"TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY"

BY

REG NO: BM0122012

Dissertation

Submitted to the KLE Academy of Higher Education and Research, Belagavi, Karnataka

In Partial Fulfilment

of the Requirements for the Degree of

M.D. (Doctor of Medicine)

in

PEDIATRICS

DEPARTMENT OF PAEDIATRICS
JAWAHARLAL NEHRU MEDICAL COLLEGE,
BELAGAVI, KARNATAKA

SEPTEMBER /OCTOBER 2025

KLE ACADEMY OF HIGHER EDUCATION AND RESEARCH,

BELAGAVI, KARNATAKA.

Endorsement

This is to certify that the dissertation entitled "**TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY"** is a bonafide research work done by **REG NO: BM0122012.**

DR DNYANESH D K M.D., L.L.B
Professor & Head
Department of Pediatrics
J N Medical College
KAHER
Belagavi, Karnataka

Dr Dnyanesh D.K
PROFESSOR & HEAD
DEPARTMENT OF PEDIATRICS
J. N. Medical College, Belagavi

Date: 09/04/2025
Place: JNM, Belagavi

DR N S MAHANTASHETTI M.D.
Principal
J N Medical College
KAHER
Belagavi, Karnataka

PRINCIPAL
Jawaharlal Nehru Medical College
BELAGAVI

Date: 09/04/2025
Place: JNMC, Belagavi

UNDERTAKING

I, **REG NO: BM0122012**, hereby declare that the information and data mentioned in my dissertation entitled "**TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY"** belongs to me and is original. I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author.
- A piece of writing or other work reflecting such unauthorized use or imitation.
- The deliberate or reckless representation of another's words, thoughts or ideas as one's own without attribution in connection with submission of academic work whether graded or otherwise.

I hereby declare that the dissertation prepared by me is original one and does not involve plagiarism anywhere. In case at a later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the institution is at liberty to take any disciplinary action against me including cancellation of dissertation or any other penalties imposed by the University.

Date: 09-04-2025

Place: JNMC, Belagavi **(REG NO: BM0122012)**

PLAGIRISM CLERANCE

JAWAHARLAL NEHRU MEDICAL COLLEGE
(A constituent unit of KLE Academy of Higher Education & Research Deemed-to-be-University)
(Recognized by National Medical Commission, New Delhi)
Accredited 'A+' Grade by NAAC (3rd Cycle) Placed in Category 'A' by MoE (GoI)
Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA
0831 – 2471350 0831 – 2470759 www.jnmc.edu principal@jnmc.edu

Ref No: MDC/PG/ Date: 09-04-2025

"ACCEPTANCE LETTER"

The softcopy of thesis entitled: **"TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY"** has been submitted for anti-plagiarism check through Turnitin software. The scan has been carried out and the scanned output reveals a match percentage of **04%** which is within the acceptable limits of **10%** as per the guidelines given by UGC.

Guide.

Dr. (Mrs.) N.S. Mahantashetti.
Chairperson-Antiplagiarism Committee &
Principal,
J. N. Medical College, Belagavi.

To,
Reg. No. BM0122012
Postgraduate Student,
2022-23 Batch,
Department of Paediatrics
J. N. Medical College, Belagavi.

ETHICAL CLERANCE

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A+' Grade by NAAC in (3rd Cycle) Placed in Category 'A' by MHRD (GoI)

JNMC INSTITUTIONAL ETHICS COMMITTEE
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)

Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

DHR Reg. No. EC/NEW/INST/2024/KA/0548

Ref No.MDC/JNMCIEC/ 432.

Date: 28/08/2024

To,

REG NO: BM0122012
PG Student in Paediatrics
J. N. Medical College,
BELAGAVI.

Sub : Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRAIL STUDY"** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

(Dr. Smita Sonoli)
Member Secretary
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi

LIST OF ABBREVIATIONS

ABBREVATION	EXPANSION OF ABBREVATION
KMC	Kangaroo Mother Care
RCT	Randomised control trial
WHO	World health organisation
LMP	Last menstrual period
LBW	Low birth weight
RDS	Respiratory distress syndrome
BPD	Bronchopulmonary dysplasia
IVH	Intraventricular haemorrhage
PVL	Periventricular leukomalacia
NEC	Necrotizing enterocolitis
iKMC	Immediate KMC
NICU	Neonatal Intensive Care Unit
NG	Nasogastric
OG	Orogastric
GI	Gastrointestinal
GT	Gastrostomy
SDG	Sustainable developmental goals
PTB	Preterm Birth
GER	Gastroesophageal Reflux

NNS	Non - Nutritive Suck
IPAT	Infant position assessment Tool
CABM	Cried after bag and mask
CAS	Cried after stimulation
CIAB	Cried immediately after birth
GRV	Gastric residual volume
HR	Heart Rate
RR	Respiratory Rate

ABSTRACT

Background: Feeding intolerance is a common complication in preterm neonates of 28–34 weeks gestational age, largely attributed to immature gastrointestinal and respiratory systems, including underdeveloped alimentation. Optimal positioning during and after feeding plays a pivotal role in promoting digestion, enhancing gastric emptying, and improving overall nutritional tolerance. Kangaroo Mother Care (KMC), a technique involving skin-to-skin contact between the mother and infant, has been associated with several neonatal benefits, including physiological stability and improved developmental outcomes. However, its specific impact on feeding tolerance, in comparison to the traditional supine positioning in a radiant warmer, remains insufficiently explored and warrants further investigation.

Objective: The primary objective of the study is to compare tolerance to orogastric feeding in preterm neonates of 28 to 34 weeks of gestational age in Kangaroo Mother Care (KMC) position versus the conventional supine position. The secondary objectives included assessing physiological stability by monitoring vital signs (heart rate, respiratory rate, oxygen saturation and temperature), assessing comfort levels using the Infant Position Assessment Tool (IPAT) score before and after feeding and determining the duration (in days) required to achieve the target feed volume in each group.

Methods: A randomized controlled trial was conducted in the NICU at KLE Dr. Prabhakar Kore Charitable Hospital, Belagavi, involving 40 preterm neonates of 28–34 weeks gestation. After obtaining ethical approval and parental consent, Preterm neonates were randomised into two groups: Kangaroo Mother Care (KMC, n = 20) and standard supine care in a radiant warmer (n = 20). All Preterm neonates received breast milk via orogastric tube. Gastric residual volumes, vital signs and assessing comfort levels using the Infant Position Assessment Tool (IPAT) score were recorded before and three hours after feeding, across three feeds within 24 hours. The time required to achieve the target feed volume was also documented. Data were collected using validated scorecards.

Result- A total of 40 preterm neonates between 28 to 34 weeks of gestational age receiving orogastric feeds were enrolled and randomized equally into two groups: Kangaroo Mother Care (KMC, n = 20) and standard supine care in a radiant warmer (n = 20).Baseline characteristics such as sