36.56 degree Celsius and 0.09. It shows the exact mean difference was 0.27^0 Celsius on the 3rd post intervention day which indicates normalization of temperature and 0.87^0 Celsius on the 5th post intervention day after receiving tactile and auditory stimulation from pre-intervention which indicates the stabilization of temperature.

Regarding heart rate, the mean value and standard deviation in post intervention 3rd and 5th were 140.73 and 4.21; 131.43 and 4.18 respectively which were lower than pre intervention score 150.90 and 4.56. This shows there was normalization of heart rate in the 3rd post intervention day with the mean difference of 140.73 and stabilization of heart rate with the mean difference on 131.43 on post intervention 5th day from pre intervention.

With regard to respiratory rate, the mean value and standard deviation in post intervention 3rd and 5th day were 43.77 and 3.98; 38.23 and 3.17 respectively which were lower than the pre intervention score 49.47 and 4.62. This shows there was normalization of respiratory rate with a mean difference of 5.7 on the post-intervention 3rd day and stabilization of respiratory rate with the mean difference of 11.24 on post intervention 5th day from pre-intervention.

Pertaining to oxygen saturation, the mean value and standard deviation on post intervention 3rd and 5th day 96.03 % and 0.58; 98.22 % and 0.58 respectively were higher than pre intervention score 93.57 % and 0.69. It shows the exact mean oxygen saturation gain on 3rd and 5th day after receiving tactile and auditory stimulation were 2.46% and 4.65% respectively.

TABLE – 4.2.2 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

The data in table 4.2.2 reveals the means of the physiological parameter scores regarding weight, temperature, heart rate, respiratory rate and oxygen saturation of the preterm neonates during pre-intervention, post intervention on 3^{rd} day and post intervention on 5^{th} day among control groups.

With regard to weight, the mean value and standard deviation on the post intervention 3^{rd} day and 5^{th} day were 1686.17 grams and175.17; 1726.33 grams and 182.18 respectively which were higher than the pre intervention mean score and 1608 grams; 168.41. It shows the exact mean weight gain on 3^{rd} and 5^{th} day after receiving tactile and auditory stimulation were 109.83grams and 176.33 grams from pre intervention. It shows the exact mean weight gain on 3^{rd} and 5^{th} day that did not receive tactile and auditory stimulation were 78.17grams and 118.33 grams respectively.

Pertaining to temperature, the mean value and standard deviation on the post intervention 3^{rd} and 5^{th} day were 36.54^{0} Celsius and 0.05; 36.86^{0} Celsius and 0.08 respectively which were higher than pre intervention score 36.54 degree Celsius and 0.05. It shows on the 3^{rd} and 5^{th} post -intervention day, there was a mean gain of 0.27degree Celsius and 0.29 degree Celsius in the control group pre term neonates who had not received tactile and auditory stimulation.

With regard to heart rate, the mean value and standard deviation on the post intervention 3^{rd} and 5^{th} were 146.70 and 4.34; 142.77 and 4.14 respectively which were lower than pre intervention score 151.33 and 5.03. It shows on the post-intervention 5^{th} day, there was stabilization in the mean difference in heart rate of 8.56 from pre-intervention to the 5^{th} day of post-intervention and 4.63 from pre-intervention to post-intervention 3^{rd} day in the control group pre term neonates who had not received tactile and auditory stimulation.

Regarding respiratory rate, the mean value and standard deviation on the post intervention 3^{rd} and 5^{th} day were 46.33 and 4.33; 43.58 and 4.06 respectively which were lower than the pre intervention score 49.33 and 4.36. It shows on the post - intervention 5^{th} day, there was stabilization in the mean respiratory rate of 5.8 from pre-intervention to 5^{th} day of post-intervention and 2.8 from pre-intervention to post - intervention 3^{rd} day in the control group pre term neonates who had not received tactile and auditory stimulation.

With regard to oxygen saturation, the mean value and standard deviation on the post intervention 3^{rd} and 5^{th} day 94.57 % and 0.69; 95.68 % and 0.71 respectively were higher than pre intervention score 93.45 % and 0.68. It shows the exact mean oxygen saturation gain on the 3^{rd} and 5^{th} day who had not received tactile and auditory stimulation were 1.11% and 2.23% respectively.

Table 4.2.3 Distribution of Frequency and Percentage of the physiological parameters in the experimental group according to structured interview schedule on 3^{rd} & 5^{th} day:

Parameters	Test	Category	F	Percentage
Feeding pattern	Pre Intervention	1. < 6 times	7	11.7%
		2. 6-10 times	53	88.3%
		3. > 10 times	0	0.0%
	Post Intervention on 3rd Day	1. < 6 times	1	1.7%
		2. 6-10 times	39	65.0%
		3. > 10 times	20	33.3%
	Post -intervention 5th Day	1. < 6 times	0	0.0%
		2. 6-10 times	30	50.0%
		3. > 10 times	30	50.0%

Sucking pattern	Pre –intervention	1. < 5 minutes	14	23.3%
		2. 5-10 minutes	46	76.7%
		3. > 10 minutes	0	0.0%
	Post -intervention 3rd Day	1. < 5 minutes	0	0.0%
		2. 5-10 minutes	39	65.0%
		3. > 10 minutes	21	35.0%
	Post -intervention 5th Day	1. < 5 minutes	0	0.0%
		2. 5-10 minutes	27	45.0%
		3. > 10 minutes	33	55.0%
Sleeping pattern	Pre –intervention	1. < 30 minutes	14	23.3%
		2. 30mins– 1 hr	46	76.7%
		3. 1-2 hours	0	0.0%
	Post -intervention 3rd Day	1. < 30 minutes	0	0.0%
		2. 30mins– 1 hr	40	66.7%
		3. 1-2 hours	20	33.3%
	Post -intervention 5th Day	1. < 30 minutes	0	0.0%
		2. 30mins– 1 hr	23	38.3%
		3. 1-2 hours	37	61.7%
Sleeping hours per Day	Pre –intervention	1. <10 hours	15	25.0%
		2. 10-18 hours	45	75.0%
		3. > 18 hours	0	0.0%
	Post -intervention 3rd Day	1. <10 hours	1	1.7%
		2. 10-18 hours	33	55.0%
		3. > 18 hours	26	43.3%
	Post Test 5th Day	1. <10 hours	0	0 (0.0%)
		2. 10-18 hours	19	31.7%
		3. > 18 hours	41	68.3%
Crying pattern	Pre Test	1. > 10 times	6	10.0%
		2. 5-10 times	54	90.0%
		3. < 5 times	0	0.0%
	Post Test 3rd Day	1. > 10 times	0	0.0%
		2. 5-10 times	36	60.0%

		3. < 5 times	24	40.0%
	Post -intervention 5th Day	1. > 10 times	0	0.0%
		2. 5-10 times	24	40.0%
		3. < 5 times	36	60.0%
Urination	Pre –intervention	1. < 5 times	17	28.3%
		2. 5-10 times	43	71.7%
		3. >10 times	0	0.0%
	Post -intervention 3rd Day	1. < 5 times	1	1.7%
		2. 5-10 times	29	48.3%
		3. >10 times	30	50.0%
	Post -intervention 5th Day	1. < 5 times	0	0.0%
		2. 5-10 times	16	26.7%
		3. >10 times	44	73.3%
Overall Score	Pre –intervention	6-9 Unsatisfactory	12	20.0%
		10-14 Satisfactory	48	80.0%
		15-18 Good	0	0.0%
	Post -intervention 3rd Day	6-9 Unsatisfactory	0	0.0%
		10-14 Satisfactory	28	46.7%
		15-18 Good	32	53.3%
	Post -intervention 5th Day	6-9 Unsatisfactory	0	0.0%
		10-14 Satisfactory	11	18.3%
		15-18 Good	49	81.7%

Table – 4.2.3 shows the physiological parameters including feeding pattern, sucking pattern, sleeping pattern, and total hours of sleep per day, crying pattern, and frequency of urination per day scores which were accessed by structural interview questionnaire and graded into unsatisfactory, satisfactory and good. (N=60)

With regard to feeding pattern, pre-intervention shows 7 out of 60(11%) pre term neonates had less than 6 times feeds per day, 53 (88.3%) had 6 to 10 times per day and none (0%) had above 10 times feed per day. In the post-intervention 3rd day only 1(1.7%) had less than 6 times feed per day, 39(65%) had 6 to 10 times feed per day and 20 (33.3%) preterm neonates had above 10 times feeds per day. In the post-intervention 5th day, none (0%) had less than 6 times feed per day, 30(50%) pre term neonates had 6 to 10 times feed per day and 30(50%) had above 10 times feed per day.

Regarding sucking pattern, pre-intervention shows 14 out of 60 (23.3 %) pre term neonates had sucking less than 5 minutes per feed, 46 (76.7%) had sucking between 5 and 10 minutes per feed and none (0%) had sucking above 10 minutes per feed. In the post-intervention 3rd day none (0 %) belonged to less than 5 times category, 39(65%) had sucking 6 to 10 minutes per feed and 21 (35%) pre term neonates had sucking above 10 minutes per feed. In the post-intervention 5th day, none (0%) had less than 5 minutes sucking pattern, 27 (45 %) pre term neonates had sucking 6 to 10 minutes per feed and 33(55%) had 10 minutes sucking pattern.

Pertaining to sleep, pre-intervention shows 14 out of 60 (23.3 %) pre term neonates were got sleep less than 30 minutes, 46 (76.7%) got sleep between 30 minutes to 1 hour per sleep and none (0%) were got sleep between 1 and 2 hours per sleep. On the post-intervention 3rd day none (0 %) were got sleep less than 30 minutes per sleep, 40 (66.7 %) got sleep between 30 minutes to 1 hour per sleep and

20 (33.3%) got sleep 1 – 2 hours per sleep. On the post-intervention 5th day, none (0%) had less than 30 minutes per sleep, 23 (38.3 %) preterm neonates had 30minutes to 1 hour per sleep and 37(61.7 %) had 1 – 2 hours per sleep.

With regard to sleeping hours per day, pre-intervention shows 15 out of 60 (25 %) pre term neonates got sleep less than 10 hours per day, 45 (75%) were got sleep between 10 - 18 hours of sleep per day and none (0%) got sleep above 18 hours. On the post-intervention 3rd day 1 (1.7 %) got sleep less than 10 hours per day, 33 (55 %) got sleep between 10 – 18 hours of sleep per day and 26 (43.3%) got sleep more than 18 hours of sleep per day. On the post-intervention 5th day, none (0%) had less than 10 hours sleep per day, 19 (31.7 %) pre term neonates had 10 - 18 hours of sleep per day and 41(68.3 %) had more than 18 hours of sleep per day.

Regarding crying pattern, pre-intervention shows 6 out of 60 (10 %) pre term neonates were cried more than 10 times per day, 54 (90%) cried between 5 - 10 times per day and none (0%) cried less than 5 times per day. On the post-intervention 3rd day none (0 %) cried more than 10 times per day, 36 (60 %) cried between 5 – 10 times per day and 24 (40%) cried less than 5 times per day. In post-intervention 5th day, none (0%) had cried more than 10 times per day, 24 (40 %) pre term neonates cried 5 to 10 times per day and 36(60 %) were less than 5 times per day.

Pertaining to urination, pre-intervention shows 17 out of 60 (28.3 %) pre term neonates passed urine less than 5 times per day, 43 (71.7%) passed urine between 5 - 10 times per day and none (0%) passed urine more than 10 times per day. On the post-intervention 3rd day none 1 (1.7 %) passed urine less than 5 times per day, 29 (48.3 %) passed urine between 5 – 10 times per day and 30 (50%) passed urine more than 10 times per day. On the post-intervention 5th day, none (0%) passed urine less than 5 times per day, 16 (26.7 %) preterm neonates passed urine 5 to 10 times per day and 44(73.3 %) passed urine more than 10 times per day.

In the overall scores, pre-intervention shows 12 out of 60 (20%) pre term neonates had unsatisfactory overall scores of between 6-9 , 48 (80%) had satisfactory scores of between 10 to 14 and none (0%) had good scores of 15-18.On the post-intervention 3rd day, none (0%) had unsatisfactory score, 28(46.7%) had satisfactory score and 32 (53.3%) preterm neonates had good score. On the post-intervention 5th day, none (0%) had unsatisfactory score, 11(18.3%) pre term neonates had satisfactory score and 49 (81.7%) had good score.

TABLE – 4.2.4 Distribution of Frequency and Percentage of the physiological parameters in the control group according to structured interview schedule on 3rd & 5th day:

Parameters	Test	Category	F	Percentage
Feeding pattern	Pre – intervention	1. < 6 times	13	21.7%
		2. 6-10 times	47	78.3%
		3. > 10 times	0	0.0%
	Post - intervention 3rd Day	1. < 6 times	10	16.75
		2. 6-10 times	49	81.7%
		3. > 10 times	1	1.7%
	Post - intervention	1. < 6 times	10	16.7%
		2. 6-10 times	43	71.7%

	5th Day	3. > 10 times	7	11.7%
Sucking pattern	Pre – intervention	1. < 5 minutes	9	15.0%
		2. 5-10 minutes	51	85.0%
		3. > 10 minutes	0	0.0%
	Post - intervention 3rd Day	1. < 5 minutes	6	10.0%
		2. 5-10 minutes	51	85.0%
		3. > 10 minutes	3	5.0%
	Post - intervention 5th Day	1. < 5 minutes	6	10.0%
		2. 5-10 minutes	48	80.0%
		3. > 10 minutes	6	10.0%
Sleeping pattern	Pre – intervention	1. < 30 minutes	8	13.3%
		2. 30mins– 1 hr	52	86.7%
		3. 1-2 hours	0	0.0%
	Post - intervention 3rd Day	1. < 30 minutes	8	13.3%
		2. 30mins– 1 hr	51	85.0%
		3. 1-2 hours	1	1.7%
	Post- intervention 5th Day	1. < 30 minutes	8	13.3%
		2. 30mins– 1 hr	48	80.0%
		3. 1-2 hours	4	6.7%
Sleeping hours per Day	Pre – intervention	1. <10 hours	11	18.33%
		2. 10-18 hours	49	81.6%
		3. > 18 hours	0	0.0%
	Post - intervention	1. <10 hours	16	26.7%
		2. 10-18 hours	44	73.3%

	3rd Day	3. > 18 hours	0	0.0%
	Post - intervention 5th Day	1. <10 hours	16	26.7%
		2. 10-18 hours	41	68.3%
		3. > 18 hours	3	5.0%
Crying pattern	Pre – intervention	1. > 10 times	8	13.3%
		2. 5-10 times	52	86.7%
		3. < 5 times	0	0.0%
	Post - intervention 3rd Day	1. > 10 times	2	3.3%
		2. 5-10 times	57	95.0%
		3. < 5 times	1	1.7%
	Post - intervention 5th Day	1. > 10 times	2	3.3%
		2. 5-10 times	57	95.0%
		3. < 5 times	1	1.7%
Urination	Pre – intervention	1. < 5 times	11	18.3%
		2. 5-10 times	49	81.7%
		3. >10 times	0	0.0%
	Post - intervention 3rd Day	1. < 5 times	15	25.0%
		2. 5-10 times	44	73.3%
		3. >10 times	1	1.7%
	Post - intervention 5th Day	1. < 5 times	14	23.3%
		2. 5-10 times	42	70.0%
		3. >10 times	4	6.7%
Overall Score	Pre – intervention	6-9 Unsatisfactory	7	11.7%
		10-14 Satisfactory	53	88.3%

		15-18 Good	0	0.0%
	Post-intervention 3rd Day	6-9 Unsatisfactory	9	15.0%
		10-14 Satisfactory	51	85.5%
		15-18 Good	0	0.0%
	Post - intervention 5th Day	6-9 Unsatisfactory	03	05.0%
		10-14 Satisfactory	49	81.7%
		15-18 Good	08	13.3%

Table 4.2.4 depicts the physiological parameters including feeding pattern, sucking pattern, sleeping pattern, total hours of sleep per day, crying pattern, frequency of urination per day scores which were accessed by structural interview questionnaire and graded into unsatisfactory, satisfactory and good. (N=60)

As regards feeding pattern, pre-intervention shows 13 out of 60(21%) pre term neonates had less than 6 times feeds per day, 47 (78.3%) had 6 to 10 times per day and none (0%) had above 10 times feed per day. On the post-intervention 3rd day only 10(16.75%) had less than 6 times feed per day, 49(81.7%) had 6 to 10 times feed per day and 1 (1.7%) pre term neonates had above 10 times feeds per day. On the post intervention 5th day, 10 (16.7%) had less than 6 times feed per day, 43(71.7%) pre term neonates had 6 to 10 times feed per day and 7(11.7%) had above 10 times feed per day.

Regarding sucking pattern, pre-intervention shows 9 out of 60 (15 %) pre term neonates had sucking less than 5 minutes sucking pattern, 51 (85%) had sucking between 5 and 10 minutes per feed and none (0%) had sucking above 10 minutes per feed. On the post-intervention 3rd day 6 out of 60 (10 %) had sucking less than 5 times , 51(85%) had sucking 6 to 10 minutes per feed and 3 (5%) pre term neonates had sucking above 10 minutes per feed. On the post-intervention 5th day, 6 (10%) had less than 5 minutes sucking pattern, 48 (80 %) pre term neonates had sucking 6 to 10 minutes per feed and 6(10%) had above 10 minutes sucking pattern.

This shows pre term neonates physiological parameters of sucking pattern were increased exactly by 33.33 % (in <5minutes suck/feed), none (0 %) in 5-10 minutes suck/ feed & 5%(in >10 minutes suck/feed) on post-intervention 3rd day and none (0%) in <5minutes suck/feed, 0.05 % (in 5-10 minutes suck/ feed) & 10%(in >10 minutes suck/feed) on the post-intervention 5th day from pre term neonates who had not received tactile and auditory stimulation.

As regards sleeping pattern, pre-intervention shows 8 out of 60 (13.3 %) pre term neonates got sleep less than 30 minutes, 52 (86.7%) got sleep between 30 minutes and 1 hour and none (0%) got sleep between 1 – 2 hours per sleep. On the post-intervention 3rd day 8 (13.3 %) got sleep less than 30 minutes, 51 (85.0 %) got sleep between 30 minutes to 1 hour per sleep and 1 (1.7%) got sleep 1 – 2 hours per sleep. On the post-intervention 5th day, 8 (13.3%) had less than 30 minutes per sleep, 48 (80.0 %) pre term neonates had 30minutes to 1 hour per sleep and 4(6.7 %) had 1 – 2 hours per sleep.

This shows pre term neonates physiological parameters of sleeping pattern were increased exactly by 0% in <30 minutes /sleep, 0.019 % (in 30 minutes-1 hour / sleep) & 1.7%(in 1-2 hour/sleep) on post-intervention 3rd day and by 0% in <30 minutes /sleep , 7.6 % (in 30 minutes-1 hour / sleep) & 6.7 %(in 1-2 hour/sleep) on the post-intervention 5th day from pre-intervention pre term neonates who had not received tactile and auditory stimulation.

Regarding sleeping hours per day, pre-intervention shows 11 out of 60 (18.33 %) pre term neonates got sleep less than 10 hours per day, 49 (81.67%) got sleep between 10 - 18 hours of sleep per day and none (0%) got sleep above 18 hours. In post-intervention 3rd day 16 (26.7 %) got sleep less than 10 hours per day, 44 (73.7 %) got sleep between 10 – 18 hours of sleep per day and none (0%) got sleep more than 18 hours of sleep per day. On the post-intervention 5th day, 16 (26.7%) had less than 10 hours sleep per day, 41 (68.3 %) preterm neonates had 10 - 18 hours of sleep per day and 3(5 %) had more than 18 hours of sleep per day.

This shows pre term neonates physiological parameter of sleeping hours per day in <10 hours sleep/day category were raised to 16 from 11 preterm neonates and 10.2 % increase seen in 10-18 hours sleep/day & none (0 %) in > 18 hours sleep/ day on posttest 3rd day and no change in <10 hours sleep/day, 6.8% increase in 10-18 hours sleep/day & 5% increase in > 18 hours sleep/ day on the post -intervention 5th day from pretest controls who had not received post tactile and auditory stimulation.

Regarding crying pattern, pre-intervention shows 8 out of 60 (13.3 %) pre term neonates cried more than 10 times per day, 52 (86.7%) cried between 5 - 10 times per day and none (0%) cried less than 5 times per day. On the post - intervention 3rd day 2 (3.3 %) cried more than 10 times per day, 57 (95 %) cried between 5 – 10 times per day and 1 (1.7%) cried less than 5 times per day. On the post-intervention 5th day, 2 (3.3%) cried more than 10 times per day, 57 (95 %) pre term neonates cried 5 to 10 times per day and 1(1.7 %) were less than 5 times per day.

This shows pre term neonates physiological parameter of crying pattern were increased exactly by 75 % in >10 times cries/ day) & 1.7 % in <5 times cries / day) and raised to 57 from 52 preterm neonates on the post -intervention 3rd day and by 75 % (>10 times cries/ day),1.7% in <5 times cries /day on the post -intervention 5th day and raised to 57 from 52 preterm neonates in 5-10 times cries /day from pre-intervention controls who had not received tactile and auditory stimulation.

As regards urination, pre-intervention shows 11 out of 60 (18.3 %) pre term neonates passed urine less than 5 times per day, 49 (81.7%) passed urine between 5 - 10 times per day and none (0%) passed urine more than 10 times per day. On the post -intervention 3rd day none 15 (25 %) passed urine less than 5 times per day, 44 (73.3 %) passed urine between 5 – 10 times per day and 1 (1.7%) passed urine more than 10 times per day. On the post-intervention 5th day, 14 (23.3%) passed urine less than 5 times per day, 42 (70 %) preterm neonates passed urine 5 to 10 times per day and 4(6.7 %) passed urine more than 10 times per day.

This shows pre term neonates physiological parameters of frequency of urination per day were increased exactly 10.2 % (5-10 times urination /day) &1.7 % (in>10 times urination / day) and raised to 15 from 11 (<5 times urination / day) on the post-intervention 3rd day. On the post -intervention 5th day there was increase of 14.2% (5-10 times urination /day) & 6.7 %(> 10 times urination /day) and raised to 14 from 11 (<5 times urination / day) from pre-intervention controls who had not received tactile and auditory stimulation.

As regards overall scores , pre-intervention shows 7 out of 60 (11.7%) pre term neonates had unsatisfactory overall scores (6-9) , 53 (88.3%) had satisfactory scores of (10 to 14) and none (0%) had good scores (15-18). On the posttest 3rd day, 9 (15%) had unsatisfactory score, 51(85.5%) had satisfactory score and none (0%) pre term neonates had good score. On the posttest 5th day, 3 (05%) had unsatisfactory score, 49(81.7%) pre term neonates had satisfactory score and 08 (13.3%) had good score.

SECTION III

TABLE -4.3.1 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)

To find out the difference between the mean weight score of the experimental and control groups, the null hypothesis is stated as follows —"There will be no significant difference between the mean posttest weight score of the preterm neonates between the experimental and the control group".

Table -4.3.1 reveals that the paired difference of mean weight gain in pre term neonates on post - intervention 3rd day and 5th day were 109.83, 78.16 grams & 176.33, 118.33 grams in experimental and control group respectively. The corresponding 't' values were 29.613, 19.532 and 35.368, 21.892 which were more than the table value of 2.9200. Hence, the weight gain in both experimental & control groups in post- intervention 3rd day and post- intervention 5th day were statistically significant at 0.01 level. This indicates that the difference between experimental and control groups is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

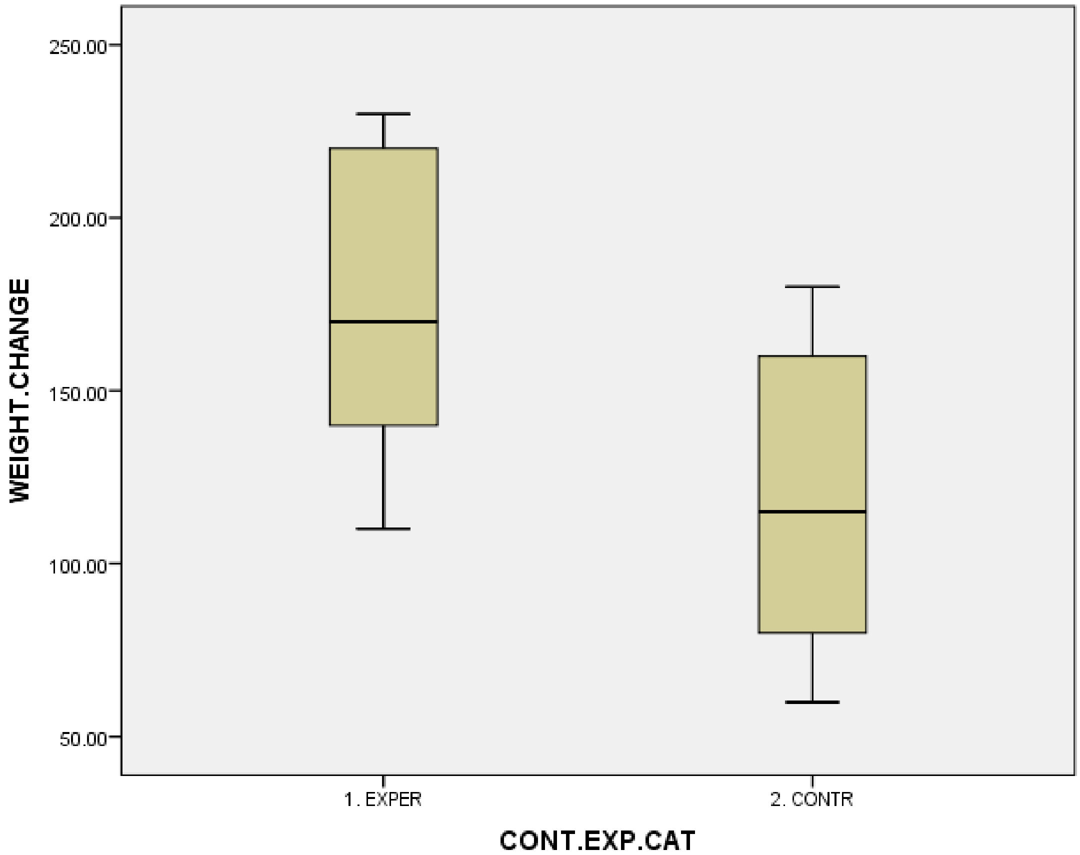


Fig 4.10: BOX PLOT SHOWING CHANGE IN WEIGHT BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS:

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

Table 4.3.2 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)

To find out the difference between the mean temperature of the experimental and control group, the null hypothesis is stated as follows—"There will be no significant difference between the mean temperature score of the preterm neonates between the experimental and the control groups".

Table 4.3.2 reveals that the paired difference of mean temperature in preterm neonates on post - intervention 3rd day and 5th day were 0.27, 0.15^{0} Celsius & 0.87, 0.31 ^{0} Celsius in experimental and control group respectively. The corresponding 't' values were 18.355, 19.699 and 55.865, 26.020 which were more than the table value of 2.9200. Hence, the temperature 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 experimental and control groups is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

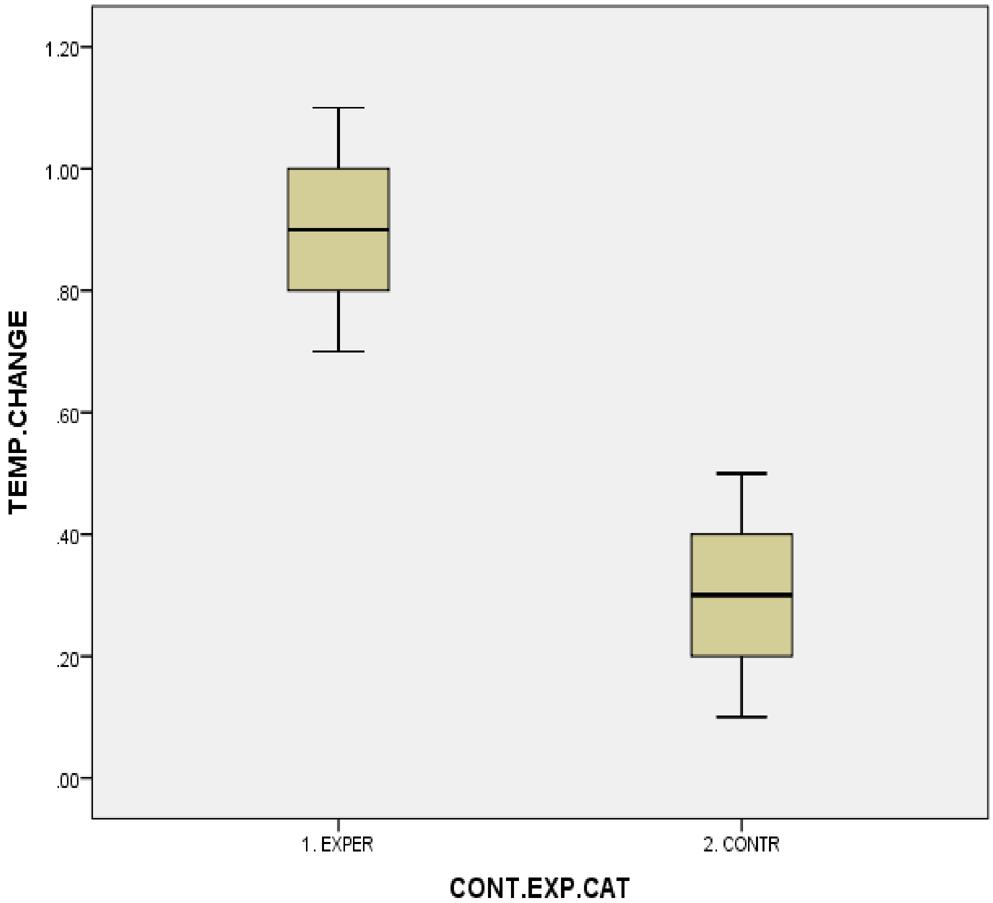


Fig. 4.11 BOX PLOT SHOWING CHANGE IN TEMPERATURE BETWEEN THE GROUPS

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

TABLE – 4.3.3 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)

To find out the difference between the mean heart rate of the experimental and control group, the null hypothesis is stated as follows:"There will be no significant difference between the mean heart rate score of the preterm neonates between the experimental and the control groups".

Table -4.3.3 reveals that the paired difference of mean heart rate in preterm neonates on post - intervention 3rd day and 5th day were 9.30, 3.93 beats/ minute & 10.17, 3.93 beats/ minute in the experimental and control groups respectively. The corresponding 't' values were 52.985, 23.304 and 40.948, 22.978 which were more than the table value of 2.9200. Hence the heart rate 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 experimental and controls group is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, researcher rejects the null hypothesis and accepts the research hypothesis.

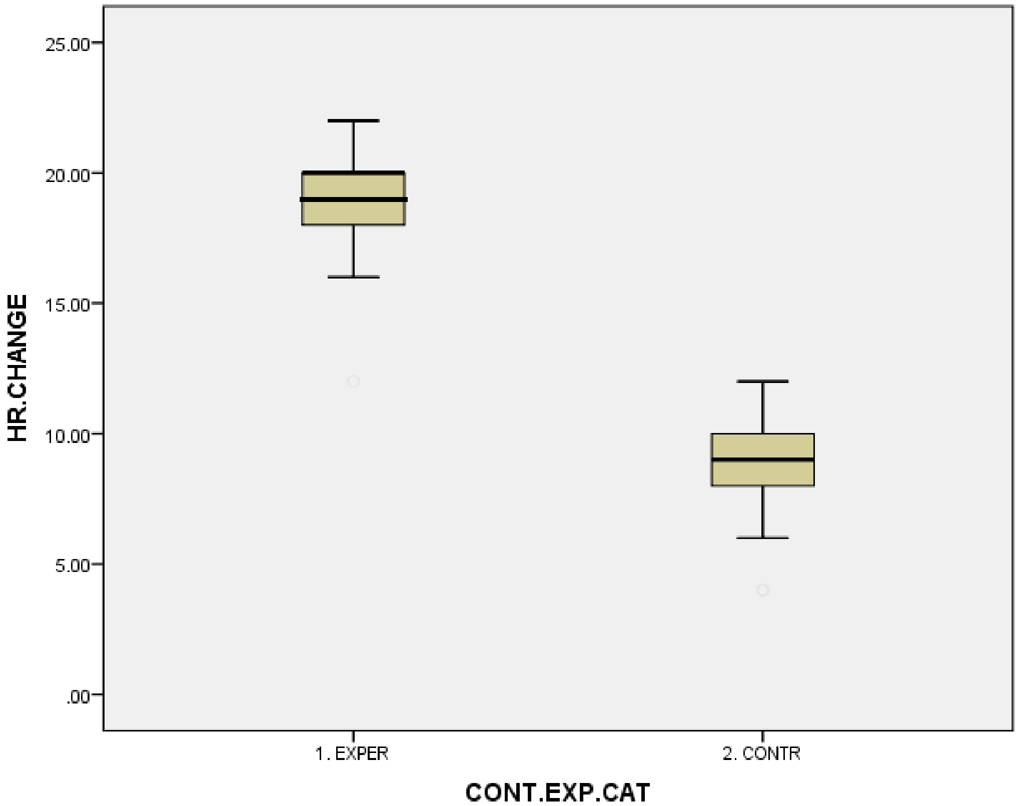


Fig. 4.12: BOXPLOT SHOWING CHANGE IN HEART RATE BETWEEN THE GROUPS

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

TABLE – 4.3.4 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)

To find out the difference between the mean respiratory rate of the experimental and control group, the null hypothesis is stated as follows—"There will be no significant difference between the mean respiratory rate score of the preterm neonates between the experimental and the control groups".

Table 4.3.4 reveals that the paired difference of mean respiratory rate in preterm neonates on post - intervention 3rd day and 5th day were 5.70, 3.00 breaths/ minute & 11.23, 5.80 breaths / minute in experimental and control groups respectively. The corresponding 't' values were 30.141, 21.646 and 41.078, 34.236 which were higher than the table value of 2.9200. Hence the respiratory rate in both the 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 experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

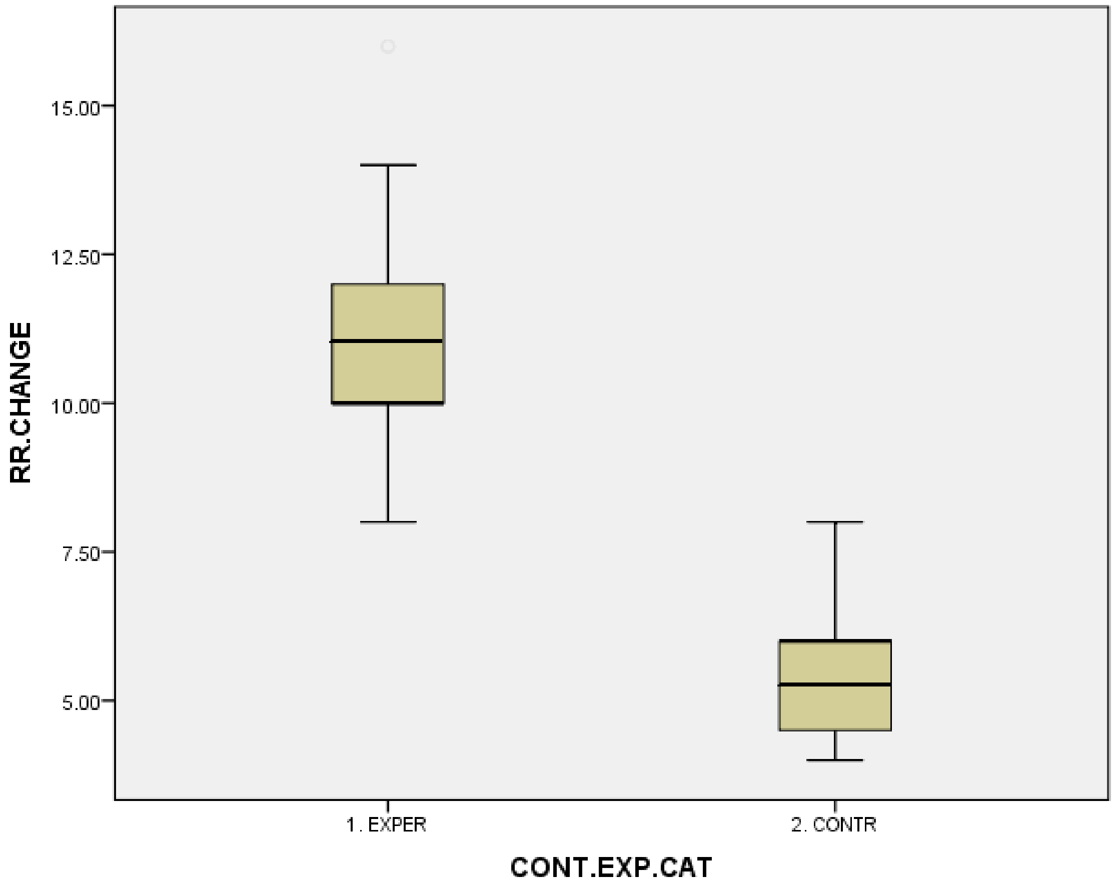


Fig. 4.13 : BOX PLOT SHOWING CHANGE IN RESPIRATORY RATE BETWEEN THE GROUPS

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

Table 4.3.5 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)

To find out the difference between the mean oxygen saturation of the experimental and control group, the null hypothesis is stated as follows –"There will be no significant difference between the mean oxygen saturation score of the preterm neonates between the experimental and the control groups".

Table 4.3.5 reveals that the paired difference of mean oxygen saturation in preterm neonates on post - intervention 3rd day and 5th day were 2.47, 1.12 % & 4.65, 2.23 % in experimental and control group respectively. The corresponding 't' values were 32.077, 23.225 and 43.937, 37.238 which were more than the table value of 2.9200. Hence the oxygen saturation in both the experimental & control groups on post-intervention 3rd day and post- intervention 5th day were statistically significant at 0.05 level. This indicates that the difference between experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

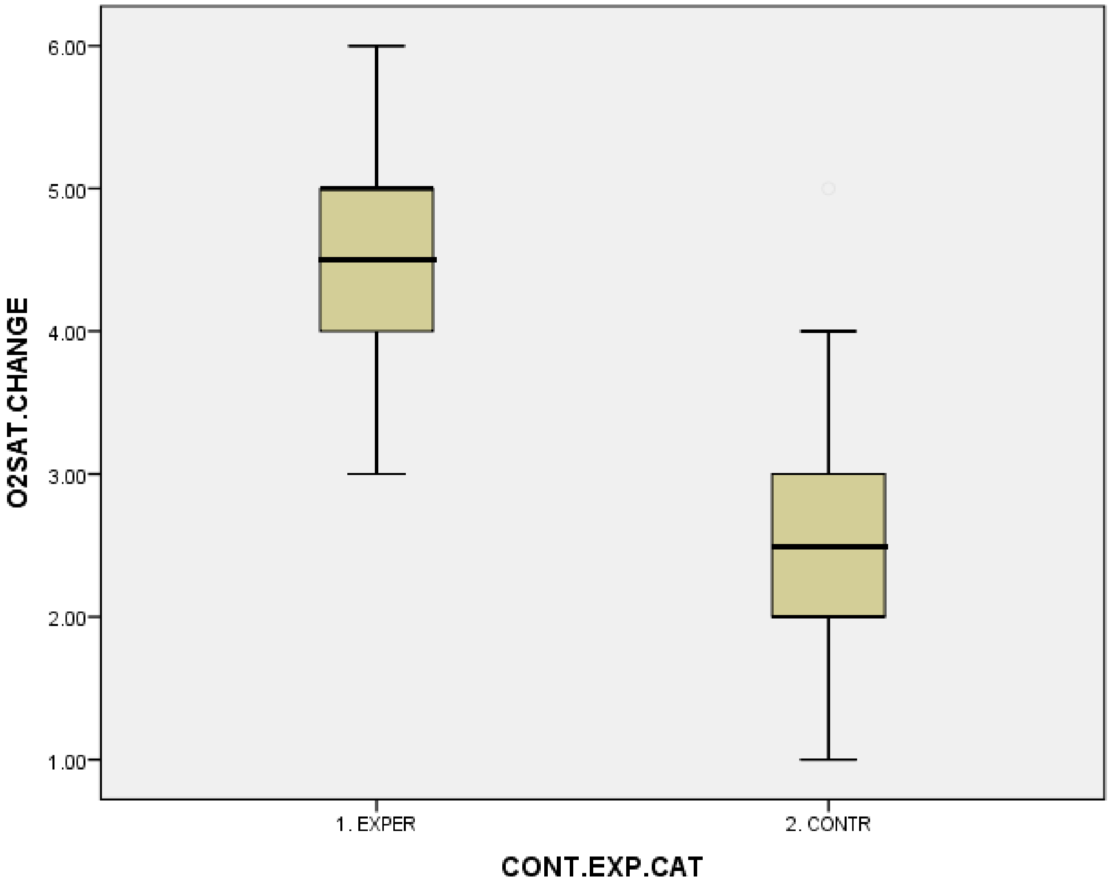


Fig 4.14: Box plot showing Change in Oxygen Saturation between the experimental and control groups

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

Table 4.3.6 shows Comparison of mean pre intervention physiological parameters between the experimental and control group:

Physiological parameters	Experimental Group		Control Group		T- Value	p- Value
	Mean	SD	Mean	SD		
Weight	1597.67	173.90	1608.00	168.41	0.109	0.742
Temperature	36.56	0.09	36.54	0.05	2.357	0.127
Heart Rate	150.90	4.56	151.33	5.03	0.244	0.622
Respiratory Rate	49.47	4.62	49.33	4.36	0.025	0.875
Oxygen Saturation	93.57	0.69	93.45	0.68	0.867	0.354

(p **>0.05 not significant**)

This table 4.3.6 shows that "t" value was less than the table value of 2.9620 and p valve was more than 0.05 it confirms that there was no statistically significant relation between the Means & SD on pre intervention in both the experimental and control groups. Hence both the groups are equal in the pretest.

Table 4.3.7 : Comparison Of Mean Posttest Physiological Parameter Score Among Preterm Neonates In The Experimental And Control Groups On Day 3 :

Parameters	Experimental Group Mean	SD	Control group Mean	SD	t value	P-value
Weight	1707.50	176.41	1686.17	175.17	33.68	**0.001*** **
Temperature	36.83	0.08	36.54	0.05	110.01	**0.001*** **
Heart Rate	140.73	4.21	146.33	4.34	58.39	**0.001*** **
Respiratory Rate	43.77	3.98	46.33	4.36	11.33	**0.001*** **
Oxygen Saturation	96.03	0.58	94.57	0.69	156.47	**0.001*** **

(P <0.01*** very significant)

To find out the difference between the mean posttest 3rd day physiological parameter score between the experimental and control group, the null hypothesis is stated as follows – "There will be no significant difference between the posttest 3rd day physiological parameter score between experimental and the control groups".

Table 4.3.7 reveals that the mean posttest weight score in the experimental group was 1707 .50 whereas in the control group was 1686.17. The corresponding't' value was 33.68 which was higher than the table value of 2.9200. Hence the weights gain between the experimental & control group on post- intervention 3rd day was statistically significant at 0.01 levels. The mean posttest temperature score in the experimental group was 36.83 whereas in the control group was 36.5. The corresponding 't' value was 110.01 which was higher than the table value of 2.9200. Hence the temperature variation among experimental & control group on post- intervention 3rd day was statistically significant at 0.01 level. The mean posttest heart rate score in the experimental group was 140.73 whereas in the control group was 146.33 The corresponding'ʻt' value was 58.39 which was higher than the table value of 2.9200. Hence the heart rate variation between the experimental & control group on post- intervention 3rd day was statistically significant at 0.05 levels. The mean posttest respiratory rate score in the experimental group was 43.77 whereas in the control group was 46.33. The corresponding 't' value was 11.33 which was higher than the table value of 2.9200. Hence the respiratory rate variation between the experimental & control group on post- intervention 3rd day was statistically significant at 0.01 levels. The mean posttest oxygen saturation score in experimental group was 96.03 whereas in control group was 94.57. The corresponding 't' value was 156.47 which was higher than the table value of 2.9200. Hence the oxygen saturation score between the experimental & the control group on post- intervention 3rd day was statistically significant at 0.01 levels. This indicates that the difference between the experimental and the control group is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

Table 4.3.8 : Comparison Of Mean Posttest Physiological Parameter Score Among Preterm Neonates In The Experimental And Control Groups On Day 5 :

Parameters	Experimental Group		Control group Mean 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)

To find out the difference between the mean posttest 5th day physiological parameter score between experimental and control group, the null hypothesis is stated as follows –"There will be no significant difference between the posttest 5th day physiological parameter score among experimental and the control groups".

Table 4.4.8 reveals that the mean posttest weight score in the experimental group was 1774 whereas in the control group was 1726.33. The corresponding 't' value was 62.21 which was higher than the table value of 2.9200. Hence the weight gain among experimental & control group on post- intervention 5th day was statistically significant at 0.01 level.

The mean posttest temperature score in the experimental group was 37.43 whereas in the control group was 36.86. The corresponding 't' value was 160.8 which was higher than the table value of 2.9200. Hence the temperature variation between the experimental & the control group on post-intervention 5^{th} day was statistically significant at 0.01 level.

The mean posttest heart rate score in experimental group was 131.43 whereas in control group was 142.77. The corresponding 't' value was 222.72 which was higher than the table value of 2.9200. Hence the heart rate variation among experimental & control group on post- intervention 5^{th} day was statistically significant at 0.01 level. The mean posttest respiratory rate score in the experimental group was 38.23 whereas in the control group was 43.53. The corresponding 't' value was 63.59 which was higher than the table value of 2.9200. Hence the respiratory rate variation between the experimental & the control group on post-intervention 5^{th} day was statistically significant at 0.01 level.

The mean posttest oxygen saturation score in the experimental group was 98.22 whereas in the control group was 95.68. The corresponding 't' value was 462.08 which was higher than the table value of 2.9200. Hence the oxygen saturation score among experimental & control group on post- intervention 5^{th} day was 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. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE – 4.3.9 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		Chi^2 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)

To find out the difference between the feeding pattern of the experimental and control group, the null hypothesis is stated as follows :

There will be no significant difference between the feeding pattern score of the preterm neonates between the experimental and the control groups.

Table 4.4.9 shows the comparison of feeding pattern in both the Experimental and the control group. On post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 25.690, 26.612 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the feeding pattern 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.

The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

Table 4.3.10 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		Chi^2 Value	p –Value
			Experimen-tal 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)

To find out the difference between the sucking pattern score of the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between the sucking pattern score of the preterm neonates between the experimental and the control groups.

Table 4.3.10 shows the comparison in sucking pattern scores both Experimental and control group. On post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 21.100, 30.572 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the sucking pattern score in both the experimental & controls 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 groups is true difference. It is due to the effect of tactile and auditory stimulation.

The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE -4.3.11 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
			Experimen-tal N=60	Control N=60		
Pre - intervention	1. < 30 minutes	22	14 (23.3%)	22 (13.3%)	2.004	0.157
	2. 30mins– 1 hr	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– 1 hr	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– 1 hr	71	23 (38.3%)	48 (80.0%)		
	3. 1-2 hours	41	37 (61.7%)	4 (6.7%)		

(P <0.01*** very significant)

To find out the difference between the sleeping pattern score of the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between the sleeping pattern score of the preterm neonates between the experimental and the control groups.

Table 4.3.11 shows the comparison in sleeping pattern scores both the experimental and control groups. On post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 26.520, 43.364 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. Hence, the sleeping pattern score in both the 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. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE – 4.3.12 Comparison of mean pre intervention Vs post intervention sleeping hours per day among preterm neonates in the experimental and control groups:

Sleeping hours per Day	Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimen -tal 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)

To find out the difference between duration of sleeping hours per day score of the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between duration of sleeping hours per day score of the preterm neonates between the experimental and the control groups.

Table 4.4.12 shows the comparison in sucking pattern score both the experimental and control group. On post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of chi square is 5.991. Since the calculated chi square value on 3rd and 5^{th} day were 40.807, 56.885 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the duration of sleeping hours per day score in both the experimental & control group on post- intervention 3^{rd} day and post- intervention 5^{th} 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. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE – 4.3.13 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		Chi^2 Value	p –Value
			Experimen -tal 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)

To find out the difference between the duration of crying pattern score of the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between the duration of crying pattern score of the preterm neonates between the experimental and the control groups.

Table 4.3.13 shows the comparison in duration of crying pattern scores both the experimental and control groups. On post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 27.902, 48.553 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the duration of crying pattern score in both experimental & control group 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.

The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE – 4.3.14 Comparison of mean pre intervention Vs post intervention urination among preterm neonates in the experimental and control groups:

Urination	Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimen -tal 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)

To find out the difference between urination score of the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between urination score of the preterm neonates between the experimental and the control groups.

Table 4.3.14 shows the comparison in duration of urination score both the experimental and control groups. On the post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 42.461 and

58.989 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the duration of urination score in both the experimental & control groups in 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.

The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

TABLE – 4.3.15 Comparison of mean pre intervention Vs post intervention over all physiological parameter score among the preterm neonates in the experimental and control groups:

Overall Score	Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimen-tal N=60	Control N=60		
Pre Intervention	6-9 Unsatisfactory	19	12 (20.0%)	7 (11.7%)	1.563	0.211
	10-14 Satisfactory	101	48 (80.0%)	53 (88.3%)		
	15-18 Good	0	0 (0.0%)	0 (0.0%)		
Post Intervention 3rd Day	6-9 Unsatisfactory	9	0 (0.0%)	9 (15.0%)	47.696	0.001***
	10-14 Satisfactory	79	28 (46.7%)	51 (85.5%)		
	15-18 Good	32	32 (53.3%)	0 (0.0%)		
Post Intervention5 th Day	6-9 Unsatisfactory	9	0 (0.0%)	4 (6.7%)	83.806	0.001***
	10-14 Satisfactory	62	11 (18.3%)	49 (18.7%)		
	15-18 Good	49	49 (81.7%)	7 (11.7%)		

(P <0.01*** very significant)

To find out the difference between the total score by structured interview between the experimental and control group, the null hypothesis is stated as follows:

There will be no significant difference between the total score by structured interview between the experimental and the control groups.

Table 4.4.15 shows the comparison in sucking pattern scores both the experimental and control group. On the post - intervention 3rd and 5th day, with degree of freedom 2 and 95% confidence interval, the table value of Chi square is 5.991. Since the calculated chi square value on 3rd and 5th day were 47.696, 83.806 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

Hence, the total score by structured interview between the 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 groups is true difference. It is due to the effect of tactile and auditory stimulation. The above findings do not support the null hypothesis. Hence, the researcher rejects the null hypothesis and accepts the research hypothesis.

SECTION IV

Table.: 4.4.1.A SHOWS THE ASSOCIATION BETWEEN THE DEMOGRAPHIC FACTORS AND POSTTEST PHYSIOLOGICAL PARAMETERS

Factors	Category	Total	Change In Weight				Change In Temperature				Change In Heart Rate				Change In Respiratory Rate				Change In Oxygen Saturation			
			Mean	SD	T Value	P Value	Mean	SD	T Value	P Value	Mean	SD	T Value	P Value	Mean	SD	T Value	P Value	Mean	SD	T Value	P Value
Gestational Age (in weeks)	28 – 30	11	135.45	15.73	28.423	0.001***	0.872	0.110	0.223	0.801	20.00	0.894	0.913	0.407	11.45	2.381	0.244	0.784	4.636	0.809	1.145	0.325
	31 – 33	24	164.17	29.18			0.883	0.123			19.50	1.588			11.00	1.956			4.833	0.816		
	34 – 36	25	206.00	30.28			0.860	0.125			19.20	1.914			11.36	2.215			4.480	0.822		
Age Category (in days)	10 – 14	27	211.48	23.81	85.176	0.001***	0.855	0.121	0.642	0.530	19.62	1.362	1.122	0.333	11.40	2.406	1.339	0.270	4.555	0.891	0.325	0.724
	15 – 19	21	157.14	17.07			0.895	0.120			19.04	2.246			10.66	1.460			4.714	0.845		
	20 – 24	12	130.83	11.64			0.866	0.123			19.83	0.577			11.83	2.329			4.750	0.621		
Gender	Male	30	175.33	42.16	0.040	0.843	0.866	0.126	0.101	0.752	19.40	1.673	0.097	0.756	10.86	2.012	1.823	0.182	4.700	0.702	0.220	0.641
	Female	30	177.33	35.42			0.876	0.116			19.53	1.634			11.60	2.190			4.600	0.932		
Birth Weight Category (in grams)	1000 –1330	11	135.45	15.72	28.42	0.001***	0.872	0.110	0.223	0.801	20.00	0.894	0.913	0.407	11.45	2.381	0.244	0.784	4.636	0.809	1.145	0.325
	1310 – 1650	24	164.16	29.17			0.883	0.123			19.50	1.588			11.00	1.956			4.833	0.816		
	1660 – 2000	25	206.00	30.27			0.860	0.125			19.20	1.914			11.36	2.215			4.480	0.822		
APGAR @ 5 Mins	7	32	172.81	40.17	0.495	0.612	0.862	0.115	2.288	0.111	19.62	1.288	0.577	0.565	10.87	1.963	1.070	0.350	4.437	0.840	3.717	0.030
	8	23	182.60	37.56			0.860	0.123			19.39	2.126			11.56	2.332			5.000	0.738		
	9	5	170.00	36.74			0.980	0.109			18.80	1.095			12.00	2.000			4.400	0.547		
MOD	Normal Vaginal Delivery	19	187.89	34.25	1.692	0.193	0.842	0.116	1.373	0.262	19.36	1.342	0.139	0.871	11.05	1.809	0.205	0.815	4.684	0.749	0.051	0.951
	Instrumental Delivery	2	195.00	35.35			0.800	0.141			20.00	0.000			12.00	2.828			4.500	2.121		
	LSCS	39	169.74	39.96			0.889	0.120			19.48	1.819			11.28	2.270			4.641	0.810		
OOB	First Order	29	184.48	39.05	5.598	0.006	0.872	0.119	0.484	0.619	19.72	1.278	0.852	0.432	11.37	2.144	0.195	0.824	4.689	0.712	0.070	0.932
	Second Order	20	182.50	33.38			0.855	0.139			19.10	1.997			11.20	2.092			4.600	0.940		
	Twins	11	143.63	31.07			0.900	0.089			19.45	1.809			10.90	2.236			4.636	0.924		

P value <0.01*** very significant

212

Fig 4.4.1.B SHOWS THE ASSOCIATION BETWEEN THE DEMOGRAPHIC FACTORS AND POSTTEST PHYSIOLOGICAL PARAMETERS BY STRUCTURED INTERVIEW.

Factors	Category	Total	Feeding Per Day					Duration of Sucking					Sleeping at Time					Sleeping Hrs Per Day					Cries Per Day					Passing Urine Per Day				
			Pre Test	Post Test	Chi² Value	df	pValue	Pre Test	Post Test	Chi² Value	df	pValue	Pre Test	Post Test	Chi² Value	df	pValue	Pre Test	Post Test	Chi² Value	df	pValue	Pre Test	Post Test	Chi² Value	df	pValue	Pre Test	Post Test	Chi² Value	df	pValue
Gestational Age (in weeks)	28 – 30	11	11	6				11	6				11	5				11	7				11	9				11	3			
	31 – 33	24	24	11	0.099	2	0.951	24	10	0.189	2	0.909	24	11	0.886	2	0.642	24	6	2.813	2	0.245	24	10	4.740	2	0.094	24	6	0.034	2	0.983
	34 – 36	25	25	13				25	11				25	7				25	6				25	5				25	7			
Age Category (in days)	10 – 14	27	27	14				27	11				27	9				27	7				27	9				27	5			
	15 – 19	21	21	11	0.146	2	0.929	21	10	0.144	2	0.931	21	7	1.026	2	0.599	21	5	2.255	2	0.324	21	7	28.20	2	0.086	21	7	0.846	2	0.655
	20 – 24	12	12	5				12	6				12	7				12	7				12	8				12	4			
Gender	Male	30	30	17	0.139	1	0.550	30	10	0.791	1	0.373	30	11	0.031	1	0.945	30	11	0.113	1	0.736	30	12	0.000	1	1.000	30	11	1.112	1	0.291
	Female	30	30	13				30	17				30	12				30	8				30	12				30	5			
Birth Weight Category (in grams)	000 –1350	11	11	6				11	6				11	5				11	7				11	9				11	3			
	1310 – 1650	24	24	11	0.099	2	0.951	24	10	0.189	2	0.909	24	11	0.886	2	0.642	24	6	2.813	2	0.245	24	10	4.741	2	0.094	24	6	0.034	2	0.983
	1660 – 2000	25	25	13				25	11				25	7				25	6				25	5				25	7			
APGAR @ 5 Mins	7	32	32	17				32	16				32	13				32	13				32	16				32	10			
	8	23	23	10	0.239	2	0.887	23	10	0.706	2	0.703	23	8	0.899	2	0.956	23	5	1.344	2	0.511	23	7	1.353	2	0.508	23	4	1.062	2	0.588
	9	5	5	3				5	1				5	2				5	1				5	1				5	2			
MOD	Normal Vaginal Delivery	19	19	10				19	6				19	6				19	6				19	6				19	7			
	Instrumental Delivery	2	2	1	1.733	2	0.421	2	2	1.331	2	0.514	2	1	0.271	2	0.873	2	0	0.659	2	0.719	2	0	1.309	2	0.519	2	0	1.225	2	0.541
	LSCS	39	39	19				39	19				39	16				39	13				39	18				39	9			
OOB	First Order	29	29	12				29	12				29	12				29	8				29	9				29	5			
	Second Order	20	20	11	0.619	2	0.734	20	9	0.204	2	0.903	20	6	0.428	2	0.807	20	4	3.006	2	0.223	20	7	2.243	2	0.325	20	8	1.777	2	0.411
	Twins	11	11	7				11	6				11	5				11	7				11	8				11	3			

P value <0.05* very significant

213

This table 4.4.1A and table 4.4.1B shows the association between the posttest physiological parameters and selected demographic variables. The ‘t’ test and chi-square were computed to find out the association between the demographic variables and physiological parameters. In the association between the selected physiological parameters temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day with demographic variables gestational age, birth weight, age of the child, sex, APGAR score at rest & 5 minutes, mode of delivery, since the p value was higher than the significant value of 0.05 level and the calculated ‘t’ value , chi square values were less than the table value which shows there was no significant association between these variables. Regarding physiological parameters, the null hypothesis was stated as follows: There will be no statistically significant association between the physiological parameter and demographic variable such as gestational age, age, gender, birth weight, APGAR score, mode of birth and order of birth. The above findings support the null hypothesis. Hence, the researcher accept the null hypothesis and rejects the research hypothesis.

Regarding the physiological parameter weight , table 4.4.1A shows the calculated ‘t’ values 26.150, 86.123 and 21.931 were higher than the table value of 2.9200 and p value was less than the significant value of 0.01 level for the demographic variables gestational age category, birth weight category, age of the child category, which shows there were significant association between these factors. The above findings not support the null hypothesis. Hence, the researcher reject the null hypothesis for gestational age, age and birth weight and accept research hypothesis.

Table 4.4.2 Demographic Factors with Change in Weight – Multiple Logistic Regression Analysis:

Variables	B	S.E	Beta	t	Sig.
Gestational Age Category	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)

This table 4.4.2 shows after Multiple Logistic Regression Analysis, gestational age category and the age of the child category have the p valve less than 0.01 level. 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.

DISCUSSION

The aim of the present study was to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates admitted at selected hospitals at Nagercoil, Kanyakumarai district.

A quantitative research approach with the true experimental research design was adopted for this study. Data were collected by using observation check list and structured interview schedule. Total sample size was 120 out of which 60 were in experimental group and 60 were in control group.

The study findings are discussed in this chapter with reference to the objectives and hypotheses stated in chapter I. For the discussion to be effective, some of the objectives are clubbed together.

Regarding the demographic characteristics of the sample, out of 120 preterm neonates 58 were males and 62 were females. Among the 58 male preterm neonates, 51.7% were from the experimental group and 48.3 % were from the control group. Among the 62 preterm neonates, 48.4% were from the experimental group and 51.6 % were from the control group.

With regard to the religion of the preterm neonates, out of 120 preterm neonates 51 were Hindu, 63 were Christians and 6 were Muslims. Among the 51 Hindu preterm neonates 49% were from the experimental group and 51% were from the control group. Among the 63 Christian preterm neonates 52.4% were from the experimental group and 47.6% were from the control group. Among the 6 Muslim preterm neonates 33.3% were from the experimental group and 66.7 % were from the control group.

With regard to the mode of the birth of the preterm neonates, out of 120 preterm neonates 45 were born by normal vaginal delivery, 7 were born by Instrumental Delivery and 68 were born by LSCS. Of the 45 normal vaginal deliveries, 42.2% were from the experimental group and 57.8 % were from the control group. Of the 7 instrumental deliveries, 28.6% were from the experimental group and 71.4% from the control group. Among the 68 LSCS 57.4% were from the experimental group and 42.6% were from the control group.

As regards to the order of the birth of the preterm neonates, out of 120 preterm neonates 51 were born by first order, 56 were born by second order, 3 were born by third order and 10 were born as twins. Of those 51 first born preterm neonates 54.9% were from the experimental group and 45.1% were from the control group. Among those 56 second order preterm neonates 44.6% were from the experimental group and 55.4% from the control group. Of the 3 third order preterm neonates 33.3% belonged to the experimental group and 66.7% belonged to the control group. In those 10 twin preterm neonates 60% were from experimental group and 40% were from control group.

Regarding the APGAR score at the birth of the preterm neonates, out of 120 preterm neonates 22 had 5 /10, 45 had 6 / 10, 41 had 7 /10 and 12 had 8 /10. Of those

22 preterm neonates 54.5% were from experimental group and 45.5 % were from the control group. Among those 45 preterm neonates 42.2% were from the experimental group and 57.8 % from the control group. Among those 41 preterm neonates 53.7 % were from the experimental group and 46.3 % were from the control group. Among the 12 preterm neonates 58.3 % were from the experimental group and 41.7 % were from the control group.

Regarding the APGAR score at 5 minutes, out of 120 preterm neonates 69 had 7 /10, 41 had 8 / 10 and 10 had 9 /10. Of the 69 preterm neonates 46.4% were from the experimental group and 53.6% were from the control group. Among the 41 preterm neonates 56.1% were from the experimental group and 43.9 % from the control group. Of the 10 preterm neonates 50 % were from the experimental group and 50 % were from the control group.

Regarding the gestational age of the preterm neonates, out of 120 preterm neonates 22 were between 28 and 30 weeks, 48 were between 31 and 33 weeks and 50 were between 34 and 36 weeks. Of the 22 preterm neonates 45.5% were from the experimental group and 54.5 % were from the control group. Among the 48 preterm neonates 47.9% were from the experimental group and 52.1 % from the control group. Of the 50 preterm neonates 54 % were from the experimental group and 46 % were from the control group.

As regards the age of the preterm neonates, out of 120 preterm neonates 54 were between 10 and 14 days, 42 were between 15 and 19 days and 24 were between

20 and 24 days. Of the 54 preterm neonates 48.1% were from the experimental group and 51.9 % were from the control group. Of the 42 preterm neonates 47.6% were from the experimental group and 52.4 % were from the control group. Among the 24 preterm neonates 58.3 % were from the experimental group and 41.7 % were from the control group.

Regarding the birth weight of the preterm neonates, out of 120 preterm neonates 22 were between 1000 and 1350 grams, 48 were between 1310 and 1650 grams and 50 were between 1660 and 2000 grams. Among the 22 preterm neonates 40.9% were from the experimental group and 59.1 % were from the control group. Of the 48 preterm neonates 52.1% were from the experimental group and 47.9 % from the control group. Among the 50 preterm neonates 52 % were from the experimental group and 48 % were from the control group.

The calculated Chi square Values (0.133, 0.826, 3.845, 1.866, 0.824, 0.972, 0.585, 0.836 and 0.891) were less than the table value and the calculated P values (0.715, 0.661, 0.146, 0.601, 0.610, 0.615, 0.746, 0.658 and 0.641) were higher than the significance level of 0.05. It shows there was no significant difference between experimental and control groups. It concluded that both the groups were equal.

For the discussion to be more perceptive, the first two objectives of the study are discussed together :

1. The first objective of the study was to assess the pre and post intervention physiological parameters score among the experimental group of preterm neonates who had tactile & auditory stimulation.

2. The second objective of the study was to assess the pre and post intervention physiological parameter score among the control group of preterm neonates.

5.1 PHYSIOLOGICAL PARAMETER SCORE BEFORE TACTILE AND AUDITORY STIMULATION AMONG PRETERM NEONATES

It represents the pre intervention scores of selected physiological parameters in the experimental group. The mean pre intervention scores of preterm neonates before tactile and auditory stimulation for weight in experimental group weight 1597.67 grams, whereas in the control group, weight 1608 grams.

The mean pre intervention scores of preterm neonates before tactile and auditory stimulation for the temperature in experimental group was 36.56 ^{0} Celsius, whereas in the control group temperature 36.54^0 Celsius.

The mean pre intervention scores of preterm neonates before tactile and auditory stimulation in the heart rate variation in the experimental group was 150.90, whereas in the control group heart rate variation was 151.33.

The mean pre intervention scores of preterm neonates before tactile and auditory stimulation in the respiratory rate variation score in the experimental group was 49.47, whereas in the control group respiratory rate variation was 49.33.

The mean pre intervention scores of preterm neonates before tactile and auditory stimulation in the oxygen saturation variation in the experimental group was 93.57 %, whereas in the control group oxygen saturation was 93.45 %.

In pre intervention, regarding the frequency of Feeding per day in the experimental group, 7 out of 60(11%) had less than 6 times feeds per day, 53 (88.3%) had 6 to 10 times per day and none (0%) had above 10 times feed per day, whereas in the control group 13 out of 60(21%) pre term neonates had less than 6 time feeds per day, 47 (78.3%) were had 6 to 10 times per day and none (0%) had above 10 times feed per day.

In pre intervention, with regard to sucking per feed in the experimental group, 14 out of 60 (23.3 %) had sucking less than 5 minutes per feed, 46 (76.7%) had sucking between 5 to 10 minutes per feed and none (0%) had sucking above 10 minutes per feed, whereas in the control group 9 out of 60 (15 %) pre term neonates had sucking less than 5 minutes sucking per feed, 51 (85%) took sucking between 5 to 10 minutes per feed and none (0%) had sucking above 10 minutes per feed.

In pre intervention, pertaining to duration per sleep in the experimental group, 14 out of 60 (23.3 %) sleep less than 30 minutes, 46 (76.7%) got sleep between 30 minutes and 1 hour and none (0%) got sleep between 1 – 2 hours, whereas in the control group 8 out of 60 (13.3 %) pre term neonates got sleep less than 30 minutes, 52 (86.7%) got sleep between 30 minutes and 1 hour and none (0%) got sleep between 1 – 2 hours.

In pre intervention ,as regards of sleeping hours per day in the experimental group, 15 out of 60 (25 %) got sleep less than 10 hours per day, 45 (75%) got sleep between 10 - 18 hours of sleep per day and none (0%) got sleep above 18 hours, whereas in the control group 11 out of 60 (18.33 %) pre term neonates got sleep less than 10 hours per day, 49 (81.67%) got sleep between 10 - 18 hours of sleep per day and none (0%) got sleep above 18 hours.

In pre intervention , regarding the number of cries per day in the experimental group, 6 out of 60 (10 %) cried more than 10 times per day, 54 (90%) cried between 5 - 10 times per day and none (0%) cried less than 5 times per day, whereas in the control group 8 out of 60 (13.3 %) pre term neonates cried more than 10 times per day, 52 (86.7%) cried between 5 - 10 times per day and none (0%) cried less than 5 times per day.

In pre intervention , as regards of passing urine per day in the experimental group, 17 out of 60 (28.3 %) passed urine less than 5 times per day, 43 (71.7%) passed urine between 5 - 10 times per day and none (0%) passed urine more than 10 times per day, whereas in the control group 11 out of 60 (18.3 %) pre term neonates passed urine less than 5 times per day, 49 (81.7%) passed urine between 5 - 10 times per day and none (0%) passed urine more than 10 times per day.

Thus, pre intervention scores were same and had no statistical significant difference for all physiological parameters in both the experimental control group.

5.2 PHYSIOLOGICAL PARAMETER SCORE OF PRETERM NEONATES AFTER TACTILE AND AUDITORY STIMULATION

It represents the post intervention 3^{rd} and 5^{th} day scores of selected physiological parameters in the experimental and control group. The mean post intervention 3rd and 5th day scores of preterm neonates after tactile and auditory stimulation include, weight 1707.50 and 1774 grams, whereas in the control group, weight 1686.17 and 1726.33 grams. The temperature in experimental group was 36.83 and 37.43 ^{0} Celsius, whereas in the control group temperature 36.69 and 36.86^{0} Celsius. The heart rate variation in the experimental group was 140.73 and 131.43, whereas in the control group heart rate variation was 146.70 and 142.77. The respiratory rate variation score in the experimental group was 43.77 and 38.23, whereas in the control group respiratory rate variation was 46.33 and 43.53. The oxygen saturation variation in the experimental group was 96.03 and 98.22%, whereas in the control group oxygen saturation was 94.57 and 95.68 %.

Regarding the feeding pattern in the experimental group on 5th day, none had less than 6 times feeds per day, 30 (50%) had 6 to 10 times per day and 30 (50%) had above 10 times feed per day, whereas in the control group 10 out of 60 (16.7%) pre term neonates had less than 6 time feeds per day, 43 (71.7%) were had 6 to 10 times per day and none 7(11.7%) had above 10 times feed per day.

With regard to sucking pattern in the experimental group on 5th day, none had sucking less than 5 minutes per feed, 27 (45%) had sucking between 5 to 10 minutes per feed and 33 (55%) had sucking above 10 minutes per feed, whereas in the control group 6 out of 60 (10 %) pre term neonates had sucking less than 5 minutes sucking pattern, 48 (80%) took sucking between 5 to 10 minutes per feed and 6 (10%) had sucking above 10 minutes per feed.

Pertaining to sleeping pattern in the experimental group on 5th day, none had sleep less than 30 minutes, 23 (31.3%) got sleep between 30 minutes and 1 hour and 37 (68.7%) got sleep between 1 – 2 hours, whereas in the control group 8 out of 60 (13.3 %) pre term neonates got sleep less than 30 minutes, 48 (80%) got sleep between 30 minutes and 1 hour and 4 (6.7%) got sleep between 1 – 2 hours.

As regards the sleeping hours per day in the experimental group on 5th day, none got sleep less than 10 hours per day, 19 (31.7%) got sleep between 10 - 18 hours of sleep per day and 41 (68.3%) got sleep above 18 hours, whereas in the control group 16 out of 60 (26.7 %) pre term neonates got sleep less than 10 hours per day, 41 (68.3%) got sleep between 10 - 18 hours of sleep per day and 3 (5%) got sleep above 18 hours.

Regarding crying pattern in the experimental group on 5th day, none were cried more than 10 times per day, 24 (40%) cried between 5 - 10 times per day and 36 (60%) cried less than 5 times per day, whereas in the control group 8 out of 60 (13.3 %) pre term neonates cried more than 10 times per day, 52 (86.7%) cried between 5 - 10 times per day and none (0%) cried less than 5 times per day.

As regards urination in the experimental group on 5th day, none were passed urine less than 5 times per day, 16 (26.7%) passed urine between 5 - 10 times per day and 44(73.3%) passed urine more than 10 times per day, whereas in the control group 2 out of 60 (3.3 %) pre term neonates passed urine less than 5 times per day, 57

(95%) passed urine between 5 - 10 times per day and 1 (1.7%) passed urine more than 10 times per day.

The investigator found that the preterm neonates who received tactile and auditory stimulation had statistically improvements on all selected parameters than the preterm neonates who did not receive it. This holds true to the current study. The current study findings configure with the following literature.

- Kim, Shin et.al[119], conducted an experimental study to estimate the responses of premature and term neonates to massage. The study concluded that massage therapy might enhance optimal physiological responses[119]

- 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[116] 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.

5.3 THE THIRD OBJECTIVE OF THE STUDY IS TO EVALUATE THE EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON SELECTED PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES.

A. Physiological parameter- weight:

The mean weight score of preterm neonates on 3^{rd} and 5^{th} day of tactile and auditory stimulation 1707.50 grams and 1774 grams, which were higher than pre intervention weight score 1597.67 grams. When paired 't' test was computed between pre intervention and post intervention weight score on the 3^{rd} and 5^{th} day of tactile and auditory stimulation, the obtained 't' values 29.613, 35.368 which are significant at 0.05 level.

When compared the mean posttest weight score was 1774 grams in the experimental group whereas in the control group it was 1726.33 grams. The corresponding 't' value was 62.21 which was higher than the table value of 2.9200. The weight gain among experimental & control group on post- intervention 5^{th} day was statistically significant at 0.05 level.

Hence there is true difference between the pre and post intervention weight scores of preterm neonates in the experimental and control group, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increased the weight of preterm neonates in the experimental group. The following studies supports the current findings.

- A study was conducted by Shankaranarayanan, Mondkar et. al.,[112] 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.,[116] 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[114] 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 growth factor-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[113] 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, 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 preterm newborns.

- A Similar study was conducted by Darmstadt, Saha et. al.,[119] 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 quantitative findings in the current study are strengthened by the verbatims expressed by the samples.

Sample I: See this child's skin is becoming shiny

Sample II: This child is becoming plumpy

Sample III: The wrinkles are gone from the buttocks

B. Temperature:

The mean temperature variation of preterm neonates on the 3rd and 5th day of tactile and auditory stimulation 36.83^0 C and 37.43^0 C, which were higher than pre intervention temperature variation 36.56 C. When paired 't' test was computed between pre intervention and post intervention temperature score on the 3rd and 5th day of tactile and auditory stimulation, the obtained ‘t’ values 18.355, 55.865 which are significant at 0.05 level.

When compared the mean posttest temperature score in experimental group was 37.43 whereas in control group was 36.86. The corresponding ‘t’ value was 160.8 which was higher than the table value of 2.9200. Hence the temperature variation among experimental & control group on post- intervention 5th day was statistically significant at 0.05 level.

Hence, there is true difference between the pre and post intervention of temperature variation to experimental and control group preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation normalize the temperature of preterm neonates in the experimental group. The current study findings configure with the following literature.

- Auditory stimulation (Music) can energetically integrate mind and body, affecting emotional response, movement and sensory input. These outcomes in the 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 that the 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.

C. Heart Rate:

The mean heart rate variation of preterm neonates on the 3rd and 5th day of tactile and auditory stimulation 140.73 and 131.43 which were lower than pre intervention heart rate variation 150.90. When paired 't' test was computed between pre intervention and post intervention heart rate score on the 3rd and 5th day of tactile and auditory stimulation, the obtained 't' values 52.985, 40. 948 which are significant at 0.05 level. When compared the mean posttest heart rate score in experimental group was 131.43 whereas in control group was 142.77. The corresponding 't' value was 222.72 which was higher than the table value of 2.9200. Hence the heart rate variation among experimental & control group on post- intervention 5th day was statistically significant at 0.05 level.

Hence, there is true difference between the pre and post intervention of heart rate variation to preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation stabilize the heart rate of preterm neonates in the experimental group. The following study supports the current findings.

- Smith, Lux et. al.,[113] 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 (2011) conducted a study to scrutinize the scrupulous use of recorded vocal music to attenuate physiological and behavioral responses to heel 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. 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. [125]

- Doheny, Hurwitz et al [153] conducted a study to evaluate the exposure to biological maternal sounds progresses cardio respiratory regulation in extremely preterm infants. Result revealed that there was an overall decreasing trend 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.

D. Respiratory Rate:

The mean respiratory rate variation of preterm neonates on the 3rd and 5th day of tactile and auditory stimulation was 43.77 and 38.23, which were lower than pre intervention respiratory rate variation 49.47. When paired 't' test was computed between pre intervention and post intervention respiratory rate score on the 3rd and 5th day of tactile and auditory stimulation, the obtained 't' values 30.141, 41.078 are significant at 0.05 level.

When compared the mean posttest respiratory rate score in experimental group was 38.23 whereas in control group was 43.53. The corresponding 't' value was 63.59 which was higher than the table value of 2.9200. Hence the respiratory rate variation among experimental & control group on post- intervention 5th day was statistically significant at 0.05 level.

This indicates that the difference between experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation.

Hence there is true difference between the pre and post intervention of respiratory rate variation to preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation stabilize the respiratory rate of preterm neonates in the experimental group.

- The current study findings are in line by a study conducted by Amini , Rafiei et. al.,[161] 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.[125]

- Similar findings were reported by Doheny and Hurwitz et.al.

E. Oxygen Saturation:

The mean oxygen saturation of preterm neonates on the 3rd and 5th day of tactile and auditory stimulation was 96.03 and 98.22 respectively which were higher than pre intervention oxygen saturation variation 93.57. When paired‘t’ test was computed between pre intervention and post intervention oxygen saturation score on the 3rd and 5th day of tactile and auditory stimulation, the obtained ‘t’ values 32.077, 43.937 are significant at 0.05 level.

When compare the mean posttest oxygen saturation score in experimental group was 98.22 whereas in control group was 95.68. The corresponding ‘t’ value was 462.08 which was higher than the table value of 2.9200. Hence the oxygen saturation score among experimental & control group on post- intervention 5th day was statistically significant at 0.05 level.

Hence there is true difference between the pre and post intervention of oxygen saturation to preterm neonates, which is due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increase the oxygen saturation of preterm neonates in experimental group. The current study findings configure with the following literature:

- Chou, Wang et al 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.[153]
- Arnon,· Shapsa et al [151] study also proved the same report.

F. Feeding pattern:

Feeding pattern on the 3rd and 5th day after tactile and auditory stimulation was scored as categorized as < 6 times per day 1.7 %, 0 %; 6 – 10 times per day 65.0%, 50 % and > 10 times per day 33.3%, 50% respectively which was increased from pre intervention parameter score as < 6 times per day 11.7%, 6 – 10 times 88. 3 % and had > 10 times per day. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 25.690, 26.612 were significant at 0.05 level. Hence, there is true difference between the pre and post intervention of feeding pattern of preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increase the feeding pattern to the preterm neonates in experimental group. The current study findings configure with the following literature:

- 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., 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.
- Tactile stimulation is a natural and almost instinctive way to care. It is the best way to get oxytocin released into the body. Oxytocin is a hormone produced by the hypothalamus and secreted by the dorsal (posterior) lobe of the pituitary gland 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 centers of 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.

The quantitative findings in the current study are strengthened by the verbatim expressed by the samples.

- **Sample I:** After the tactile and auditory stimulation the child takes feed well and empty his mother's breast faster than before.
- **Sample 2:** Now the child's only work is feeding, sleeping, emptying the bladder and bowel.
- **Sample 3:**This child is demanding feed soon after passing the urine

Frequency of duration of sucking

Frequency of duration of sucking on the 3rd and 5th day after tactile and auditory stimulation were scored as categorized as < 5 minutes per feed 0 %, 0%; 5 – 10 minutes per feed 65.0 %, 45 % and > 10 minutes per feed 35 %, 55 % respectively which was increased from pre intervention parameter score as < 5 minutes per feed 23.3 %, 5 – 10 minutes per feed 76.7 % and > 10 minutes per feed 0%. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 21.100, 30.572 were significant at 0.05 level. Hence, there is true difference between the pre and post intervention of frequency of duration of sucking in preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is 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., 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 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).

Sleeping pattern:

Sleeping pattern on the 3rd and 5th day after tactile and auditory stimulation were scored as categorized as < 30 minutes per sleep 0%, 0%; 30 minutes – 1 hour per sleep 66.7 %, 38.3 % and 1 to 2 hours per sleep 33.3 %, 61.7% respectively which was increased from pre intervention parameter score as < 30 minutes per sleep 23.3%, 30 minutes to 1 hour 76.7% and 1 to 2 hours 0%. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 26.520, 43.364 were significant at 0.05 level. Hence, there is true difference between the pre and post intervention of sleeping pattern of preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increase the duration of sleep per feed to the preterm neonates in experimental group. The following study supports the current findings:

- Field, Hernandez-Reif et.al· conducted a study to assess the effect of massage. Their study said moderate pressure massage clues to more organized behavior. The result showed a smaller decrease in deep sleep, a greater decrease in heart rate and a greater increase in vagal tone.

Sleeping hours per day:

Sleeping hours per day on the 3rd and 5th day after tactile and auditory stimulation were scored as categorized as < 10 hours per day 1.7 %, 0%; 10 – 18 hours per day 55 %, 31.7 % and >18 hours per day 43.3 %, 68.3% respectively which was increased from pre intervention parameter score as < 10 hours per day 25%, 10 - to 18 hours per day 75 % and >18 hours per day 0%. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 40.807, 56.885 were significant at 0.05 level. Hence there is true difference between the pre and post intervention of sleeping hours per day of preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increase the sleeping hours per day to the preterm neonates in experimental group. The current study findings configure with the following literature.

- Agarwal , Gupta et. al.,[129] 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 mid leg circumferences. Massage improved the post massage sleep, the maximum being 1.62 hours in the sesame oil group

- Dieter et al.,[125] 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.

Crying pattern:

Crying pattern on the 3rd and 5th day after tactile and auditory stimulation were scored as categorized as > 10 times per day 0 %, 0%; 5 – 10 times per day 60 %, 40 % and < 5 times per day 40 %, 60 % respectively which was increased from pre intervention parameter score as > 10 times per day 10 %, 5 -to 10 hours per day 90 % and < 5 times per day 0 %. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 27.902, 48.553 were significant at 0.05 level. Hence, there is true difference between the pre and post intervention of crying per day to preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation decrease the crying pattern to the preterm neonates in experimental group.

- The current study findings are in line with a study conducted by Ramasundari.[139] 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.

Urination:

Urination on the 3rd and 5th day after tactile and auditory stimulation were scored as categorized as < 5 times per day 1.7 %, 0%; 5 – 10 times per day 48.3 %, 26.7 % and > 10 times per day 40 %, 73.3 % respectively which was increased from pre intervention parameter score as < 5 times per day 28.3%, 5 -to 10 hours per day 71.7 % and > 10 times per day 0 %. When chi – square value was computed between pretest and posttest on the 3rd and 5th day of tactile and auditory stimulation the obtained values 42.461, 58.989 were significant at 0.05 level. Hence, there is true difference between the pre and post intervention of urination to preterm neonates, which was due to the effect of tactile and auditory stimulation. From the above findings, it is evident that tactile and auditory stimulation increase the frequency of urine per day to the preterm neonates in experimental group. The following study supports the current findings:

5.4 THE FOURTH OBJECTIVE OF THE STUDY WAS TO FIND OUT THE ASSOCIATION BETWEEN POSTTEST PHYSIOLOGICAL PARAMETERS AFTER TACTILE & AUDITORY STIMULATION & SELECTED DEMOGRAPHIC VARIABLES SUCH AS GESTATION WEEKS, AGE, SEX, BIRTH WEIGHT OF THE BABY, APGAR SCORE, MODE OF DELIVERY

In the association between the selected physiological parameters temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day with demographic variables gestational age, birth weight, age of the child, sex, APGAR score at rest & 5 minutes, mode of delivery, since the p value was higher than the significant value of 0.05 level and the calculated 't' value , the chi square were less than the table value which shows there was no significant association between these variables.

Regarding weight gain and demography variables,. the calculated 't' values 26.150, 86.123 and 21.931 were higher than the table value of 2.9200 and p value was less than the significant value of 0.01 level for gestational age, birth weight, age of the child, which shows there was a significant association between gestational age, age and birth weight with weight gain. After Multiple Logistic Regression Analysis, 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 p valve less than 0.01 level.

SUMMARY, CONCLUSIONS, IMPLICATION AND RECOMMENDATION

The heart of the research project lies in reporting the findings. This is the most creative and demanding part of the study. This chapter gives a summary, conclusions of the study, their implications for nursing practice, nursing education, nursing administration and nursing research guided by its limitations and recommendations.

6.1 SUMMARY

Neonates in NICU are subjected to a highly stressful environment that is high intensity noise and bright light. Tactile and auditory stimulation help to reduce stress and anxiety by relaxing both mind and body, create a feeling of well-being and enhanced self-esteem, promote positive body awareness and an improved body image through relaxation and ease emotional trauma through relaxation. So it has been recommended as an intervention to promote growth and development of preterm and low birth weight neonates. This made the researcher study the effect of tactile and auditory stimulation on selected parameters such as weight, temperature, heart rate, respiratory rate, oxygen saturation, and duration of sleep per day, duration of sucking per feed, frequency of urine per day &crying spells among preterm neonates.

Objectives

1. To assess the pre and post intervention physiological parameter scores among experimental group of preterm neonates who had tactile & auditory stimulation.

2. To assess the pre and post intervention physiological parameter score among control group of preterm neonates.
3. To evaluate the effectiveness of tactile & auditing stimulation on physiological parameters among preterm neonates.
4. To find out the association between the physiological parameters after tactile & auditory stimulation & selected demographic variables such as gestation weeks, age, sex, birth weight of the baby, APGAR score and mode of delivery.

Hypotheses

- The mean post test physiological parameter score of the preterm neonates in experimental group who received tactile & auditory stimulation will be significantly higher than the mean pretest score of premature neonates
- The mean post test physiological parameter score of the experimental group who received tactile & auditory stimulation will be significantly higher than posttest physiological score of the control group
- There will be significant association between physiological parameters after tactile & auditory stimulation among preterm neonates and their selected demographic variables such as gestational weeks, age, sex, birth weight APGAR score and mode of delivery.

Research design:

- Research design is the overall plan for addressing a research question including specifications for enhancing the study's integrity.

- A True Experimental Research Design was adopted for this study, which 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 to 36 weeks of gestation with a birth weight of 1000 gm to 2000 gm.

Accessible population

Preterm Neonates admitted from 01/07/2013 to 15/06/2014 at KanyaKumari Government Medical College Hospital, Asaripallam, Nagercoil, (KKGMCH).

Settings of the study

This study was conducted in the neonatal units of KanyaKumari Government Medical College Hospital, Asaripallam, Nagercoil, which is situated around 2 kilometers away from Nagercoil town. It is a 750-bedded multispecialty Government medical college hospital. The pediatric unit comprises Pediatric medical ward, surgical ward, Isolation ward, Pediatric Intensive Care Units, and Neonatal Intensive Care Units. The Neonatal Care Units are one of the best and busiest neonatal care units with latest equipments and monitors. Both inborn and out born neonates are admitted and cared from this unit. The average monthly inpatients in the NICU are

123; among them the preterm neonates are 41. The care of neonates is categorized into two levels (Level I and Level II).

Level I care - Care of critically ill neonates with major neonatal complications. Level II care - Care of neonates with mild to moderate risk.

Mothers of these neonates could be located next to the NICU and in the postnatal wards. The Kanyakumari Government Medical College hospital was selected for this study because of the availability of subjects and feasibility of conducting the study.

Population: In this study, target population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g. The accessible population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted into the neonatal care units of Kanyakumari Medical College Hospital, Nagercoil.

Sample Size Calculation: The sample size calculated was 120, in which 60 were selected for experimental group and 60 were selected for control group.

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

1. Critically ill preterm baby
2. Preterm babies with respiratory distress & on assisted ventilation
3. Preterm neonates with genetic (or) CNS abnormalities
4. Preterm neonates with severe birth injuries, skin infection & open wounds.
5. Preterm neonates on sedatives.
6. Preterm neonates on phototherapy treatment.
7. Abandoned preterm neonates.
8. Preterm neonates with Ryle's tube feeding and Expressed Breast feeding.

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 01.07.2014 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.

An in depth review of literature was done for the study. The conceptual framework adopted for this study was Earnestine Weidenbach, the helping art of clinical nursing theory. An experimental pretest, posttest, two groups and experimental design were adopted for this study. The populations chosen for this study were preterm neonates. The subjects were selected based on inclusion criteria and allocated to the experimental and control groups by random sampling technique.

The experimental group received tactile and auditory stimulation and control group did not receive intervention. The tools used for data collection had three parts.

1. Demographic data
2. Observation check list and
3. Structured interview schedule.

A pilot study was conducted to assess the feasibility of the study. Main study was conducted with 120 samples (60 in experimental group, 60 in control group) for a period of one year. The collected data were analyzed using descriptive and inferential statistics.

6.2 MAJOR FINDINGS OF THE STUDY

1. **Demographic Data**

The study findings show that the sex of preterm neonates, out of 120 preterm neonates 58 was males and 62 were females. Among the 58 male preterm neonates, 51.7% were from the experimental group and 48.3% were from the control group. Among the 62 preterm neonates, 48.4% were from the experimental group and 51.6% were from the control group.

With regard to the religion of the preterm neonates, out of 120 preterm neonates 51 were Hindus, 63 were Christians and 6 were Muslims. Among the 51 Hindu preterm neonates 49% were from the experimental group and 51% were from the control group. Among the 63 Christian preterm neonates 52.4% were from the experimental group and 47.6% were from the control group. Among the 6 Muslim preterm neonates 33.3% were from the experimental group and 66.7% were from the control group.

With regard to the mode of birth of the preterm neonates, out of 120 preterm neonates 45 were born by normal vaginal delivery, 7 were born by instrumental delivery and 68 were born by LSCS. Among the 45 normal vaginal delivery, 42.2% were from the experimental group and 57.8% were from the control group. Among the 7 instrumental delivery, 28.6% were from the experimental group and 71.4% from the control group. Of the 68 LSCS 57.4% were from the experimental group and 42.6% were from the control group.

With regard to the order of birth of the preterm neonates, out of 120 preterm neonates 51 were born by first order, 56 were born by second order, 3 were born by third order and 10 were born as twins. Among those 51 first born preterm neonates 54.9% were from the experimental group and 45.1% were from the control group. Of the 56 second order preterm neonates 44.6% were from the experimental group and 55.4% from the control group. Among the 3 third order preterm neonates 33.3% belong to the experiment group and 66.7% were belongs to the control group. Of the 10 twin preterm neonates 60% were from the experimental group and 40% were from the control group.

Regarding the APGAR score at birth of the preterm neonates, out of 120 preterm neonates 22 had 5 /10, 45 had 6 / 10, 41 had 7 /10 and 12 had 8 /10. In those 22 preterm neonates 54.5% were from the experimental group and 45.5% were from the control group. Of the 45 preterm neonates 42.2% were from the experimental group and 57.8% from the control group. In those 41 preterm neonates 53.7% were from the experimental group and 46.3% were from the control group. Among the 12 preterm neonates 58.3% were from the experimental group and 41.7% were from the control group.

Regarding the APGAR score at 5 minutes, out of 120 preterm neonates 69 had 7 /10, 41 had 8 / 10 and 10 had 9 /10. Among the 69 preterm neonates 46.4% were from the experimental group and 53.6% were from the control group. In those 41 preterm neonates 56.1% were from the experimental group and 43.9% from the control group. In those 10 preterm neonates 50% were from the experimental group and 50% were from the control group.

As regards the gestational age of the preterm neonates, out of 120 preterm neonates 22 were between 28 and 30 weeks, 48 were between 31 and 33 weeks and 50 were between 34 and 36 weeks. Among the 22 preterm neonates 45.5% were from the experimental group and 54.5% were from the control group. Of the 48 preterm neonates 47.9% were from the experimental group and 52.1% from the control group. Among the 50 preterm neonates 54% were from the experimental group and 46% were from the control group.

Regarding the age of the preterm neonates, out of 120 preterm neonates 54 were between 10 and 14 days, 42 were between 15 and 19 days and 24 were between 20 and 24 days. Of the 54 preterm neonates 48.1% were from the experimental group and 51.9% were from the control group. Among the 42 preterm neonates 47.6% were from the experimental group and 52.4% were from the control group. Of the 24 preterm neonates 58.3% were from the experimental group and 41.7% were from the control group.

Regarding the birth weight of the preterm neonates, out of 120 preterm neonates 22 were between 1000 and 1350 grams, 48 were between 1310 and 1650 grams and 50 were between 1660 and 2000 grams. Of the 22 preterm neonates 40.9% were from the experimental group and 59.1% were from the control group. Among those 48 preterm neonates 52.1% were from the experimental group and 47.9% from the control group. Of the 50 preterm neonates 52% were from the experimental group and 48% were from the control group.

Effects of tactile and auditory stimulation:

- The mean posttest weight score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. ($t = 29.613, 35.368$ and $P < 0.01$)
- The mean posttest temperature score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. ($t = 18.355, 55.865$ and $P < 0.01$)
- The mean posttest heart rate score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. ($t = 52.985, 40. 948$ and $P < 0.01$)
- The mean posttest respiratory rate score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. ($t = 30.141, 41.078$ and $P < 0.01$)
- The mean posttest oxygen saturation score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. ($t = 32.077, 43.937$ and $P < 0.01$)

- The mean posttest frequency of feeding per day score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 25.690, 26.612 and $P < 0.01$)
- The mean posttest duration of sucking per feed score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 25.690, 26.612 and $P < 0.01$)
- The mean posttest duration per sleep score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 26.520, 43.364 and $P < 0.01$)
- The mean posttest duration of sleep per day score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 40.807, 56.885 and $P < 0.01$)
- The mean posttest cries per day score on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 27.902, 48.553 and $P < 0.01$).
- The mean posttest score of passing urine per day on the 3rd and 5th day was higher than the pretest weight score in the experimental group. (X^2 = 42.461, 58.989 and $P < 0.01$).

- The mean posttest weight score in the experimental group was 1774 whereas in the control group was 1726.33. The corresponding ‘t’ value was 62.21 which was higher than the table value of 2.9200. Hence the weight gain among experimental & control group on post- intervention 5th day was statistically significant at 0.01 level. The mean posttest temperature score in the experimental group was 37.43 whereas in the control group was 36.86. The corresponding ‘t’ value was 160.8 which was higher than the table value of 2.9200. Hence the temperature variation between the experimental & control groups on post-intervention 5th day was statistically significant at 0.01 level. The mean posttest heart rate score in the experimental group was 131.43 whereas in the control group was 142.77. The corresponding ‘t’ value was 222.72 which was higher than the table value of 2.9200. Hence the heart rate variation between the experimental & control group on post- intervention 5th day was statistically significant at 0.01 level.

- The mean posttest respiratory rate score in the experimental group was 38.23 whereas in the control group was 43.53. The corresponding ‘t’ value was 63.59 which was higher than the table value of 2.9200. Hence the respiratory rate variation between the experimental & control group on post- intervention 5th day was statistically significant at 0.01 level. The mean posttest oxygen saturation score in the experimental group was 98.22 whereas in the control group was 95.68. The corresponding ‘t’ value was 462.08 which was higher than the table value of 2.9200. Hence the oxygen saturation score between the experimental & control group on post- intervention 5th day was statistically significant at 0.01

level. This indicates that the difference between experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation.

- The comparison of feeding pattern in both the Experimental and control groups on post-intervention 3rd and 5th day, Since the calculated chi square value on 3rd and 5th day were 25.690, 26.612 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. In comparison in sucking pattern score both the Experimental and control groups on post-intervention ^{3rd} and ^{5th} day, since the calculated chi square value on 3rd and ^{5th} day were 21.100, 30.572 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. In comparison in sleeping pattern score both the experimental and control groups. on post - intervention 3rd and 5th day, the calculated chi square value on 3rd and 5th day were 26.520, 43.364 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01.

- In comparison in sleeping hours per day both the experimental and control group. on post - intervention 3rd and 5th day, the calculated chi square value on 3rd and 5th day were 40.807, 56.885 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. In comparison in duration of crying pattern score both the experimental and control groups, the calculated chi square value on 3rd and 5th day were 27.902, 48.553 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. In comparison of duration of urination score both the experimental and control group the calculated chi square value on

3rd and 5th day were 42.461 and 58.989 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01. Hence, the duration of all above mentioned structured interview physiological parameters score in 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.

- In the association between the demographic variable and physiological parameters the calculated 't' value and chi-square values were below the table values. Since the p value was also more than the significance value at 0.05 level which indicates there were no significant association between the selected physiological parameters temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day and demographic variables gestational age, birth weight, age of the child, sex, APGAR score at rest & 5 minutes, mode of delivery.

- In the association between the physiological parameter weight and the demographic factors gestational age, birth weight, age of the child, sex, APGAR score at rest & 5 minutes, mode of delivery , the calculated 't' values 26.150, 86.123 and 21.931 were higher than the table value of 2.9200 and p value was less than the significant value of 0.01 level for gestational age category, birth weight category, age of the child category , which shows there is significant association with the changes in weight gain . Out of gestational age category, birth weight category, age of the child category which shows significant association with the changes in weight gain, after the Multiple Logistic Regression Analysis , Gestational Age Category (p value of 0.001) and Age of the child Category (p valve of 0.001) are the statistically significant at $p < 0.01$ level associated with Weight gain on the 5th day.

6.3 IMPACT OF THE STUDY

A major criticism of neonatal intensive care unit care is the rapid development of the specialty during the past few decades but it has not been accompanied by adequate evaluation of outcome after such care. 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. Complementary and alternative therapies such as music therapy and tactile stimulation therapy provide additional tool for the nurses to administer to the critically ill preterm neonates. It helps to manage symptoms and promote healing in a holistic way. In view of this, the present study is aimed to study the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates. The study findings have proved that the experimental group have significant higher in physiological parameters such as weight gain, temperature regulation , heart rate normalization , respiratory rate stabilization , increase in oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day. 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. It is also statistically proved that the demographic variables gestational age and age of the preterm babies are associated with the physiological parameter weight gain.

6.4 CONCLUSIONS

The following conclusions are drawn from the study:

- The selected physiological parameters (weight, temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day) score in the experimental group was significantly improved after tactile and auditory stimulation than before tactile and auditory stimulation.

- The selected physiological parameters (weight, temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day) score in the experimental group was higher than the post intervention physiological parameter score in the control group.

- The findings of this studies suggest that music & massage interventions may have positive effects on preterm infants in the NICU including increased oxygen saturation levels, reduced heart rates, increased levels of quiet alert or quiet sleep states, improved parent-infant interaction, improved weight gain, and reduced length of hospitalization.

- The mean posttest physiological parameters score in the experimental group was higher than the control group preterm neonates on 3rd day and 5th day and the "t"value was more than 2.920 and p value more than 0.01 which concluded that the weight gain , temperature , respiratory rate, heart rate and oxygen saturation score among experimental & control group on post- intervention 3rd and 5th day was statistically significant at 0.01 level. This indicates that the difference between experimental and control group is true difference. It is due to the effect of tactile and auditory stimulation.

- The structured interview physiological parameters feeding pattern , sucking pattern, sleeping pattern, sleeping hours per day, duration of crying pattern, duration of urination were higher than in the experimental than the control group preterm neonates on post - intervention 3rd and 5th day. Since the chi square value on 3rd and 5th day were 25.690, 26.612 which were higher than the table value and the calculated P value of 0.001 was less than the significance level of 0.01 indicates that the difference between the experimental and control groups is true difference. It is due to the effect of tactile and auditory stimulation.
- In the association between the selected physiological parameters temperature, heart rate, respiratory rate, oxygen saturation, frequency of feeding per day, duration of sucking per feed, duration per sleep, duration of sleep per day, cries per day and passing urine per day with demographic variables gestational age, birth weight, age of the child, sex, APGAR score at rest & 5 minutes, mode of delivery since the p value was higher than the significant value of 0.05 level and ‘t’ value less than the table value which shows there was no significant association between these variables.

- The association between the demographic variable and weight parameter, the calculated 't' values 26.150, 86.123 and 21.931 were higher than the table value of 2.9200 and p value was less than the significant value of 0.01 level for gestational age category, birth weight category, age of the child category , which shows there is significant association . After the Multiple Logistic Regression Analysis ,Gestational Age Category (p value of 0.001) and Age of the child Category (p valve of 0.001) are the statistically significant at $p< 0.01$ level which are only associated factors with the weight gain on the 5^{th} day.
- There is significant association between the weight gain and the selected demographic variables such as gestational age, age of the preterm neonates in the experimental group.

6.5 NURSING IMPLICATION

The findings of the study have practical application in the nursing field. The implication of the present study has been discussed in four areas namely nursing service, nursing administration, nursing education and nursing research.

Nursing Service:

The findings of the present study will help the nurse in the following way,

1. To assess the need for tactile and auditory stimulation to the preterm and term neonates.
2. To plan the tactile and auditory stimulation according to the preterm and term neonate's need.
3. Nurses should use the tactile and auditory stimulation, which can be safely included in daily routine care.
4. To conduct awareness programs regarding tactile stimulation and auditory stimulation for the antenatal and postnatal mothers.
5. Education and demonstration must be provided to all nurses and they should be encouraged to practice tactile and auditory stimulation

Nursing Education:

The findings of the present study will help the nurse educator in the following ways:

1. To conduct in service education programs regarding tactile stimulation and auditory stimulation to the staff nurses in order to increase knowledge.

2. 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:

The findings of the present study will help the nurse administrator in the following way,

1. To arrange and organize a continuing education program for nurses regarding tactile and auditory stimulation.

2. To prepare adequate learning materials regarding tactile and auditory stimulation.

3. To formulate policy and protocols for practicing tactile and auditory stimulation as a routine care in the neonatal unit.

4. To conduct health education campaign in the outpatient department regarding tactile and auditory stimulation by using handouts, pamphlets and demonstration.

5. To plan and organize counseling session among preterm neonate's mothers to continue tactile and auditory stimulation at home.

Nursing Research:

The findings of the present study will help the nurse researcher in the following ways:

1. To conduct further studies in different settings which might ultimately reduce the neonatal morbidity and mortality.

2. 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.

6.6 LIMITATIONS

- Sample size was limited to 60 preterm neonates in the experimental group and 60 preterm neonates in the control group.
- The study was limited to Kanyakumari government medical college hospital admitted ICU and ward preterm neonates due to shorter period for data collection. (One year).
- 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.
- Monitor will measure oxygen saturation and heart rate & any malfunction of the monitor during the observation may happen.
- The physiological changes in the preterm neonates may be influenced by extraneous variables like environmental temperature, procedures preceding the observation & stimuli present in the neonatal intensive care unit. (Light & Monitor sounds).
- In characteristics of the setting, number of visitors and staff in the unit are not considered when the intervention is provided in the NICU.
- In characteristics of the intervention, live maternal voice songs stimulation was not considered instead of pre recorded music used.
- The use of same prerecorded music for all the study group preterm neonates with the same decibel level is the other limitation.
- Long term follow up is not possible.

6.7 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.
- Further research is necessary on the benefits and risks of implementing massage therapy in the hospital setting.
- 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.
- It is recommended to conduct further research studies to discover more effective complementary therapies on preterm neonates.
- 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 of high-quality research.

- A similar study can be conducted in different settings to strengthen the findings.
- A similar study can be conducted on the preterm neonates by their mothers after the education regarding tactile and auditory stimulation.
- Comparative study can be conducted to assess the effectiveness of tactile stimulation and auditory stimulation among preterm neonates.
- A similar study can be conducted among Low Birth Weight babies.
- Comparative study can be conducted to assess the effect of unimodal and multimodal stimulation among preterm neonates.
- It is recommended to conduct further research on barriers in utilization of complementary and alternative therapies in NICU.
- Future research studies regarding characteristics of the intervention that should be 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.

BIBLIOGRAPHY

1. Cunningham FG, et al. Williams Obstetrics. 24th ed. New York, N.Y.: The McGraw-Hill Companies; 2013. http://www.accessmedicine.com/resourceTOC.aspx? resourceID=46. Accessed Oct. 3, 2014
2. Kliegman RM, et al. Nelson Textbook of Pediatrics. 19th ed. Philadelphia, Pa.: Saunders Elsevier; 2011. http://www.clinicalkey.com. Accessed Oct. 13, 2014
3. Hay WW, et al. Current Diagnosis & Treatment: Pediatrics. 21st ed. New York, N.Y.: The McGraw-Hill Companies; 2012. http://accessmedicine.mhmedical.com/book.aspx?bookid=497. Accessed Oct. 17, 2014.
4. Creasy RK, et al., eds. Creasy and Resnik's Maternal-Fetal Medicine: Principles and Practice. 7th ed. Philadelphia, Pa.; Saunders Elsevier: 2014. http://www. clinicalkey.com. Accessed Sept. 30, 2014.
5. Norwitz ER. Prevention of spontaneous preterm birth. http://www.uptodate.com/home. Accessed Sept. 30, 2014.
6. Harms RW (expert opinion). Mayo Clinic, Rochester, Minn. Oct. 23, 2014
7. Fenton TR, et al. A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants. BMC Pediatrics. 2013;13:59.
8. Robinson JN, et al. Risk factors for preterm labor and delivery. http://www.uptodate.com/home. Accessed Sept. 30, 2014.
9. Mandy GT. Short-term complications of the premature infant. http://www.uptodate.com/home. Accessed Oct. 18, 2014.
10. Stewart J. Care of the neonatal intensive care unit graduate. http://www.uptodate.com/home. Accessed Oct. 18, 2014.

11. Dr. Deepa. Late pre-term births a cause for concern: The Hindu. Chennai, November 18, 2013
12. Cook WJ, et al. Mayo Clinic Guide to Your Baby's First Year. Intercourse, Penn.: Good Books; 2012:503.
13. NatthayaCherngchallard. Development and evaluation of clinical practice guideline of tactile stimulation for preterm infants in the neonatal moderate care unit. Prince of Songlauniversity.
14. Stacy Beck, Daniel Wojdyla, Lale Say, Ana PilarBetran, Mario Merialdi, Jennifer Harris Requejo, et al. The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity: Bulletin of the WHO. 2010;88:31-38. doi: 10.2471/BLT.08.062554.
15. DacherKeltner. Hands On Research: The Science of Touch. 2010
16. Lauren suval. THE SURPRISING PSYCHOLOGICAL VALUE OF HUMAN TOUCH: PSYCH CENTRAL, 2014.
17. Massaro AN, Hammad TA, JazzoB, Alyh. Massage with kinesthetic stimulation improves weight gain in preterm infants. J Perinatol[Serial online] 2009 May;29(5):352-7 [Cited 2011 Nov 17];Available fromhttp://www. ncbi.nlm. nih.gov/pubmed/19148112
18. http://www.academia.edu/446343/the_rhythms_of_life_music_therapy_for_the_body_mind_and_soul
19. Thoman, E. & Ingersoll, E.W (1993). Learning in premature infants. Developmental Psychology, 29(4), 692-700
20. Malloy, G. (1979). The relationship between maternal andmusical auditory stimulation and the developmental behavior of premature infants. Birth Defects: Original Article Series, 15(1),

21. Gitanjali B. Effect of the Karnatic music raga "Neelambari" on sleep architecture. Indian J PhysiolPharmacol. 1998 Jan;42(1):119-22.

22. *International classification of diseases and related health problems*. 10th revision. Geneva: World Health Organization; 1992.

23. Huddy CL, Johnson A, Hope PL. Educational and behavioral problems in babies of 32–35 weeks gestation. *Arch Dis Child Fetal Neonatal Ed* 2001; 85: 23F-8 doi: 10.1136/fn.85.1.F23.

24. Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical outcomes of near-term infants. *Pediatrics* 2004;114: 372-6 doi: 10.1542/peds. 114.2.372 pmid: 15286219

25. Petrou S. The economic consequences of preterm birth during the first 10 years of life. *BJOG* 2005; 112: 10-5 doi: 10.1111/j.1471-0528.2005.00577. x pmid: 15715587.

26. Petrou S, Mehta Z, Hockley C, Cook-Mozaffari P, Henderson J, Goldacre M. The impact of preterm birth on hospital inpatient admissions and costs during the first 5 years of life. *Pediatrics* 2003; 112: 1290-7 doi:10.1542/peds.112.6. 1290 pmid: 14654599

27. Stacy Beck, Daniel Wojdyla, Lale Say, Ana PilarBetran, Mario Merialdi, Jennifer Harris Requejo, Craig Rubens, RamkumarMenon& Paul FA Van Look.,The worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity: Bulletin of the World Health Organization. 2010;88:31-38. doi: 10.2471/BLT.08.062554

28. Lawn JE, Wilczynska-Ketende K, Cousens SN. Estimating the causes of 4 million neonatal deaths in the year 2000. *Int J Epidemiol* 2006; 35: 706-18 doi:10.1093/ije/dyl043 pmid: 16556647.

29. Kaunteya Sinha. 70% of infant deaths within 30 days of birth;Prevalence of preterm neonate. 2012.TNN | Apr 3, 2012, 03.47AM IST
30. National Health Mission, Tamilnadu. Department of health and family welfare; State health society
31. Mandy GT. Short-term complications of the premature infant. http://www. uptodate.com/home. Accessed Oct. 18, 2014.
32. Thomas C. Hulsey, MSPH, ScD, Greg R. Alexander, MPH, ScD, Pierre Yves Robillard, MD,David J. Annibale, MD, Andrea Keenana. Hyaline membrane disease: The role of ethnicity and maternal risk characteristics: American Journal of Obstetrics and Gynecology Volume 168, Issue 2, February 1993, Pages 572–576
33. Thomas C.Hulsey, Greg R. Alexander, Pierre Yves Robillard, David J. Annibale, Andrea Keenana. Hyaline membrane disease: The role of ethnicity and maternal risk characteristics,American Journal of Obstetrics and Gynecology. Volume 168, Issue 2, February 1993, Pages 572–576
34. Mammel MC, Johnson DE, Green TP, Thompson TR. Controlled trial of dexamethasone therapy in infants with bronchopulmonary dysplasia. Lancet. 1983;1(8338):1356–1358. [PubMed]
35. Avery GB, Fletcher AB, Kaplan M, Brudno DS. Controlled trial of dexamethasone in respirator-dependent infants with bronchopulmonary dysplasia. Pediatrics. 1985;75(1):106–111. [PubMed]
36. Bhutta T, Ohlsson A. Systematic review and meta-analysis of early postnatal dexamethasone for prevention of chronic lung disease. Archives of Disease in

Childhood: Fetal and Neonatal Edition. 1998;79:F26–F33. [PMC free article] [PubMed]

37. Halliday HL, Ehrenkranz RA. Early postnatal (<96 hours) corticosteroids for preventing chronic lung disease in preterm infants. Cochrane Database of Systematic Reviews (Online: Update Software) 2001b;1 [PubMed]
38. Finer NN, Higgins R, Kattwinkel J, Martin RJ. Summary proceedings from the apnea of prematurity group. Pediatrics. 2006;117:47–51. [PubMed]
39. Henderson-Smart D, Steer P. Doxapram treatment for apnea in preterm infants. Cochrane Database of Systematic Reviews (Online: Update Software) 2004;4 [PubMed]
40. Baird TM. Clinical correlates, natural history and outcome of neonatal apnoea. Seminars in Neonatology. 2004;9(3):205–211. [PubMed]
41. Vaucher YE. Bronchopulmonary dysplasia: An enduring challenge. Pediatrics in Review/American Academy of Pediatrics. 2002;23(10):349–358. [PubMed]
42. Berseth CL. Developmental anatomy and physiology of the gastrointestinal tract. In: Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. 8th edition. Philadelphia, PA: Elsevier Saunders; 2005. pp. 12–34.
43. Hooker D, Hare C. Early human fetal behavior, with a preliminary note on double simultaneous fetal stimulation. Research Publications—Association for Research in Nervous and Mental Disease. 1954;33:98–113. [PubMed]
44. Lee SK, McMillan DD, Ohlsson A, Pendray M, Synnes A, Whyte R, Chien L-Y, Sale J. Variations in practice and outcomes in the Canadian NICU network: 1996-1997. Pediatrics. 2000;106(5 I):1070–1079. [PubMed]

45. Lemons JA, Bauer CR, Oh W, Korones SB, Papile LA, Stoll BJ, Verter J, Temprosa M, Wright LL, Ehrenkranz RA, Fanaroff AA, Stark A, Carlo W, Tyson JE, Donovan EF, Shankaran S, Stevenson DK. Very low birth weight outcomes of the National Institute of Child Health and Human Development Neonatal Research Network, January 1995 through December 1996. Pediatrics. 2001;107:E1. [PubMed]
46. Smith VC, Zupancic JAF, McCormick MC, Croen LA, Greene J, Escobar GJ, Richardson DK. Trends in severe bronchopulmonary dysplasia rates between 1994 and 2002. Journal of Pediatrics. 2005;146(4):469–473. [PubMed]
47. Walsh MC, Szefler S, Davis J, Allen M, Van Marter L, Abman S, Blackmon L, Jobe A. Summary proceedings from the bronchopulmonary dysplasia group. Pediatrics. 2006;117(3):S52–S56. [PubMed]
48. Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. Philadelphia, PA: Elsevier Saunders; 2005.
49. Cohen BA, Siegfried EC. Newborn skin: Development and basic concepts. In: Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. 8th edition. Philadelphia, PA: Elsevier Saunders; 2005. pp. 1471–1483.
50. Conner JM, Soll RF, Edwards WH. Topical ointment for preventing infection in preterm infants. Cochrane Reviews. 2003;4 [PubMed]
51. Maschoff KL, Baldwin HS. Embryology and development of the cardiovascular system. In: Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. 8th edition. Philadelphia, PA: Elsevier Saunders; 2005. pp. 156–167.

52. Schultheiss TM, Xydas S, Lassar AB. Induction of avian cardiac myogenesis by anterior endoderm. Development. 1995;121(12):4203–4214. [PubMed]
53. Lee SK, McMillan DD, Ohlsson A, Pendray M, Synnes A, Whyte R, Chien L-Y, Sale J. Variations in practice and outcomes in the Canadian NICU network: 1996-1997. Pediatrics. 2000;106(5 I):1070–1079. [PubMed]
54. Malviya M, Ohlsson A, Shah S. Surgical versus medical treatment with cyclooxygenase inhibitors for symptomatic patent ductusarteriosus in preterm infants. Cochrane Reviews. 2006;1 [PubMed]
55. Shah S, Ohlsson A. Ibuprofen for the prevention of patent ductusarteriosus in preterm and/or low birth weight infants. Cohrane Reviews. 2006;1 [PubMed]
56. Juul SE. Developmental biology of the hematologic system. In: Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. Philadelphia, PA: Elsevier Saunders; 2005. pp. 112–132.
57. Vamvakas EC, Strauss RG. Meta-analysis of controlled clinical trials studying the efficacy of rHuEPO in reducing blood transfusions in the anemia of prematurity. Transfusion. 2001;41(3):406–415. [PubMed]
58. Starr A, Amlie RN, Martin WH, Sanders S. Development of auditory function in newborn infants revealed by auditory brainstem potentials. Pediatrics. 1977;60(6):831–839. [PubMed]
59. Madan A, Good WV. Disorders of the eye. In: Taeusch HW, Ballard RA, Gleason CA, editors. Avery's Diseases of the Newborn. Philadelphia, PA: Elsevier Saunders; 2005. pp. 1471–1483.pp. 1539–1555.
60. Madan A, Jan JE, Good WV. Visual development in preterm infants. Developmental Medicine and Child Neurology. 2005;47(4):276–280. [PubMed]

61. Marlow N, Wolke D, Bracewell MA, Samara M. the EPICure Study Group. Neurologic and developmental disability at six years of age after extremely preterm birth. New England Journal of Medicine. 2005;352(1):9–19. [PubMed]

62. Vohr BR, Wright LL, Poole WK, McDonald SA. for the NICHD Neonatal Research Network Follow-up Study. Neurodevelopmental outcomes of extremely low birth weight infants <32 weeks' gestation between 1993 and 1998. Pediatrics. 2005;116(3):635–643. [PubMed]

63. Repka MX. Ophthalmological problems of the premature infant. Mental Retardation and Developmental Disabilities Research Reviews. 2002;8(4):249–257. [PubMed]

64. Brion LP, Bell EF, Raghuveer TS. Vitamin E supplementation for prevention of morbidity and mortality in preterm infants. Cochrane Database of Systematic Reviews (Online: Update Software) 2003;3 [PubMed]

65. De Vries LS, Groenendaal F. Neuroimaging in the preterm infant. Mental Retardation and Developmental Disabilities Research Reviews. 2002;8(4):273–280. [PubMed]

66. Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical outcomes of near-term infants. Pediatrics. 2004;114(2 I):372–376. [PubMed]

67. Linda Fehrs.Oxytocin: The Hormone of peace and trust, Institute of integrative health care. 2010.

68. *Warren Hammer*. Physiological Effects of Therapeutic Massage. *Dynamic Chiropractic* – December 2, 2011, Vol. 29, Issue 25.

69. Shalvia S. & De Dreub C. (2014). Oxytocin promotes group-serving dishonesty, *PNAS*, DOI: 10.1073/pnas.1400724111

70. Field, T., Diego, M., & Hernandez-Reif, M. (2010). Moderate pressure is essential for massage therapy effects. International Journal of Neuroscience, 120, 381-385.

71. Scafidi, F. A., Field, T., &Schanberg, S. M. (1993). Factors that predict which preterm infants benefit most from massage therapy. Developmental and BehavioralPediatrics, 14(3), 176-180.

72. Parambi et al. International journal of pharmaceutical science and research: IJPSR, 2011; Vol. 2(2): 237-246.

73. Anthony A, Brister NW, Colurso GJ.J HistochemCytochem.Cytochemical bioassay and radioimmunoassay of ACTH in noise stressed rats.1979 Oct;27(10):1380-1.

74. Catherine Ulbricht Pharm.D.Music Therapy for Health and Wellness. Jun 21, 2013.

75. Schelz, Ayelet; Litmanovitz, Ita; Bauer, Sophia; Dolfin, Tzipora; Regev, Rivka; Arnon, Shmuel (June 2011). "Combining Kangaroo Care and Live Harp Music Therapy in the Neonatal Intensive Care Unit Setting". *Israel Medical Association Journal* 13 (6): 354–357.

76. Weidenbach, E. (1964). *Clinical nursing: A helping art.* New York: Springer.

77. McKee, N. J., Danko, M., Heidenreiter, T. J. Hunt, N. E., Marich, J. E., Tomey, A. M., McCreary, C. A., & Stuart, M. (1998). Ernestine Wiedenbach: The helping art of clinical nursing. In A. M. Tomey& M. R. Alligood (Eds.), *Nursing theorists and their work* (4th ed., pp. 86-98). St. Louis: Mosby

78. Nickel S, Gesse T, MacLaren A. Ernestine Wiedenbach. Her professional legacy. J Nurse Midwifery. 1992 May-Jun;37(3):161-7

79. Denise F. Polit, Cheryl Tatano Beck. Nursing Research: Principles and Methods. Lippincott Williams & Wilkins, 2004
80. Blencowe H, Cousens S, Oestergaard M, Chou D, Moller AB, Narwal R, Adler A, Garcia CV, Rohde S, Say L, Lawn JE. National, regional and worldwide estimates of preterm birth. The Lancet, June 2012. 9;379(9832):2162-72. Estimates from 2010.
81. Premature birth. Centers for Disease Control and Prevention, Preterm labor and birth, National Institutes of Health, National Institute of child Health and Human Development: Health guide, New york times
82. Hannah Blencowe, Simon Cousens, Doris Chou, MikkelOestergaard, Lale Say. et al. Born Too Soon: The global epidemiology of 15 million preterm births. *Reproductive Health* 2013, 10(Suppl 1):S2.
83. Robinson JN, et al. Risk factors for preterm labor and delivery. http://www.uptodate.com/home. Accessed Sept. 30, 2014
84. Sarah Harding. Characteristics of a Premature Baby. Jan 23, 2014
85. Mandy GT. Short-term complications of the premature infant. http://www.uptodate.com/home. Accessed Oct. 18, 2014
86. Mandy GT. Long-term complications of the premature infant. http://www. uptodate.com/home. Accessed Oct. 18, 2014.
87. Harris MN, et al. ADHD and learning disabilities in former late preterm infants: A population-based birth cohort. Pediatrics. 2013;132:e630.
88. Rita H Pickler, Jacqueline M McGrath, Barbara A Reyna, Heather L Tubbs-Cooley, Al M Best4 Mary Lewis, Sharon Cone, Paul A Wetzel. Effects of the

neonatal intensive care unit environment on preterm infant oral feeding. Research and Reports in Neonatology-2013.

89. Apgar Score University of Maryland Medical Center http://umm.edu/health/medical/pregnancy/labor-and-delivery/apgar-score#ixzz3Ro4quGoz
90. Lissauer T. Physical examination of the newborn. In: Neonatal-Perinatal Medicine: Diseases of the Fetus and Infant, 9th, Martin RJ, Fanaroff AA, Walsh MC (Eds), Elsevier Mosby, St. Louis 2011. Vol 1, p.485.
91. American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Care of the Newborn. In: Guidelines for Perinatal Care, 7th, Riley LE, Stark AR (Eds), American Academy of Pediatrics, Elk Grove Village, IL 2012. p.265
92. Southgate WM, Pittard WB. Classification and physical examination of the newborn infant. In: Care of the High-Risk Neonate, 5th, Klaus MH, Fanaroff AA (Eds), WB Saunders, Philadelphia 2001. p.100.
93. Hernandez P, and Hernandez J. Physical Assessment of the Newborn. In: Assessment and Care of the Well Newborn, Thureen PJ, et al (Eds), WB Saunders, Philadelphia 1999. p.135
94. McGovern M, Mulligan S, Carney O, et al. Ultrasound investigation of sacral dimples and other stigmata of spinal dysraphism. Arch Dis Child 2013; 98:784.
95. Late preterm infant: what parents need to know. Washington (DC): Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), 2005-2007. 2 p. Available as a free download in Spanish and English from the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) Web site

96. Lowdermilk, D. L., Perry, S. E, Cashion, K., & Alden, K. R. (2012). *Maternity & women's health care* (10th ed.). St. Louis, MO: Elsevier Mosby. pp. 567-570.

97. Pillitteri, A. P. (2007). *Maternal & child health nursing: Care of the childbearing & childrearing family.*Philadelphia, PA: Lippincott Williams & Wilkins. pp. 705-707.

98. Susan A Furdon, MS, RNC, NNP; Chief Editor: Ted Rosenkrantz, MD et.al, Prematurity Treatment & Management, Medscape

99. Ruolin Z, Tao B, Li S, et al. Effect of dexamethasone on intelligence and hearing in preterm infants: a meta-analysis. *Neural Regen Res*. 2014;9(6):637-45. Ballard JL, Khoury JC, Wedig K, et al. New Ballard Score, expanded to include extremely premature infants.*JPediatr*. Sep 1991;119(3):417-23.

100. Barton L, Hodgman JE, Pavlova Z. Causes of death in the extremely low birth weight infant. *Pediatrics*. Feb 1999;103(2):446-51.

101. Creasy RK, Gummer BA, Liggins GC. System for predicting spontaneous preterm birth. *Obstet Gynecol*. Jun 1980;55(6):692-5.

102. [Best Evidence] Robertson CM, Howarth TM, Bork DL, Dinu IA. Permanent bilateral sensory and neural hearing loss of children after neonatal intensive care because of extreme prematurity: a thirty-year study.*Pediatrics*. May 2009;123(5):e797-807.

103. Pittman G. Vaginal Delivery Safer for Many Preemies: Study. *Medscape* [serial online]. May 8 2013;Accessed May 23 2013. Available at http://www.medscape.com/viewarticle/803871.

104. Werner EF, Han CS, Savitz DA, et al. Health outcomes for vaginal compared with cesarean delivery of appropriately grown preterm neonates. *Obstet Gynecol*. June 2013;121(6):1195-200.

105. Kent AL, Wright IM, Abdel-Latif ME. Mortality and Adverse Neurologic Outcomes Are Greater in Preterm Male Infants. *Pediatrics*. Jan 2012;129(1):124-131.

106. Dubowitz LM, Dubowitz V, Goldberg C. Clinical assessment of gestational age in the newborn infant. *J Pediatr*. Jul 1970;77(1):1-10.

107. Vimala Schneider McClure. Infant Massage--Revised Edition: A Handbook for Loving Parents Paper back– October 31, 2000.

108. Guzzetta A, Baldini S, Bancale A, Baroncelli L, Ciucci F, Ghirri P, et al. Massage accelerates brain development and the maturation of visual function.

109. J Neurosci. 2009 May 6;29(18):6042-51. doi: 10.1523/JNEUROSCI.5548-08.2009.

110. Vickers A, Ohlsson A, Lacy JB, Horsley A. Massage for promoting growth and development of preterm and/or low birth-weight infants. Cochrane Database Syst Rev [Serial online] 2004 ;(2):CD000390 [Cited 2011 Nov 23]; Available from http://www.ncbi.nlm.nih.gov/pubmed/15106151

111. Tiffany Field, Miguel Diego, and Maria Hernandez-Reif., Moderate Pressure is Essential for Massage Therapy Effects. May 2010, Vol. 120, No. 5 , Pages 381-385 (doi:10.3109/00207450903579475

112. K Shankaranarayanan, J.A. Mondkar, M.M Chauhan, B.M. Mascarenhas, A.R. Mainkar, R.Y. Salvi.Oil massage in neonates. Indian peadiatrics; 2005 (42) sept 17:877-884.

113. Sari Goldstein Ferber a,b, Jacob Kuintb,c, et al. Massage therapy by mothers and trained professionals enhances weight gain in preterm infants. Department of Neonatology, Wolfson Medical Center, Early Human Development (Impact Factor: 1.93). 05/2002; 67(1-2):37-45. DOI: 10.1016/S0378-3782(01)00249-3

114. Tiffany Field, Miguel Diego, and Maria Hernandez-Reif, Touch Research Institute, University of Miami School 2Fielding Graduate University 3University of Alabama Potential Underlying Mechanisms for Greater Weight Gain in Massaged Preterm Infants, Infant Behav Dev. 2011 June ; 34(3): 383–389. doi:10.1016/j.infbeh.2010.12.001.

115. Priya Singh Rangey and Megha Sheth. Comparative Effect of Massage Therapy versus Kangaroo Mother Care on Body Weight and Length of Hospital Stay in Low Birth Weight Preterm Infants. International Journal of Pediatrics. Volume 2014 (2014), Article ID 434060, 4 pages. http://dx.doi.org/10.1155/2014/434060

116. ZohrehBadiee , Shiva Samsamshariat2, PegahPourmorshed . Effect of Massage on Weight Gain in Premature Infants , Iranian Journal of Neonatology Summer 2012. Vol. 3, No.2.

117. Field, T. Diego, M., & Hernandez-Reif, M. (2007). Massage therapy research. Developmental Review, 27, 75-89. doi:10.1016/j.dr.2005.12.002.

118. Wheeden A, Scafidi FA, Field T, Ironson G, Valdeon C, Bandstra E. Massage effects on cocaine-exposed preterm neonates. J DevBehavPediatr. [Serial online] 1993 Oct; 14(5):318-22[cited 2011 Nov 11]. Available from http://www.ncbi.nlm.nih.gov/pubmed/8254063

119. Darmstadt GL, Saha SK, Ahmed AS, Ahmed S, Chowdhury MA, Law PA,et al. Effect of skin barrier therapy on neonatal mortality rates in preterm infants

in Bangladesh: a randomized, controlled, clinical trial.Pediatrics [Serial online] 2008 Mar; 121(3):522-9 [Cited 2011 Nov 11]; Available from http://www.ncbi.nlm.nih.gov/pubmed/18310201

120. Lee HK. The effect of infant massage on weight gain, physiological and behavioral responses in premature infants. Taehan Kanho Hakhoe Chi [Serial online] 2005 Dec; 35(8):1451-60 [Cited 2011 Nov 25]; Available from http://www.ncbi.nlm.nih.gov/pubmed/16415626

121. Arora J, Kumar A, Ramji S. Effect of oil massage on growth and neurobehavior in very low birth weight preterm neonates.Indian Pediatr [Serial online] 2005. Nov; 42(11):1092-100 [Cited 2011 Nov 11]; Available from http://www.ncbi.nlm.nih.gov/pubmed/16340050.

122. Agarwal KN, Gupta A, Pushkarna R, Bhargava SK, Faridi MM, Prabhu MK. Effects of massage& use of oil on growth, blood flow & sleep pattern in infants.Indian J Med Res [Serial online] 2000 Dec; 112:212-7 [Cited 2011 Nov 8]; Available from http://www.ncbi.nlm.nih.gov/pubmed/11247199

123. Lee HK. The effects of infant massage on weight, height, and mother-infant interaction. TaehanKanhoHakhoe Chi [Serial online] 2006 Dec; 36(8):1331-9 [Cited 2011 Nov 16]; Available from http://www.ncbi.nlm.nih.gov/pubmed/17215606

124. Diego MA, Field T, Hernandez-Reif M. Preterm infant massage elicits consistent increase in vagal activity and gastric motility that are associated with greater weight gain. ActaPaediatric [Serial online] 2007; 96: 1588-1591[Cited 2011 Nov

125. Dieter, J., Field, T., Hernandez-Reif, M., Emory, E., Redzepi, M. (2003). Stable Preterm Infants Gain More Weight and Sleep Less after Five Days of Massage Therapy. *Journal of Pediatic Psychology*, 403-411.

126. Dieter J. & E. Emory, (2002) Supplemental Stimulation for Preterm Infants. In L Rich Ed. *Massage Therapy*, Harcourt Health Sciences, London pp. 135-164

127. Ancy Varghese, Effectiveness of massage therapy on weight gain and sleep awake pattern among preterm babies –dissertation: 2013.

128. Hae-Kyung Lee, The Effects of Infant Massage on Weight, Height, and Mother-Infant Interaction: Journal of Korean Academy of Nursing (2006) Vol. 36, No. 8, 1331-1339.

129. Agarwal KN, Gupta A, Pushkarna R; Effects of massage and use of oil on growth, blood flow and sleep pattern is infant, Indian Journal Medicine Res.2000 Dec; 112:212-7.

130. Solanki K, Matnani M, Kale M, Joshi K, Bavdekar A, Bhave S, *et al*. Transcutaneous absorption of topically massaged oil in neonates. Indian Pediatr 1987; 24: 1111-1116.

131. Anjali kulkarni, Jaya Shankar kaushik, Piyushgupta, Harsh Sharma, RK Agrawal. Massage and touch therapy in neonates: the current evidence. Indian paediatrics.[Online]. Vol 47. Sep17. 2010. [Cited 2011 Nov 15]; Available from http:/medind.nic.in/ibv/t10/i9/ibvt10i9p771.pdf3.

132. B. Ramasundari and A. Judie. Effectiveness of massage therapy on newborns. Nightingale Nursing, July 6 /2nd volume 2006

133. S L Smith, R Lux, S Haley, H Slater, J Beechy, L J Moyer-Mileur. The effect of massage on heart rate variability in preterm infants. *Journal of Perinatology*, 2012; 33 (1): 59 DOI: 10.1038/jp.2012.47.

134. Kim, T.I., Shin, Y.H., White-Traut, R.C. Multisensory intervention improves physical growth and illness rates in Korean orphaned newborn infants. Res Nurs Health. [Online] 2003.26,424-33. [Cited 2011 Nov 27]; Available from http:/www.diannalindensportsmassage.com/abstracts/ abstracts - infant - massage.html

135. Fatima F Aly and GhulamMurtaza. Massage Therapy in Preterm Infants: case report. Pediatrics & Therapeutics. ISSN: 2161-0665

136. Jocelyn Y. Ang, MD, Jorge L. Lua, MD, AmbikaMathur, PhD, Ronald Thomas, PhD, BasimI.Asmar, MD, SureyyaSavasan, MD, Steven Buck, MSc, Michael Long, PhD, and SeethaShankaran, MD A Randomized Placebo-Controlled Trial of Massage Therapy on the Immune System of Preterm Infants, pediatrics 2012; 130(6) :1549.

137. Andrea guzzetta.,maria g d'acunto., marcocarotenuto, nicolettaberardi, adabancale ., et al. The effects of preterm infant massage on brain electrical activity. Article first published online: 21 SEP 2011 DOI: 10.1111/j.1469-8749.2011.04065.x

138. Guzzetta A, Baldini S, Bancale A, Baroncelli L, Ciucci F, Ghirri P, et al. Massage accelerates brain development and the maturation of visual function. J Neurosci. 2009 May 6;29(18):6042-51. doi: 10.1523/JNEUROSCI.5548-08.2009.

139. Procianoy RS, Mendes EW, Silveira RC. Massage therapy improves neurodevelopment outcome at two years corrected age for very low birth weight infants.Early Hum Dev. 2010 Jan;86(1):7-11. doi: 10.1016/j.earlhumdev.2009.12.001. Epub 2009 Dec

140. Karen Livingston. Shay Beider. Alexis J. Kant. Constance C. Gallardo. Michael H. Joseph. And Jeffrey I. Gold .Touch and massage for medically fragile infants. Advance Access Publication 6 August2007. eCAM 2009 .6(4)473–482

141. R. Burton. A Study of the Music Therapy: "Music a remedy" for the treatment of melancholy using music in his The Anatomy of Melancholy.

142. Daniel J. Levitin. This is brain on music. American *Music Therapy* Association.http://daniellevitin.com/levitinlab/printmedia/2013-07-02-National-Post.pdf

143. Harmat L, Taka'cs J, Bo'dizs R. Music improves sleep quality in students. J AdvNurs. 2008 May;62(3):327-35.

144. Camila Mendes da Silva, Jessica Marcelle R. Cação, Karin Cristina dos S. Silva, Cassia Fernandes Marques, Leila Simone F. Merey. Physiological responses of preterm newborn infants submitted to classical music therapy. Rev Paul Pediatr 2013;31(1):30-6.

145. Miriam Lense et.al.,[145] Effects of Music on Physiological and Behavioral Indices of Acute Pain and Stress in Premature Infants: Clinical Trial and Literature ReviewMusic and Medicine April 2011 3: 72-83,

146. Caine J. The effects of music on the selected stress behaviors, weight, caloric and formula intake and length of hospital stay of premature and low birth weight neonates in a newborn intensive care unit. JBI Library of Systematic Reviews JBL000717 2012;10 (58) 4600 – 4609 Page 4606 J Music Ther 1991; 28(4): 180-92

147. Chou LL, Wang RH, Chen SJ, Pai L. Effects of music therapy on oxygen saturation in premature infants receiving endotracheal suctioning. J Nurs Res 2003; 11(3): 209-15
148. Hartling L, Shaik MS, Tjosvold L, Leicht R, Liang Y, Kumar M. Music for medical indications in the neonatal period: a systematic review of randomised controlled trials. Arch Dis Child Fetal Neonatal Ed 2009; 94(5): F349-54.
149. Dr Amir Lahav, The effects of noise on preterm infants in the NICU. Department of Newborn Medicine, Brigham and Women's Hospital-CWN 418, 75 Francis Street, Boston, MA 02115, USA; amir_lahav@hms.harvard. edu Accepted 26 March 2010 Published Online First 14 June 2010
150. Rand K, Lahav A. Early Hum Dev. 2014 Oct; 90(10):679-83. Epub 2014 Sep 9.
151. Arnon S, Shapsa A, Forman L, Regev R, Bauer S, Litmanovitz I, Dolfin T. Live music is beneficial to preterm infants in the neonatal intensive care unit environment.irth. 2006 Jun;33(2):131-6.
152. Whipple J. The effect of music-reinforced nonnutritive sucking on state of preterm, low birth weight infants experiencing heelstick. J Music Ther. 2008 Fall;45(3):227-72.
153. Doheny L, Hurwitz S, Insoft R, Ringer S, Lahav A. Exposure to biological maternal sounds improves cardiorespiratory regulation in extremely preterm infants.J Matern Fetal Neonatal Med. 2012 Sep;25(9): 1591-4. doi: 10.3109/ 14767058. 2011.648237. Epub 2012 Feb 2.
154. White-Traut RC, Nelson MN, Silvestri JM, Vasan U, Littau S, Meleedy-Rey P, Gu G, Patel M. Effect of auditory, tactile, visual, and vestibular intervention

on length of stay, alertness, and feeding progression in preterm infants.Dev Med Child Neurol. 2002 Feb;44(2):91-7.

155. Cassidy JW. The effect of decibel level of music stimuli and gender on head circumference and physiological responses of premature infants in the NICU.J Music Ther. 2009 Fall;46(3):180-90.

156. Standley, JM (1998). "The effect of music and multimodal stimulation on responses of premature infants in neonatal intensive care". *Paediatric Nursing* 6 (24): 532–157.

157. Standley J. Music therapy research in the NICU: an updated meta-analysis.Neonatal Netw. 2012 Sep-Oct;31(5):311-6. doi: 10.1891/0730-0832.31.5.311.

158. Malloy, G. (1979). The relationship between maternal andmusical auditory stimulation and the developmental behavior of premature infants. Birth Defects: Original Article Series, 15(1), 81-98

159. Rabold, Stefanie. The Effects of Music Therapy in the NICU on Behavior, Weight, and Length of Stay: A Systematic Review. URI: http://hdl.handle.net/10211.8/373Date: 2013-05-0.

160. Vianna MN, Barbosa AP, Carvalhaes AS, Cunha AJ. Music therapy may increase breastfeeding rates among mothers of premature newborns: a randomized controlled trial. J Pediatr (Rio J). 2011;87:206-212.

161. Amini E, Rafiei P, Zarei K, Gohari M, Hamidi M. Effect of lullaby and classical music on physiologic stability of hospitalized preterm infants: a randomized trial.J Neonatal Perinatal Med. 2013 Jan 1;6(4):295-301. doi: 10.3233/NPM-1371313.

162. Campbell-Yeo ML[1], Johnston CC, Joseph KS, Feeley N, Chambers CT, Barrington KJ.Cobedding and recovery time after heel lance in preterm twins: results of a randomized trial.Pediatrics. 2012 Sep;130(3):500-6. doi: 10.1542/peds.2012-0010. Epub 2012 Aug 27.

163. da Silva CM, Cação JM, Silva KC, Marques CF, Merey LS. Physiological responses of preterm newborn infants submitted to classical music therapy.Rev Paul Pediatr. 2013 Jan-Mar;31(1):30-6.

164. Yildiz A, Arikan D. The effects of giving pacifiers to premature infants and making them listen to lullabies on their transition period for total oral feeding and sucking success.J ClinNurs. 2012 Mar;21(5-6):644-56. doi: 10.1111/j.1365-2702.2010.03634.x. Epub 2011 Jun 13.

165. Charoensri, P. (2002) Effect of multimodalities sensory stimulation program on the growth of premature infants and maternal infant attachment, masters thesis. Mahidol university, Bangkok

166. Kanagasabai PS, Mohan D, Lewis LE, Kamath A, Rao BK. Effect of multisensory stimulation on neuromotor development in preterm infants. Indian J Pediatr.2013 Jun;80(6):460-4. doi: 10.1007/s 12098- 012-0945-z. Epub 2013 Jan 4

167. White-Traut RC[1], Schwertz D, McFarlin B, Kogan J. Salivary cortisol and behavioral state responses of healthy newborn infants to tactile-only and multisensory interventions.J ObstetGynecol Neonatal Nurs. 2009 Jan-Feb;38(1):22-34. doi: 10.1111/j.1552-6909.2008.00307.x.

168. Bellieni CV, Buonocore G, Nenci A, Franci N, Cordelli DM, Bagnoli F. Sensorial saturation: an effective analgesic tool for heel-prick

in preterm infants:a prospective randomized trial.Biol Neonate. 2001 Jul;80(1):15-8.

169. Joanne Loewy, Kristen Stewart, Ann-Marie Dassler, Aimee Telsey, and Peter Homel. The Effects of Music Therapy on Vital Signs, Feeding, and Sleep in Premature Infants. Official journal of American Academy of pediatrics http://pediatrics.aappublications.org/content/early/2013/04/10/peds.2012-1367.abstract

APPENDIX – I

SACRED HEART NURSING COLLEGE

ULTRA TRUST

4 / 235, COLLEGE ROAD,
THASILDAR NAGAR,
MADURAI - 625 020.
TAMILNADU, INDIA.
PHONE : 0452 - 2534593
Email : ultratrust@rediffmail.com

Ref : UT : SHNC:Ph.D(N) : 2014 — Date : 20.12.2010

ETHICAL COMMITTEE

The following members of the ethics committee were present at the meeting held on 20.12.2010 at 2.00 pm in Sacred Heart Nursing College.

CHAIR PERSON

1. **Dr.SABHESAN, M.B.B.S. DPM, MNAMS, Ph.D.**
   Head, Department of Psychiatry
   CSI Mission Hospital, Madurai.

DEPUTY CHAIRMAN

2. **Dr.NALINI JEYAVANTH SANTHA, M.Sc., (N) Ph.D.**
   Principal, Sacred Heart Nursing College, Madurai – 625 020.

MEMBER SECRETARY

3. **Prof. S.CHANDRAKALA, M.Sc., (N) Ph.D**
   Vice Principal, Sacred Heart Nursing College, Madurai – 625 020.

MEMBERS

4. **Prof. K.R.ARUMUGAM M.Pharm**
   Chairman,
   Ultra Trust.

5. **Dr.K.N. KRISHNAN MBBS M.S** (General Surgery)
   Best Dental Science College, Ultra Nagar,
   Madurai.

6. **Dr.SUBRAMANIAN, M.D. (Pathology)**
   Head, Department of Pathology,
   Best Dental Science College &
   Former President of Rotary Club, Madurai.

7. **Prof. JULIET SYLVIA, M.Sc., (N) Ph.D.**
   Head, Department of Community Health Nursing,
   Sacred Heart Nursing, Madurai – 625 020.

8. **Prof. DEVAKIRUBAI, M.Sc., (N) Ph.D.**
   Professor, Department of Medical Surgical Nursing,
   Sacred Heart Nursing, Madurai – 625 020.

...2...

SACRED HEART NURSING COLLEGE

ULTRA TRUST

4 / 235, COLLEGE ROAD,
THASILDAR NAGAR,
MADURAI - 625 020.
TAMILNADU, INDIA.
PHONE : 0452 - 2534593
Email : ultratrust@rediffmail.com

Ref : UT : SHNC:Ph.D(N) : 2014 **Date :** 20.12.2010

9. **Dr. VIJAYA, M.Pharm., Ph.D**
Dean, Clinical Pharmacologist
Ultra College of Pharmacy, Madurai

10. **Mr. CHINNAKARUPPAN M.A., B.L., DCFSC**
Advocate and Notary Public,
14, Asari Street, Thallakulam, Madurai – 2.

11. **Mr. SURESH KUMAR, M.A., M.Phil., (Psy) Ph.D**
Asst. Prof. Cum Clinical Psychologist,
Dept. of Psychiatry,
Govt. Rajaji Hospital, Madurai – 625 020.

12. **Dr. VICTOR P. LAWRENCE, D. Div.**
Theologist, Madurai.

RESOLUTION – 7/2010

It is resolved to accept **Mrs. L.M. MAJELLA LIVINGSTON** to conduct a study in the Topic "A study to evaluate the effectiveness of tactile and auditory stimulation on physiological parameters among preterm neonates admitted in selected hospitals at Nagercoil, Tamilnadu, India".

The institutional Ethics Committee expects to be informed about the progress of the study, any changes in the protocol, patient information and asks to be provided a copy of the final report.

Yours Sincerely

Chair Person
Ethics Committee

Dr.SABHESAN, M.B.B.S. DPM, MNAMS, Ph.D.

Member Secretary
Ethics Committee

Prof. S.CHANDRAKALA M.Sc., (N) Ph.D

Prof. S. CHANDRAKALA. MSc (N)
VICE PRINCIPAL. HOD OF MED. SUR.DEPT.
SACRED HEART NURSING COLLEGE
ULTRA TRUST. MADURAI

APPENDIX - II

LETTER SEEKING PERMISSION TO CONDUCT THE STUDY

To

The Dean,

Kanyakumari Government Medical College,

Asaripallam, Kanyakumari District,

Tamilnadu .

Respected Madam/ Sir,

I Mrs. L.M.MAJELLA LIVINGSTON is doing Ph.D. in Nursing under MGR Medical University Chennai. My topic is “**A STUDY TO EVALUATE THE EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES”**

As part of my study I need to give tactile and auditory stimulation to the preterm neonates and observe the changes in weight, cry, feeding skills and vital signs. Since the availability of preterm neonates is very less in our district, I would like to select your institute as one among data collection institute. So I am requesting you to grant permission to collect data in your esteemed Hospital. I will abide the rules and regulations of your Hospital during the data collection period

Thanking you

Date: Yours faithfully,

APPENDIX- III

CONSENT FORM

(PART 1of 2)

INFORMED CONSENT

Study title: EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES.

Subject's initials:

Subject's name :

Age :

Date of Birth :

1. I confirm that I have read and understood the information sheet dated………… for the above study and have had the opportunity to ask questions. ( )

2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason. ( )

3. I understand that the Ethics. Committee and the Regulatory Authorities, will not need my permission to look at my child, their health records both in respect to the current study and any further research that may be conducted in relation to it. ( )

4. I agree not to restrict the use of any data or results that may arise from this study provided such a use is only for scientific purpose(s). ( )

5. I agree to take part in this study. ( )

Signature of the parent / Legacy acceptable.

Representative:

Date:

Signatory's name:

Signature of the Investigator:

Date:

Study investigator's name:

Signature of the Witness:

Date:

Name of the Witness:

CONSENT FORM

(PART 2 of 2)

(PARTICIPANTS CONSENT FORM)

STUDY TITLE: **“EFFECTIVENESS** OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES**”**.

Serial No. : O.P. No. :

Name of the participant of the study :

Date of Birth : Age: Sex:

Name of the Mother of the study participants:

Name of the Father of the study participants:

Note: This is a research project concerned mainly with massage and music therapy in my pre term child health and other details related to it. The investigator will study the effectiveness of tactile and auditory stimulation in my pre term child who has got admitted at the icu in Kanyakumari Government Medical College Hospital, Asaripalam .The details of the study have been explained to me in writing and the details have been fully explained to me. I am aware that the results of the study may not be directly beneficial to me but will help in the advancement of medical sciences. I confirm that I have understood the study and had the opportunity to ask questions. I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without the medical care that will normally be provided by the hospital being affected. I agree not to restrict use of any data or results that arise from this study provided such a use is only for scientific purpose(s). I have been given an information sheet giving details of the study. I fully consent to participate in the above mentioned study.

Signature of the Parents :

Address of the Parents :

Contact number of the Parents :

Signature/ Thumb impression of the Parents:

Witnesses:

1.

2.

Date:

Place:

APPENDIX – IV

THE VALLIAMMAL INSTITUTION (TVI)

11/6 B.B. Road 2nd St., Pankajam Colony , Madurai-625 009.

98942 49630 email: ananthibetsy@rediffmail.com

Certificate Course in Massage Therapy to the Preterm Neonates

Reg. No. 01/May 2011 Date: 27/05/2011

This is to certify that **Mrs. L.M. MAJELLA LIVINGSTON** *has completed our* **CERTIFICATE COURSE IN MASSAGE THERAPY TO THE PRETERM NEONATES** *(24hrs Part-time Education Programme designed and offered by experts) by effectively particpating in theory & practical classes and successfully completing all the exercises. She has been placed in* ....**FIRST CLASS**..................

S. Jeyapragasam 27/5/11

Prof. Dr. S. Jeyapragasam M.Sc.,M.A.,M.A.,Ph.D.,
Director
Rajarajan Institute of Science (RISE)

Ananthi 27/05/11

Dr. B. Ananthi M.Sc.,M.A.,M.Phil.,Ph.D.,
Director & Secretary
The Valliammal Institution (TVI)

APPENDIX – V

SAMSON SCHOOL OF MUSIC

60-C, Zion Street, Christunagar Road,
Nagercoil - 629001

Ph: 04652-278548
Cell : 9843766724

Email : samsonsings@hotmail.com
samsonsings@gmail.com

Dr.J.S.SAMSON, B.Sc., M.PEd., D.B.M.,

CONTENT VALIDITY CERTIFICATE

I hereby certify that I have validated the tool of Mrs. L. M. Majella Livingston, Ph.D Scholar who is undertaking,

"A STUDY TO EVALUATE THE EFFECT OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES' and found that the tool is valid. The tool contains adequate and appropriate information about physiological parameters. I have also certified that the music played in this thesis for data collection in Preterm Neonates is "lullaby music" with "raga Neelambari".

For SAMSON SCHOOL OF MUSIC

Director

APPENDIX – VI

Dr. B. Ananthavalli
Director,
The Valliammal Institution (TVI),
11/6 B.B. Road 2nd St.,
Pankajam Colony, Madurai - 625 009.

CONTENT VALIDITY CERTIFICATE

I hereby certify that I have validated the tool of Mrs. L. M. Majella Livingston , Ph.D Scholar who is undertaking, "A STUDY TO EVALUATE THE EFFECT OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES" and found that the tool is valid. The tool contains adequate and appropriate information about physiological parameters.

Date : 27/06/2011

Dr. B. Ananthavalli
Director

THE VALLIAMMAL INSTITUTION (TVI)
11/6 B.B. Road
2nd St.,
Pankajam Colony ,
Madurai-625 009.
Ph: 4210258

APPENDIX – VII

CONTENT VALIDITY CERTIFICATE

I hereby certify that I have validated the tool of Mrs. L. M. Majella Livingston, Ph.D. Scholar who is undertaking,

"A STUDY TO EVALUATE THE EFFECT OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES" and found that the tool is valid. The tool contains adequate and appropriate information about physiological parameters.

DATE SIGNATURE WITH SEAL

APPENDIX – VIII

LIST OF EXPERTS

MEDICAL EXPERTS

1.	Dr. Ramesh, DM(Neonatology)., Assistant Professor, Dept. of Paediarics, Kanyakumari Govt. Medical College Hospital, Assaripallam, Kanyakumari District, Tamilnadu
2.	Capt.Dr. Sudha Ponnu, M.D(Paediatrics)., Medical Director, Gerdi Gutperle Agasthiyar Muni Child Care Centre. Vellamadam, Kanyakumari District, Tamilnadu.
3.	Dr. K. M. Sanjay, M.D(Paediatrics)., Assistant Professor, Dept. of Paediarics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamilnadu – 629 161.
4.	Dr. T. Diana, M.D(Paediatrics)., Assistant Professor, Dept. of Paediarics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamilnadu – 629 161.
5.	Dr. S. Sabin Roy, DCH., DNB(Paediatrics)., Fellowship in Nanotechnology (NNF) Neonatologist Paediatrician, Gerdi Gutperle Agasthiyar Muni Child Care Centre. Vellamadam, Kanyakumari District, Tamilnadu.
6.	Dr. M. P. Kumar, DCH., Director and Child Specialist, MP Children Hospital, Nagercoil, Kanyakumari District, Tamilnadu.
7.	Prof. Dr. Pethuru Devadhasan. M.D, Professor, Dept. of Community Medicine, SMIMS, Director, Grace Hospital, Aralvoimozhi, Kanyakumari District, Tamilnadu.

NURSING EXPERTS

8.	Prof. Dr. C. Nalini Jeyavantha Santha, M.Sc. (N), Ph.D., Professor in Nursing, Principal, Sacred Heart Nursing College, Madurai.
9.	Prof. Dr. S. Margaret Ranjitham, M.Sc.(N), Ph.D., Professor in Nursing, Principal, Nehru Nursing College, Vallioor, Tirunelveli – 627 117.
10.	Dr. Jeba Jothi Priya, M.Sc.(N), Ph.D., Nursing Director, Canada.
11.	Prof. Dr. Rejina, M.Sc.(N), Ph.D., Professor in Nursing, Principal, Doctors College of Nursing, Pudukkottai
12.	Prof. Dr. T. C. Suguna, M.Sc.(N), Ph.D., Professor, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamilnadu – 629 161.

OTHER EXPERTS

13.	Mr.M.Arumugam, M.Sc. (Biostatistics), Assistant Professor & Bio-statistician, Muthukumaran Medical College, Chennai
14.	Mr. M.B. Kumar, Assistant Professor,Dept. of Bio Statistics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamilnadu – 629 161.
15.	Dr. B. Ananthavalli, Massage Expert, Director, The Vallimmal Institution (TVI), 11/6, B.B. Road, 2nd Street, Pankajam Colony, Madurai – 625 009
16.	Dr. J. S. Samson, B.Sc., M.Ped., D.B.M.,Ph.D., Music Expert, Director, Samson School of Music, Nagercoil, Kanyakumari District, Tamilnadu.
17.	Dr. Rev. Fr. Lord M. Winner, Ph.D., CMF, Music Expert, Mission Procura, Ranchi, India

APPENDIX - IX

TOOLS

PART-1

DEMOGRAPHIC DATA

1.	Gestational Age	:	__________ weeks.
2.	Sex	:	a. Male b. Female
3.	Age of the child	:	___________ days.
4.	Mode of delivery	:	1. Normal Vaginal Delivery
			2. Instrumental Delivery
			3. LSCS
5.	Birth Weight	:	______ grams.
6.	Apgar Score	:	A. Initial
			B. At 5 minutes
7.	Order of Birth	:	1. First Order
			2. Second Order
			3. Third Order.
			4. Twins.

PART – 2

CHECK LIST TO ASSESS THE PHYSIOLOGICAL PARAMETERS

PHYSIOLOGICAL PARAMETERS	CONTROL GROUP			EXPERIMENTAL GROUP		
	Pre Intervention	Post Intervention		Pre Intervention	Post Intervention	
		3rd Day	5th Day		3rd Day	5th Day
Weight						
Temperature						
Heart rate						
Respiratory rate						
Oxygen saturation						

PART – 3

STRUCTED INTERVIEW SHEDULE

A. How many times does the baby take feed per day?

1. <6 times 2. 6 -10 times 3. > 10 times

B. How long does the baby suck one breast for feed?

1. < 5 minutes 2. 5 – 10 minutes 3. > 10 minutes

C. How long does the baby sleep at a time?

1. < 30 minutes 2. 30 minutes – 1 hour 3. 1 -2 hours

D. How many hours does the baby sleep per day?

1. < 10hours 2. 10 – 18 hours 3. >18 hours

E. How many times does the baby cry per day?

1. >10 times 2. 5 – 10 times 3. < 5 times

F. How many times does the baby pass urine per day?

1. <5 times 2. 5 – 10 times 3. >10 times

Scoring key:1.6-9 - Unsatisfactory, 2. 10-14 - Satisfactory , 3. 15 -18 - Good

APPENDIX – X

TIME SCALE FOR EVENTS OF RESEARCH FROM JAN 2011 TO DEC 2014									
Sl. No.	Task	2011		2012		2013		2014	
		Jan. 11 – Jun. 11	Jul. 11 – Dec. 11	Jan. 12 – Jun. 12	Jul. 12 – Dec. 12	Jan. 13 – Jun. 13	Jul. 13 – Dec. 13	Jan. 14 – Jun. 14	Jul. 14 – Dec. 14
1.	Literature review								
2.	Research proposal and provisional registration								
3.	Seminar attended and presentation								
4.	Methodology Exam								
5.	Research tool(s) selection and draft preparation								
6.	Validity and reliability of tools								
7.	Pilot study permission and conduction								
8.	Main study permission and data collection								
9.	Draft all writing for chapters								
10.	Coding, data for analysis and compiling results								
11.	Preparation and submission of synopsis								
12.	Final draft preparation and thesis submission								

EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON

BY EX11(1)/56431/2014 L.M.MAJELLA LIVINGSTON ,MSC (N)

EFFECTIVENESS OF TACTILE AND AUDITORY STIMULATION ON PHYSIOLOGICAL PARAMETERS AMONG PRETERM NEONATES

A Thesis submitted to The Tamil Nadu Dr. MGR Medical University, Chennai for the award of the Degree of
Doctor of Philosophy in Nursing

BY

L. M. MAJELLA LIVINGSTON, M.Sc.(N), M.B.A.(HM)
Professor
Nehru Nursing College,
Valliyoor.

Under the Guidance of

Dr. C. NALINI JEYAVANTHA SANTHA, M.Sc.(N), Ph.D.,
Research Guide
Sacred Heart Nursing College,

No Service Currently Active

Journal of Research in Public Health
An International Scientific Research Journal
ISSN - Print: 2319 - 1627; Online: 2319 - 1635

Journal of Research in Public Health

Original Research Paper

Accelerated Weight Gain Among Preterm Infants After Tactile And Auditory Stimulation

Authors:

Majella Livingston L .M[1] ,
Nalini Jeyavantha Santha[2],
Jeya Singh[3],
Pethuru Devadason[4].

Institution:

[1]Research Scholar (Ph.D – Nursing), The Tamilnadu Dr. M.G.R. Medical University, Chennai, Tamilnadu, India.

[2]Principal, Sacred Heart Nursing College, Madurai, Tamilnadu, India.

[3]Former Professor and Head, Department of STD, Coimbatore Medical College, Coimbatore, Tamilnadu, India.

[4]Professor, Department of Community Medicine, SMIMS, Kulasekharam, Tamilnadu, India.

Corresponding author:

Majella Livingston L .M

Web Address:
http://jhealth.info/documents/PH0050.pdf.

ABSTRACT:

Introduction: Preterm is a major communal health problem in many mounting countries including India. Effectual neonatal care can grasp up their growth and survival. Tactile and auditory stimulation as intervention is useful in premature neonates as it enhances child development, including brain, physical, emotional, mental and social development. This enhances the bonding, improves sleep pattern, stimulate circulation, improves digestion, facilitates food absorption, resulting in faster weight gain.

Objectives: 1) To observe and compare the weight gain pattern among the Preterm Infants who had received tactile and auditory stimulation with those who had not received the same and 2) To find out the association of selected demographic variables with the weight gain after tactile & auditory stimulation.

Methodology: 120 preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted into the neonatal care units of KanyaKumari Medical College Hospital, Nagercoil were randomized in to two equal experimental and control groups. A pilot tested tool was developed to measure the demographic factors and weight on the pre intervention, 3rd day and 5th day of the tactile and auditory stimulation. Data was entered in Excel and analyzed with SSPS version 20.

Results: Of the total 120 preterm neonates 58 were males and 62 were females. In Experimental group, the mean weight gain on 3rd and 5th day after receiving tactile and auditory stimulation were 109.83 grams and 177 grams respectively. In Control group, mean weight gain on 3rd and 5th day was only 78.17 grams and 118.33 grams respectively which was less as compared to the Experimental group. Regression analysis shows Age and Gestational Age of the preterm babies are the significant factors associated with Weight gain on 5th post intervention day.

Conclusion: The weight gain in the experimental group of preterm babies who had received tactile and auditory stimulation is significantly high as compared to the controls who had not received the same. This weight gain is significantly associated with the age and gestational age of the preterm babies receiving the stimulation.

Keywords:

Tactile Stimulation, Auditory Stimulation, Weight Gain, Preterm Babies.

Article Citation:
Majella Livingston L .M , Nalini Jeyavantha Santha, Jeya Singh, Pethuru Devadason.
Accelerated Weight Gain Among Preterm Infants After Tactile And Auditory Stimulation
Journal of Research in Public Health (2014) 3(2): 1-10

Dates:
Received: 18 Oct 2014 /**Accepted: 12 Nov 2014** /**Published: 27 Dec 2014**

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. After its birth, the extra uterine life presents a dispute to the newborn baby, because the newborn baby undergoes a conventional sequence of events to become accustomed the extra uterine life1. 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 survival2. The rate of premature birth about the world is increasing hurriedly, which is the main origin of neonatal death and ranks in second place as the most common reason of mortality in children under the age of five. More or less 13 million premature babies are born worldwide. Preterm is a major communal health problem in many mounting countries including India. It recorded the highest number of births of babies born before time, at 35.19 lakh children in 2010. Almost 13% of all children born in India were born too soon, while China ranked second. The rate of preterm birth in India is approximately 21%. In Tamil Nadu around 20 per cent of women go for pre-term birth3.

Effectual neonatal care can grasp up their growth and survival. Accessibility of sophisticated high technology has rebellion the care of preterm and sick neonates, but the technology should not become an obstacle against the communication, compassion and anxiety of the treating team and the family. Ayurveda recommends usage of five senses to interact with the environment in order to create balance in the energy in definite pathways that correspond to physiological systems. The five senses are touch, smell, vision, hearing and taste, through massage and other specific bodywork technique especially auditory stimulation which allows the body to heal itself naturally by energy flow cordially through these pathways4. Tactile stimulation is part and 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 sensations that play an important role in the development of the infant. The skin is having intimate contact with the Central Nervous System.

Tactile stimulation is thus an intervention that may be useful in premature neonates and newborns with low birth weight because it enhances child development, including brain, physical, emotional, mental and social development5. Performing massage therapy for infants in NICU is a kind of alternative treatment that has been the subject of long debates. Studies showed that tactile stimulation (massage therapy) along with auditory stimulation (music therapy) is highly effective than tactile stimulation alone because music is an art form whose medium is sound and silence.

JUSTIFICATION

Neonatal health is undoubtedly one of the most significant health challenges, facing the developing world. Adequate and appropriate care could prevent the neonatal mortality rate. Tactile stimulation enhances the bonding, improves sleep pattern, stimulate circulation, improves digestion, facilitates food absorption, results faster weight gain and the infants level of stress hormone reduces as a result it improves immune function6. Massage or touch therapy is a natural and almost instinctive way to care.

Auditory stimulation improves oral feeding among premature neonates. and the rate of Feeding7. Auditory stimulation (Music) brings positive changes in mood, promotes emotional intimacy with parents and family and reduces stress and anxiety. The right type of music helps a person healthy; physically as well as mentally relax by soothing the nerves.

Tactile and Auditory stimulation, promotes the weight gain, increases appetite, improve in sucking behavior, thermoregulation, positive effects on neurobehavioral pattern, enhance mother to child bonding and induce sleep to the infants, which helps the preterm neonates to improve health status as like term infants and decreases the mortality, morbidity rate. There are studies proved that the hospital stay has been significantly reduced by tactile and auditory stimulation8.

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 reduces the infant morbidity and mortality rate and helps to maintain and improve the normal physiological parameters including weight. Thus the investigator has taken an effort to measure weight gain by giving tactile and auditory stimulation in the clinical setting.

AIMS AND OBJECTIVES

This study had the following two objectives:

- To observe and compare the weight gain pattern among the Preterm Infants who had received tactile and auditory stimulation with those who had not received the same.
- To find out the association of selected variables such as Gestational Age, Age, Gender, Birth weight, APGAR score, Mode of delivery, Order of Birth with the weight gain after tactile & auditory stimulation.

MATERIALS AND METHODS

Study Design and Settings: An experimental research design was adopted for this study. In this study, target population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g. The accessible population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted into the neonatal care units of KanyaKumari Medical College Hospital, Nagercoil.

Sample Size Calculation: The size of the study population was calculated using OpenEpi, Version3, Open source calculator. With the mean difference of weight gain between the groups as 100gm, 95% Confidence Interval and 90% Power, the sample size was estimated to be 60 on each group. All the preterm neonates who got admitted in NICU, Kanya kumari Government Medical College Hospital between 01/07/2013 to 15/06/2014 and who fulfilled the following inclusion and exclusion criteria and given consent were included as study samples.

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 to 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.
- Abandoned preterm neonates.
- Preterm neonates with Ryle's tube feeding and Expressed Breast feeding.

Totally 120 preterm neonates as study samples were selected using the above Inclusion and Exclusion criteria. Then Simple Randomization was done to divide them in to two equal comparable groups. Thus the required 60 Experimental group study samples and 60 Control group study samples had been selected. The tool (Questionnaire) used in this study was developed and modified after a Pilot study. It consists of 3 parts. The first part was demographic variables, the second part was observation checklist and the third part was Structured Interview Schedule on physiological parameters.

Ethical Consideration: The proposed study was conducted after getting approval from the Institutional Ethical Committee of Sacred Heart Nursing College and Screening committee of Dr. M.G.R. Medical University, Chennai and written permission from Dean, KanyaKumari Medical College Hospital, Nagercoil. Consent of each subject was obtained from the parents before starting the data collection. Assurance was given to them that the secrecy of each subject would be maintained.

Procedure: After getting consent from mothers, one drop of oil would be poured over the selected preterm neonate's forearm to find out the hypersensitivity and waited for 30 minutes. If they exhibit no hypersensitivity reaction, expose the body parts one by one as per the manual to give stimulation. Pre warm the oil by rubbing it between the palms. Tactile stimulation was given for 10 minutes as per the prepared manual along with the auditory stimulation (recorded lullaby was played by the tab) to the experimental group twice daily for 5 consecutive days. Post evaluation was done to both control and experimental group on the third and fifth day after giving tactile and auditory stimulation by using the same tool.

Data analysis: The data obtained was entered in Excel Spreadsheet and was analyzed by both descriptive and inferential statistics, on the basis of objective and the study hypothesis. SPSS software version 20 was used for statistical analysis.

RESULTS

There were 120 subjects in this study who were randomized to Experimental and Control groups of 60 subjects in each group. Table 1 shows the basic characteristic of the subjects and its distribution between groups.

Out of 120 preterm neonates 58 were males and 62 were females. Regarding the religion of the preterm neonates in which Hindus were 51 out of 120 and 63 were Christians and 6 were Muslims. Regarding the mode of birth of the pre term neonates, out of 120 pre term neonates 45 were born by normal vaginal delivery, 7 by Instrument delivery and 68 were born by LSCS. Regarding the order of birth of the preterm neonates, out of 120 preterm neonates 51 were born by first order, 56 were born by second order and 3 were born by third order.

Regarding the APGAR score at birth of the preterm neonates, out of 120 preterm neonates 22 had 5 /10, 45 had 6 / 10, 41 had 7 /10 and 12 had 8 /10. Regarding the APGAR score at 5 minutes of the preterm neonates, out of 120 preterm neonates 69 had 7 /10, 41 had 8 / 10 and 10 had had 9 /10. Regarding the gestational age category of the preterm neonates, out of 120 preterm neonates 22 were between 28 to 30 weeks, 48 have the gestational age group between 31 to 33 weeks and 50 have the gestational age between 34 to 36 weeks. Regarding the age category of the preterm neonates, out of 120 preterm neonates 54 were between 10 to 14 days, 42 were in the age group between 15 to 19 days and 24 were in the age group between 20 to 24 days. Regarding the birth weight category of the preterm neonates, out of 120 preterm neonates 22 were between 1000 to 1350 grams, 48 have the birth weight group between 1310 to 1650 grams and 50 have the birth weight between 1660 to 2000 grams.

Table 1- General 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%)			
Religion	Hindu	51	25 (49.0%)	26 (51.0%)	0.826	2	0.661
	Christian	63	33 (52.4%)	30 (47.6%)			
	Muslim	6	2 (33.3%)	4 (66.7%)			
MOB	Normal Vaginal Delivery	45	19 (42.2%)	26 (57.8%)	3.845	2	0.146
	Instrumental Delivery	7	2 (28.6%)	5 (71.4%)			
	LSCS	68	39 (57.4%)	29 (42.6%)			
OOB	First Order	51	28 (54.9%)	23 (46.3%)	1.866	3	0.601
	Second Order	56	25 (44.6%)	31 (55.4%)			
	Third Order	3	1 (33.3%)	2 (66.7%)			
	Twins	10	6 (60.0%)	4 (40.0%)			
APGAR @ Birth	5	22	12 (54.5%)	10 (45.5%)	1.824	3	0.610
	6	45	19 (42.2%)	26 (57.8%)			
	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%)	0.972	2	0.615
	8	48	23 (56.1%)	18 (43.9%)			
	9	50	5 (50.0%)	5 (50.0%)			
Gestational Age	28 – 30 Weeks	22	10 (45.5%)	12 (54.5%)	0.585	2	0.746
	31 – 33 Weeks	48	23 (47.9%)	25 (52.1%)			
	34 – 36 Weeks	50	27 (54.0%)	23 (46.0%)			
Age Category	10 – 14 Days	54	26 (48.1%)	28 (51.9%)	0.836	2	0.658
	15 – 19 Days	42	20 (47.6%)	22 (52.4%)			
	20 – 24 Days	24	14 (58.3%)	10 (41.7%)			
Birth Weight Category	1000 –1300 grams	22	09 (40.9%)	13 (59.1%)	0.891	2	0.641
	1310 – 1650 grams	48	25 (52.1%)	23 (47.9%)			
	1660 – 2000 grams	50	26 (52.0%)	24 (50.0%)			

From the Table 1, as the p-Values for the differences in the demographic variables between groups are higher than 0.05, this shows that they are not statistically significant and so both the groups are comparable.

In Experimental group, the mean value of weight in pre- intervention was 1597.67 grams and the standard deviation was 173.90. In post-intervention on 3rd day, the mean and the standard deviation values were 1707.50 grams and 176.4 respectively. At post-intervention on 5th day, the mean and the standard deviation values were 1774.00 grams and 184.93

TABLE - 2 Weigh Measurements of Experimental Group (N=60)

Weight – Experimental Group	Mean	SD
Pre Intervention	1597.67	173.90
Post Intervention on 3rd Day	1707.50	176.41
Post Intervention on 5th Day	1774.00	184.93

TABLE - 3 Weigh Measurements of Control Group (N=60)

Weight – Control Group	Mean	SD
Pre Intervention	1608.00	168.41
Post Intervention on 3rd Day	1686.17	175.17
Post Intervention on 5th Day	1726.33	182.18

Table - 4 Comparison of Mean Weight between Experimental and Control group

Weight	Experimental Group		Control Group		T- Value	p- Value
	Mean	SD	Mean	SD		
Pre Test	1597.67	173.90	1608.00	168.41	0.109	0.742
Post Test 3rd Day	1707.50	176.41	1686.17	175.17	33.68	**0.000***
Post Test 5th Day	1774.00	184.93	1726.33	182.18	62.21	**0.000***

* Significant at 0.01 level.

respectively. It shows the mean weight gain on 3rd and 5th day after receiving tactile and auditory stimulation were 109.83grams and 177 grams respectively.

In Control group, the mean value of weight in pretest was 1608 grams and the standard deviation was 168.41. In post-intervention on 3rd day, the mean and the standard deviation values were 1686.17 grams and 175.17 respectively. At post-intervention on 5th day, the mean and the standard deviation value were 1726.33 grams and 182.18 respectively. It shows the mean weight gain on 3rd and 5th day on Control who did not receive tactile and auditory stimulation was only 78.17grams and 118.33 grams respectively which was less as compared to Experimental group.

Table 4 shows the mean pretest value of weight in both groups are not statistically significantly different as 'p' value is 0.742. The mean posttest score on 3rd day in the experimental group is 1707 and the same in control group is 1686.17. This difference is statistically significant as the 'p' value is < 0.001. The mean post test score on 5th day in the experimental group is 1774 and the same in control group is 1726.33. This difference is also statistically significant as the 'p' value is < 0.001.

Table 5 shows the mean weight gain in pre term neonates in post - intervention 3rd day was 109.83 grams & 78.16 grams in Experimental and control group respectively. At post- intervention 5th day the mean weight gain among pre term neonates was 176.33 and 118.33 grams respectively. The weight gain in both experimental & control group in post- intervention 3rd day and post- intervention 5th day were statistically

Fig 1. Box plot showing Weight Gain in the Experimental and Control group

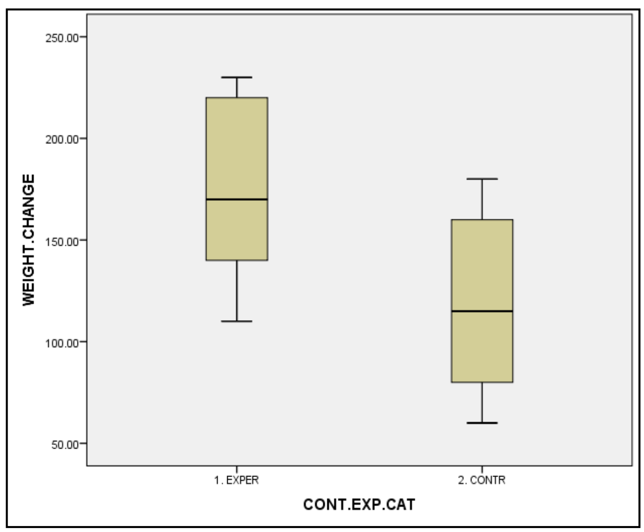


Table – 5 Comparison of Weight Gain between Experimental and Control group

Group	Category	Mean	SD	Paired Difference Mean	Paired Difference SD	't' - Value	p - Value
Experimental	POST.WT.3D	1707.50	176.41	109.83	28.73	29.613	**0.000**
	PRE.WT	1597.67	173.90				
	POST.WT.5D	1774.00	184.93	176.33	38.62	35.368	**0.000**
	PRE.WT	1597.67	173.90				
Control	POST.WT.3D	1686.17	175.17	78.16	31.00	19.532	**0.000**
	PRE.WT	1608.00	168.41				
	POST.WT.5D	1726.33	182.18	118.33	41.87	21.892	**0.000**
	PRE.WT	1608.00	168.41				

Table - 6 Association between Demographic variables and Weight gain

Factors	Category	Total	Weight Gain		't' Value	p Value
			Mean	SD		
Gestational Age	28 – 30 Weeks	10	132.00	15.73	26.150	**0.000**
	31 – 33 Weeks	23	164.34	29.18		
	34 – 36 Weeks	27	202.96	31.10		
Age Category	10 – 14 Days	26	213.07	22.76	86.123	**0.000**
	15 – 19 Days	20	157.50	17.43		
	20 – 24 Days	14	135.00	15.56		
Gender	Male	30	175.33	42.16	0.040	0.843
	Female	30	177.33	35.42		
Birth Weight Category	1000 –1350 grams	9	133.33	15.72	21.931	**0.000**
	1310 – 1650 grams	25	164.40	29.17		
	1660 – 2000 grams	26	202.69	34.12		
APGAR @ 5 Mins	7	32	172.81	40.17	0.495	0.612
	8	23	182.60	37.56		
	9	5	170.00	36.74		
MOB	Normal Vaginal Delivery	19	187.89	34.25	1.692	0.193
	Instrumental Delivery	2	195.00	35.35		
	LSCS	39	169.74	39.96		
OOB	First Order	28	185.00	39.67	2.058	0.116
	Second Order	25	174.800	33.92		
	Third Order	1	170.00	-		
	Twins	6	143.33	42.73		

significant as compared to the pretest weights. But comparatively the weight gain in Experimental group was higher than the weight gain in control groups as inferred from corresponding 't' values which were more for experimental group than control group. This is also shown as the Box plot picture as in Figure 1.

Factors associated with Weight Gain in Experimental group

The mean weight gain on 5th post intervention day among the Experimental group was 176.33 with the SD of 38.62 grams. The minimum weight gain was 110 grams and the maximum weight was 230 grams in pre term neonates after tactile and auditory stimulation. The demographic factors associated with this weight gain was analysed as shown in Table 6 and Figure 2.

Table 6 shows the association between 5th day post intervention weight gain and demographic variables. As the p value was less than 0.01 level for Gestational age category, Birth weight category, Age category of the children, there was a significant association between Gestational age, Age and Birth weight. After the Multiple Logistic Regression analysis, Gestational Age category and Age category are the significant factors associated

Table 7 Demographic Factors and Weight gain – Multiple Logistic Regression Analysis

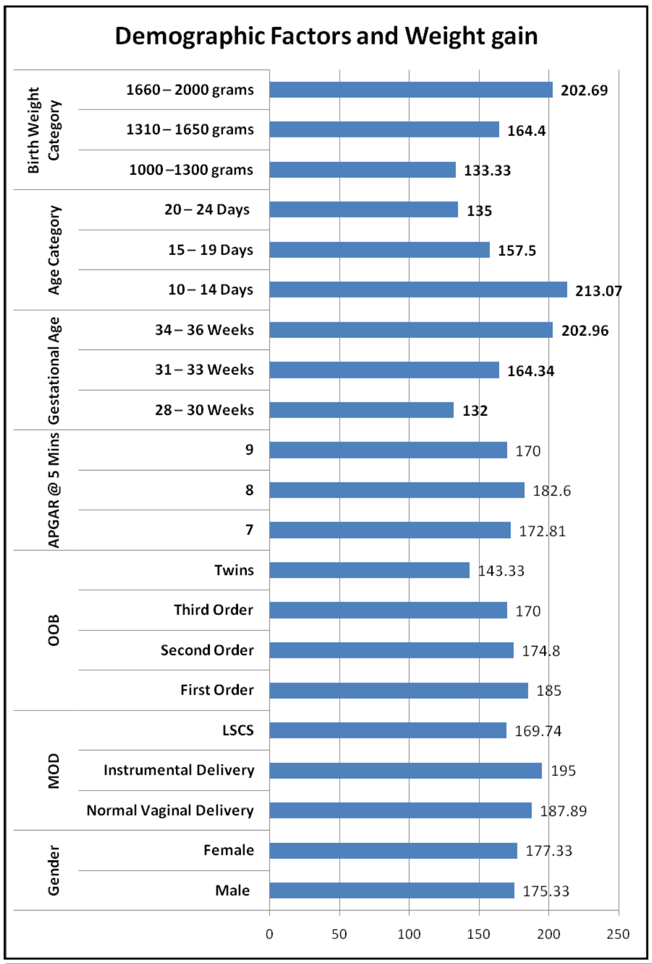
Variables	B	S.E	Beta	t	Sig.
Gestational Age Category	25.592	8.882	0.489	2.881	**0.006**
Age Category	-35.402	4.478	-0.732	-7.906	**0.000**
Sex	0.886	5.432	0.012	0.163	0.871
Birth Weight Category	-12.846	9.752	-0.238	-1.317	0.194
Apgar @ 5 mins	-4.584	4.180	-0.077	-1.097	0.278
Mode of Delivery	1.755	2.860	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	0.000

with Weight gain on 5th post intervention day as shown in the Table 7.

DISCUSSION

Preterm is a most important communal health crisis in all developing countries including India. The sensory stimulated preterm neonates by the intervention , tactile and auditory stimulation have greater weight gain, fewer hospital days, fewer stress behaviors, and accelerated brain maturation; all with no adverse outcomes. Despite all these probable benefits, only one third of NICU's offer tactile and auditory stimulation to their preterm infants or provide information and / or instructions to parents / caregivers about massage therapy for their preterm infants.

Figure 2 Bar Chart showing Demographic Factors and Weight Gain



In this study, among the Experimental group, the mean weight gain on 3rd and 5th day after receiving tactile and auditory stimulation were 109.83grams and 177 grams respectively. Among Control group, the mean weight gain on 3rd and 5th day on Control who did not receive tactile and auditory stimulation was only 78.17grams and 118.33 grams respectively which was significantly less as compared to Experimental group. It shows that there was an accelerated weight gain in those who received tactile and auditory stimulation as compared to those who did not receive the same.

These results are supported by a study conducted by John N. I. Dieter et al concluded that Five Days of Massage would increased Weight Gain in Stable Preterm Infants which concluded more weight gain experimental group than in controls9. Another study conducted by Partovi, S. et al10 concluded that the mean weight gain after 7 days of therapy were 105±1.3g, 52± 0.1g and 54 ± 1.3g respectively in the group with MCT oil massage, the group with massage without oil and the control group. These differences were statistically significant only between the MCT oil massage group and the massage group (P=0.002) and also between the MCT oil massage group and the control group (p=0.000).

In the present study the mean weight gain in massage group on post 5th day was 177±1.8 g and also in the present study, weight gain in massage group (11.6 g /day) which was higher than the weight gain in the massage group of nurses & mothers in a randomized clinical trial study conducted by Zohreh Badiee et al11 in Iran. In this Iran study, Weight Gain in Premature Infants by massage was 6.5+1.5 g / day in the nurse group, 4.6 +1 g/day in the mother group and 3.7+1 g/day in the control group, p=0.001 and those who were massaged by their mothers also gained weight significantly more than the control group (P =0.05).

The mean weight gain on 5th post intervention day among the Experimental group was 176.33 with the SD of 38.62 grams. The minimum weight gain was 110 grams and the maximum weight was 230 grams. Gestational Age category and Age category are the statistical significant factors associated with Weight gain on 5th post intervention day in the experimental group. This shows that while considering the beneficial effects of tactile and auditory stimulation on Preterm babies, we need to consider these factors too for consideration for a favorable outcome.

CONCLUSION

This study concluded that the weight gain in the experimental group of preterm babies who had received tactile and auditory stimulation is significantly high as compared to the controls who had not received the same. So the tactile and auditory stimulation has the accelerated weight gain effect. This weight gain is significantly associated with the age and gestational age of the preterm babies receiving the stimulation.

REFERENCES:

Noah H. Hillman, Suhas G. Kallapur and Alan H. Jobe. 2012. Physiology of Transition from Intrauterine to Extrauterine Life. Clinics in Perinatology. Volume 39, Issue 4, December 2012, Pages 769–783. **doi:**10.1016/j.clp.2012.09.009.

Daynia E Ballot, Tobias F Chirwa and Peter A Cooper. Determinants of survival in very low birth weight neonates in a public sector hospital in Johannesburg. BMC Pediatrics 2010, 10:30 **doi:**10.1186/1471-2431-10-30.

Late pre-term births - A cause for concern. The Hindu Chennai. 2013 Nov 23. Available at: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/ late-preterm-births-a-cause-for-concern/article5362664.ece.

Sanjeev Rastogi. 2010. Building bridges between Ayurveda and Modern Science. Int J Ayurveda Res. 2010 Jan-Mar; 1(1): 41–46. doi: 10.4103/0974-7788.59943.

Faranak Aliabadi and Reihaneh K. Askary. 2013. Effects of Tactile–Kinesthetic Stimulation on Low Birth Weight Neonates. Iran J Pediatr. 2013 Jun; 23(3): 289–294.

James S. Gordona and Denise Murray Edwards. 2005. Mind Body Spirit Medicine. Seminars in Oncology Nursing , Volume 21 , Issue 3 , 154 - 158

Tiffany Field, Miguel Diego and Maria Hernandez-Reif. 2010. Preterm Infant Massage Therapy Research: A Review. Infant Behav Dev. 2010 Apr; 33(2): 115–124.

Rosemary White-Traut and Kathleen Norr. 2013. An Ecological Model for Premature Infant Feeding. J Obstet Gynecol Neonatal Nurs. 2009 Jul-Aug; 38(4): 478–490.

John N. I. Dieter, Tiffany Field, Maria Hernandez-Reif, Eugene K. Emory, and Mercedes Redzepi. 2003. Stable Preterm Infants Gain More Weight and Sleep Less after Five Days of Massage Therapy. Journal of Pediatric Psychology, 2003; 28 (6) : 403–411

Partovi S, Kianifar H, Gholami Robatsangi M, Ghorbani Z and Saeidi R. 2009. Evaluation of massage with oil containing medium chain triglyceride on weight gaining in preterm. Koomesh. 2009; 11 (1) : 1-6. . Availabe at http://koomeshjournal.semums.ac.ir/browse.php?a_code=A-10-4-385&slc_lang=en&sid=1

Zohreh Badiee, Shiva Samsamshariat and Pegah Pourmorshed. 2012. Effect of Massage on Weight Gain in Premature Infants , Iranian Journal of Neonatology Summer 2012. Vol. 3, No.2. Pages 57-62.

Journal of Research in Public Health
An International Scientific Research Journal
ISSN - Print: 2319 - 1627; Online: 2319 - 1635

Original Research Paper

Effect Of Tactile And Auditory Stimulation On Sleeping Pattern Among Preterm Infants

Authors:

Majella Livingston L .M[1] ,
Nalini Jeyavantha Santha[2],
Jeya Singh[3],
Pethuru Devadason[4].

Institution:

[1]Research Scholar (Ph.D – Nursing), The Tamilnadu Dr. M.G.R. Medical University, Chennai, Tamilnadu, India.

[2]Principal, Sacred Heart Nursing College, Madurai, Tamilnadu, India.

[3]Former Professor and Head, Department of STD, Coimbatore Medical College, Coimbatore, Tamilnadu, India.

[4]Professor, Department of Community Medicine, SMIMS, Kulasekharam, Tamilnadu, India.

Corresponding author:

Majella Livingston L .M

ABSTRACT:

Introduction: Touching and hearing are the first two communications a baby receives. Tactile stimulation enhances the bonding, improves sleep pattern, stimulate circulation, improves digestion, facilitates food absorption, results faster weight gain and the infants level of stress hormone reduces as a result it improves immune function. Even though tactile and auditory stimulations are traditionally practiced in India, it is not routinely practiced in the hospital setting.

Objectives: To assess and compare the sleeping pattern of preterm babies who had received the tactile and auditory stimulation and those who had not received the same.

Methodology: In this experimental research design, 120 preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted into the neonatal care units of KanyaKumari Medical College Hospital, Nagercoil were randomized in to two equal experimental and control groups. A pilot tested tool was developed to measure the demographic factors and sleeping pattern on the pre intervention, 3rd day and 5th day of the tactile and auditory stimulation. Data was entered in Excel and analyzed with SSPS version 20.

Results: Of the total 120 preterm neonates 58 were males and 62 were females. There is a steady improvement in the Duration per Sleep and the Sleeping hours per Day on 3rd and 5th post- intervention days as compared to the pre- intervention in the study subjects. Among the experimental group, both in the duration per sleep and sleeping hours per day, there was a steady improvement on 3rd and 5th post- intervention days. Among the control group also these were increased significantly but when comparing to experimental group it was lower than the experimental group who received tactile and auditory stimulation.

Conclusion: There is a significant difference between the Duration per Sleep and Sleeping hours per Day of the pre term neonates between the Experimental and Control group at post - intervention 5rd day which was higher than the post - intervention 3rd day. So the tactile and auditory stimulation has the positive impact on the favorable sleeping pattern among the preterm infants.

Keywords:

Tactile Stimulation, Auditory Stimulation, Sleeping Pattern, Preterm Babies.

Article Citation:

Majella Livingston L .M , Nalini Jeyavantha Santha, Jeya Singh, Pethuru Devadason.
Effect Of Tactile And Auditory Stimulation On Sleeping Pattern Among Preterm Infants
Journal of Research in Public Health (2014) 3(2): 11-19

Web Address:
http://jhealth.info/documents/PH0051.pdf.

Dates:

Received: 10 Nov 2014 /**Accepted: 02 Dec 2014** /**Published: 29 Dec 2014**

INTRODUCTION

Touching and hearing are the first two communications a baby receives. The first languages of its development are through the skin and ear. The newborn baby undergoes a conventional sequence of events to become accustomed the extra uterine life. When the baby is born much in advance than expected and when it is very little and week, the challenge to regulate the extra-uterine life is much better than for normal term babies. In general, the nearer they are to the normal term newborn in gestational age and birth weight, the easier will be their regulation to the external environment.

Preterm is a major communal health problem in many mounting countries including our own country. India recorded the highest number of births of preemies, or babies born before time, at 35.19 lakh children in 20101. Almost 13% of all children born in India were born too soon, while China ranked second. The rate of preterm birth in India is approximately 21%. In Tamil Nadu around 20 per cent of women go for pre-term birth2.

Touch is the first sense develops in human and it may be the very last to fade. Massage is the language of touch. Touch is one of the essential human needs. Touching induces oxytocin, the "bonding hormone / the hormone of love and attachment," that's renowned for reducing stress, lowering cortisol levels and increasing a sense of trust and security. Hugs strengthen the immune system, the gentle pressure on the sternum and the emotional charge, this creates activates the Solar Plexus Chakra. This stimulates the thymus gland, which regulates and balances the body's production of white blood cells, which keeps you healthy and disease free3."

Infant and children who endure from a deprivation of touch normally experience behavior abnormality in the later years. Reaction to tactile stimulation has been observed by ultra sound as early as an eight week of completed conceptual age. Tactile stimulation (a type of massage therapy) is thus an intervention that may be useful in premature neonates and newborns with low birth weight because it enhances child development, including brain, physical, emotional, mental and social development4.

Studies showed that tactile stimulation (massage therapy) along with auditory stimulation (music therapy) is highly effective than tactile stimulation alone because music is an art form whose medium is sound and silence. When the preterm infant first arrives in the NICU (Neonatal Intensive Care Unit) he or she is bounded by unfamiliar sounds and lies alone on a rigid, motionless mattress. Nurses working in the NICU play a vital role in providing an individualized complete care which includes tactile and auditory stimulation to prevent neonatal morbidity and mortality.

Tactile stimulation enhances the bonding, improves sleep pattern, stimulate circulation, improves digestion, facilitates food absorption, results faster weight gain and the infants level of stress hormone reduces as a result it improves immune function5. Auditory stimulation improves oral feeding among premature neonates. and the rate of Feeding. Auditory stimulation (Music) brings positive changes in mood, promotes emotional intimacy with parents and family and reduces stress and anxiety as evident by sleeping pattern. The right type of music helps a person healthy; physically as well as mentally relax by soothing the nerves.

Auditory stimulation is given by using exact raga 'Neelambari' through which playing music 'Lullaby' helps to relieve stress, induce sleep and growth. The raga Nelambari in the classical Indian Karnatic system of music is said to be able to induce sleep and also have some sleep promoting qualities6. Massage and music therapy can have a positive impact on quality of life and helps to improve one's mood . It has been reported that music is an excellent distracter and relaxant.

From above it is observed that tactile and auditory stimulation, promote thermoregulation, positive effects on neurobehavioral pattern, enhance mother to child bonding and induce sleep to the infants, which helps the preterm neonates to improve health status as like term infants and decreases the mortality, morbidity rate. There are studies proved that the stay hospital significantly reduced by tactile and auditory stimulation7. 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 reduces the infant morbidity and mortality rate and helps to maintain the normal physiological parameters. So this study has been undertaken to assess the effect of tactile and auditory stimulation on sleeping pattern of preterm babies in the clinical setting.

AIMS AND OBJECTIVES:

The main aim and objective of the study was to assess and compare the sleeping pattern of preterm babies who had received the tactile and auditory stimulation and those who had not received the same.

MATERIALS AND METHODS

Study Design and Settings: An experimental research design was adopted for this study. In this study, target population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g. The accessible population was preterm neonates who were born between 28 to 36 weeks of gestation and with a birth weight of 1000g to 2000g and admitted into the neonatal care units of KanyaKumari Medical College Hospital, Nagercoil. All the preterm neonates who got admitted in NICU, Kanya kumari Government Medical College Hospital between 01/07/2013 to 15/06/2014 and who fulfilled the following inclusion and exclusion criteria and given consent were included as study samples.

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 to 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

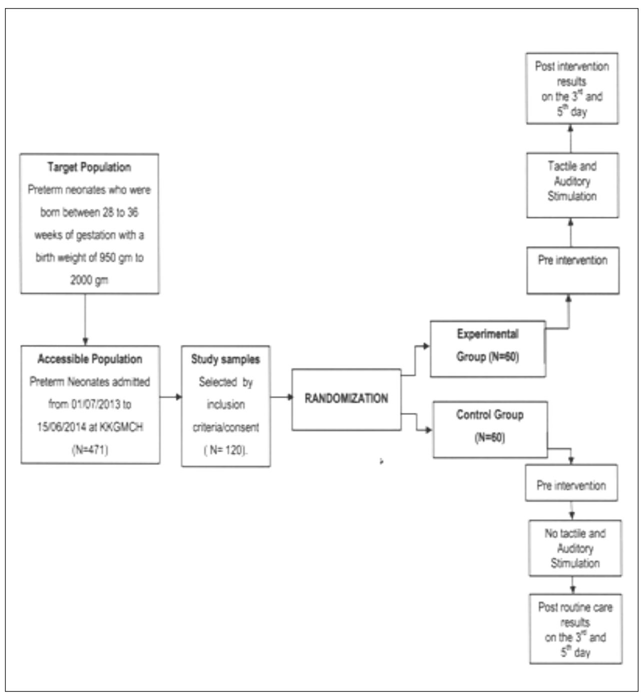


Fig 1. Pictorial Representation of Study Design and Selection of Study Subjects

infection & open wounds.

- Preterm neonates on sedatives.
- Preterm neonates on phototherapy treatment.
- Abandoned preterm neonates.
- Preterm neonates with Ryle's tube feeding and Expressed Breast feeding.

Totally 120 preterm neonates as study samples were selected using the above Inclusion and Exclusion criteria. Then Simple Randomization was done to divide them in to two equal comparable groups. Thus the required 60 Experimental group study samples and 60 Control group study samples had been selected. This is pictorially represented in Figure 1.

Sleeping Pattern: The tool (Questionnaire) used in this study was developed and modified after a Pilot study. It consists of 3 parts. The first part was demographic variables, the second part was observation checklist on physiological parameters and the third part was Structured Interview Schedule on including Sleeping pattern like Duration of sleep at a time and Sleeping hours per day.

Ethical Consideration: The proposed study was conducted after getting approval from the Institutional Ethical Committee of Sacred Heart Nursing College and Screening committee of Dr. M.G.R. Medical University, Chennai and written permission from Dean, KanyaKumari

Table 1- 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%)			
Religion	Hindu	51	25 (49.0%)	26 (51.0%)	0.826	2	0.661
	Christian	63	33 (52.4%)	30 (47.6%)			
	Muslim	6	2 (33.3%)	4 (66.7%)			
MOB	Normal Vaginal Delivery	45	19 (42.2%)	26 (57.8%)	3.845	2	0.146
	Instrumental Delivery	7	2 (28.6%)	5 (71.4%)			
	LSCS	68	39 (57.4%)	29 (42.6%)			
OOB	First Order	51	28 (54.9%)	23 (46.3%)	1.866	3	0.601
	Second Order	56	25 (44.6%)	31 (55.4%)			
	Third Order	3	1 (33.3%)	2 (66.7%)			
	Twins	10	6 (60.0%)	4 (40.0%)			
APGAR @ Birth	5	22	12 (54.5%)	10 (45.5%)	1.824	3	0.610
	6	45	19 (42.2%)	26 (57.8%)			
	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%)	0.972	2	0.615
	8	48	23 (56.1%)	18 (43.9%)			
	9	50	5 (50.0%)	5 (50.0%)			
Gestational Age	28 – 30 Weeks	22	10 (45.5%)	12 (54.5%)	0.585	2	0.746
	31 – 33 Weeks	48	23 (47.9%)	25 (52.1%)			
	34 – 36 Weeks	50	27 (54.0%)	23 (46.0%)			
Age Category	10 – 14 Days	54	26 (48.1%)	28 (51.9%)	0.836	2	0.658
	15 – 19 Days	42	20 (47.6%)	22 (52.4%)			
	20 – 24 Days	24	14 (58.3%)	10 (41.7%)			
Birth Weight Category	1000 –1300 grams	22	09 (40.9%)	13 (59.1%)	0.891	2	0.641
	1310 – 1650 grams	48	25 (52.1%)	23 (47.9%)			
	1660 – 2000 grams	50	26 (52.0%)	24 (50.0%)			

Medical College Hospital, Nagercoil. Consent of each subject was obtained from the parents before starting the data collection. Assurance was given to them that the secrecy of each subject would be maintained.

Procedure: After getting consent from mothers, one drop of oil would be poured over the selected preterm neonate's forearm to find out the hypersensitivity and waited for 30 minutes. If they exhibit no hypersensitivity reaction, expose the body parts one by one as per the manual to give stimulation. Pre warm the oil by rubbing it between the palms. Tactile stimulation was given for 10 minutes as per the prepared manual along with the auditory stimulation (recorded lullaby was played by the tab) to the experimental group twice daily for 5 consecutive days. Post evaluation was done to both control and experimental group on the third and fifth day after giving tactile and auditory stimulation by using the same tool.

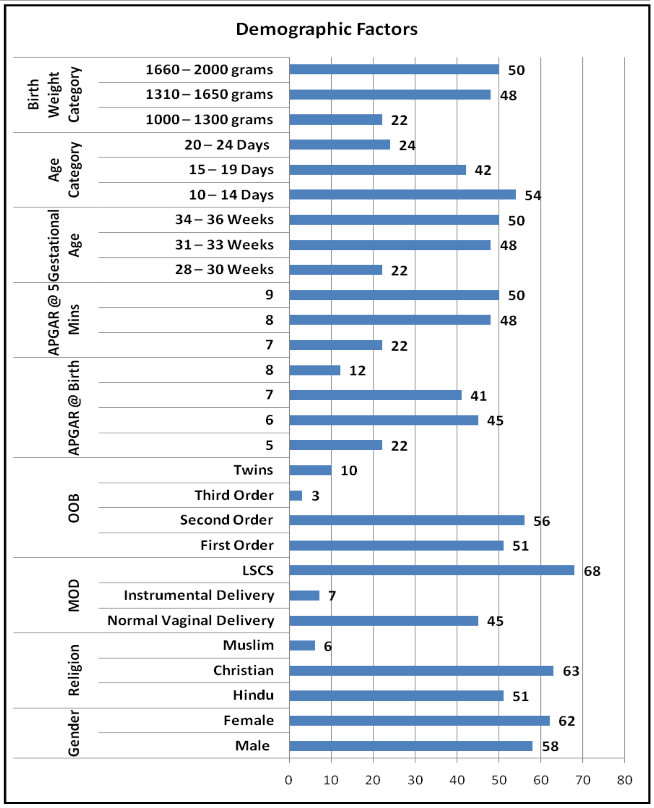


Fig 2 Showing the Demographic Factors of the Study population

Data analysis: The data obtained was entered in Excel Spreadsheet and was analyzed by both descriptive and inferential statistics, on the basis of objective and the study hypothesis. SPSS software version 20 was used for statistical analysis.

RESULTS

There were 120 subjects in this study who were randomized to Experimental and Control groups of 60 subjects in each group. Figure 1 shows the basic characteristics of the study population. Table 1 shows the basic characteristic of the subjects and its distribution between groups.

Out of 120 preterm neonates 58 were males and 62 were females. Regarding the religion of the preterm neonates in which Hindus were 51 out of 120 and 63 were Christians and 6 were Muslims. Regarding the mode of birth of the pre term neonates, out of 120 pre term neonates 45 were born by normal vaginal delivery, 7 by Instrument delivery and 68 were born by LSCS. Regarding the order of birth of the preterm neonates, out of 120 preterm neonates 51 were born by first order, 56 were born by second order and 3 were born by third order.

Regarding the APGAR score at birth of the preterm neonates, out of 120 preterm neonates 22 had 5 /10, 45 had 6 / 10, 41 had 7 /10 and 12 had 8 /10. Regarding the APGAR score at 5 minutes of the preterm neonates, out of 120 preterm neonates 69 had 7 /10, 41 had 8 / 10 and 10 had had 9 /10. Regarding the gestational age category of the preterm neonates, out of 120 preterm neonates 22 were between 28 to 30 weeks, 48 have the gestational age group between 31 to 33 weeks and 50 have the gestational age between 34 to 36 weeks. Regarding the age category of the preterm

Table 2 - Sleeping Pattern in the Study Population Before and After giving Tactile and Auditory Stimulation (N = 120)

Sleeping Pattern	Phase	Category	Number N=120	Percentage
Sleeping at time	Pre - intervention	1. < 30 minutes	22	18.3%
		2. 30mins– 1 hr	98	81.7%
		3. 1-2 hours	0	0.0%
	Post - intervention 3rd Day	1. < 30 minutes	8	6.7%
		2. 30mins– 1 hr	91	75.8%
		3. 1-2 hours	21	17.5%
	Post - intervention 5th Day	1. < 30 minutes	8	6.6%
		2. 30mins– 1 hr	71	59.2%
		3. 1-2 hours	41	34.2%
Sleeping hours per Day	Pre - Intervention	1. <10 hours	26	21.7%
		2. 10-18 hours	94	78.3%
		3. > 18 hours	0	0.0%
	Post - Intervention 3rd Day	1. <10 hours	17	14.2%
		2. 10-18 hours	77	64.2%
		3. > 18 hours	26	21.6%
	Post – intervention 5th Day	1. <10 hours	16	13.3%
		2. 10-18 hours	60	50.0%
		3. > 18 hours	44	36.7%

neonates, out of 120 preterm neonates 54 were between 10 to 14 days, 42 were in the age group between 15 to 19 days and 24 were in the age group between 20 to 24 days. Regarding the birth weight category of the preterm neonates, out of 120 preterm neonates 22 were between 1000 to 1350 grams, 48 have the birth weight group between 1310 to 1650 grams and 50 have the birth weight between 1660 to 2000 grams. These are shown in Figure 2.

From the Table 1, the p-Values for the differences in the demographic variables between groups show that they are not statistically significant and so both the groups are comparable.

Table 2 shows that there is a steady improvement in the Duration per Sleep and the Sleeping

Table 3- Comparison of Duration per Sleep among Preterm Neonates between Experimental and Control Groups

Sleeping at time	Duration Category	Total N=120	Group		Chi^2 Value	p –Value
			Experimental N=60	Control N=60		
Pre - interven-tion	1. < 30 minutes	22	14 (23.3%)	22 (13.3%)	2.004	0.157
	2. 30mins– 1 hr	98	46 (76.7%)	52 (86.7%)		
	3. 1-2 hours	0	0 (0.0%)	0 (0.0%)		
Post - inter-vention 3rd Day	1. < 30 minutes	8	0 (0.0%)	8 (13.3%)	26.520	**0.000***
	2. 30mins– 1 hr	91	40 (66.7%)	51 (85.0%)		
	3. 1-2 hours	21	20 (33.3%)	1 (1.7%)		
Post - inter-vention 5th Day	1. < 30 minutes	8	0 (0.0%)	8 (13.3%)	43.364	**0.000***
	2. 30mins– 1 hr	71	23 (38.3%)	48 (80.0%)		
	3. 1-2 hours	41	37 (61.7%)	4 (6.7%)		

* Significant at 0.01 level

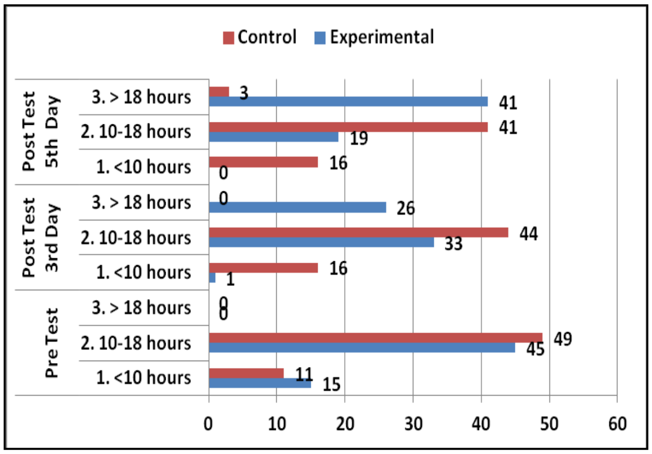


Fig - 3 Comparison of Duration per sleep between experimental and control groups

hours per Day on 3rd and 5th post- intervention days as compared to the pre- intervention.

Table 3 shows the duration per sleep in both Experimental and control group before the application of tactile and auditory stimulation. In pre intervention, since the Chi square value 2.004 was lower than the table value and the calculated P value was 0.157, there is no significant difference between the duration per sleep of the pre term neonates in experimental and control group.

In post - intervention 3rd day, since the Chi square value 26.520 was more than table value and the calculated p value was 0.000, there is a significant difference in the duration per sleep of the pre term neonates between experimental and control group at post - intervention 3rd day. In post -intervention 5th day, since the Chi square value 43.364 was more than the table value and the calculated p value was 0.000, there is a significant difference between the duration per sleep of the pre term neonates between the Experimental and Control group at post - intervention 5rd day which was higher than the post - intervention 3rd day. This is represented by the figure 3.

Table 4 shows the comparison of sleep hours per day in both experimental and control group before the application of tactile and auditory stimulation. In pre intervention, since the calculated Chi square value 0.786 was lower than the table value and the calculated p value was 0.375, there is no significant difference in sleeping hours per day of the pre term neonates between the experimental and control group in pre - intervention.

In post - intervention 3rd day, since the Chi square value 40.807 was more than the table value and the calculated p value was 0.000, there is a significant difference in the sleeping hours per day of the pre term neonates between experimental and control group at

Table 4 - Comparison of Sleeping hours per Day among Preterm Neonates between Experimental and Control Group

Sleeping hours per Day	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	**0.000***
	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	**0.000***
	2. 10-18 hours	60	19 (31.7%)	41 (68.3%)		
	3. > 18 hours	44	41 (68.3%)	3 (5.0%)		

* Significant at 0.01 level

post - intervention 3rd day. In post - intervention 5th day, since the calculated Chi square value 56.885 was more than the table value and the calculated p value was 0.000, there is a significant difference in the sleeping hours per day of the pre term neonates between experimental and control group at post - intervention 5rd day which was higher than the post- intervention 3rd day. This is represented by the figure 4.

DISCUSSION

It is commonly acknowledged that shorter the gestational age, smaller the body, higher is the risk of death, morbidity, poor sucking, loss of weight, respiratory distress, hypothermia and disability which have revealed that the mortality rate differ 100 folds across the continuum. That is more than one in 10 babies died in each year in the world. The sensory stimulated preterm neonates by the intervention, tactile and auditory stimulation had fewer hospital days, fewer stress behaviors, and accelerated brain maturation; all with no adverse outcomes8.

Among the experimental group, in the duration per sleep, there is a steady improvement in the duration per sleep on 3rd and 5th post- intervention days. Among

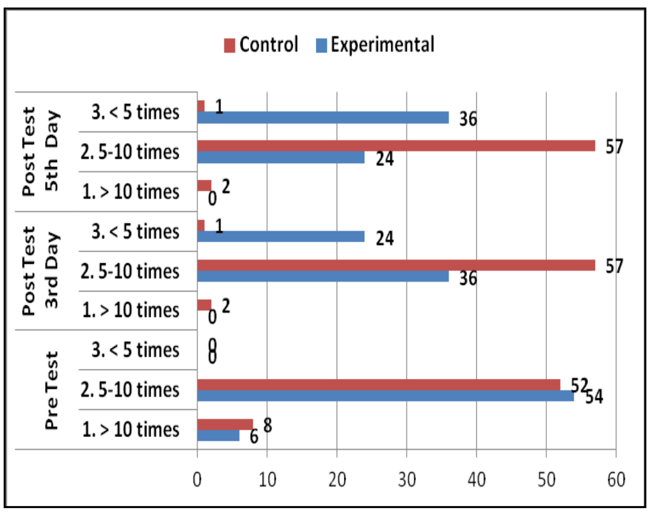


Fig -4 Comparison of Sleeping hours per day between experimental and control groups

the control group also the duration per sleep were increased significantly but when comparing to experimental group it was lower than the experimental group who received tactile and auditory stimulation.

This scenario is comparable with study on low birth weight infants in Russia by Dieter et al which concluded that sleep-disordered breathing in infants born with LBW were improved who were massaged from 2-8 months of life. The study also demonstrated that massaged infants were also highly alert at day time, awake less times in night for feeding, low snoring suggesting that massage helped infants to achieve more effective sleeping9.

Among the experimental group, in sleeping hours per day, there is a steady improvement in the sleeping hours per day on 3rd and 5th post- intervention days. Among the control group also the sleeping hours per day were increased significantly but when comparing to experimental group it was lower than the experimental group who received tactile and auditory stimulation.

The following studies are supporting the present study. Massage is more effective and mature sleep patterns, allowing growth and more efficient body repair. Dieter et al9 concluded that massage stimulation in preterm babies was a cost effective management in all diseases of premises and they were expected to stay at hospital lesser time than the non massage babies. The study done regarding the frequency of sleeping by Tiffany Field10 on "Preterm infant massage therapy studies: an American approach" which concluded that the massage group preterm neonates had less hours of sleeping than the control groups

CONCLUSION

There is a steady improvement in the Duration per Sleep and the Sleeping hours per Day on 3rd and 5th post- intervention days as compared to the pre-intervention. There is a significant difference between the Duration per Sleep of the pre term neonates between the Experimental and Control group at post - intervention 5rd day which was higher than the post - intervention 3rd day. There is also a significant difference in the Sleeping hours per Day of the pre term neonates between experimental and control group at post - intervention 5rd day which was higher than the post- intervention 3rd day. So this study concludes that the tactile and auditory stimulation has the positive impact on the favorable sleeping pattern among the preterm infants.

REFERENCES:

Blencowe, H., Cousens, S., Chou, D., Oestergaard, M., Say, L., Moller, A.-B., Kinney, M and Lawn, J. (2013). Born Too Soon: The global epidemiology of 15 million preterm births. Reproductive Health, 10 (Suppl 1), S2. **doi:**10.1186/1742-4755-10-S1-S2.

Late pre-term births - A cause for concern. The Hindu Chennai. 2013 Nov 23. Available at: http:// www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/ late-preterm-births-a-cause-for-concern/ article5362664.ece.

Keltner, Dacher. 2010. "Hands on Research: The Science of Touch." The Psychology of Wellbeing. N.p., 5

Tiffany Field, Miguel Diego and Maria Hernandez-Reif. 2010. Preterm Infant Massage Therapy Research: A Review. Infant Behav Dev. 2010 Apr; 33(2): 115–124.

Ben Godde, Beate Stauffenberg, Friederike Spengler, and Hubert R. Dinse. 2000. Tactile Coactivation-Induced Changes in Spatial Discrimination Performance. The Journal of Neuroscience, 20(4):1597–1604.

Gitanjali B. 1998. Effect of the Karnatic music raga "Neelambari" on sleep architecture. Indian J Physiol Pharmacol. 1998 Jan;42(1):119-22.

Kelmanson, I. A. & Adulas, E. I. (2006). Massage therapy and sleep behavior in infants born with low birth weight. Complementary Therapies in Clinical Practice, 12, 200-205. doi:10.1016/j.ctcp.2005.11.007

Faranak Aliabadi and Reihaneh K. Askary. 2013. Effects of Tactile–Kinesthetic Stimulation on Low Birth Weight Neonates. Iran J Pediatr. 2013 Jun; 23(3): 289–294.

Dieter, J. N., Field, T., Hernandez-Reif, M., Emory, E. K., & Redzepi, M. (2003). Stable preterm infants gain more weight and sleep less after five days of massage therapy. Journal of Pediatric Psychology, 28(6), 403-411.

Tiffany Field. 2002. Preterm infant massage therapy studies: An American approach. Seminars in Neonatology, 7, 487–494.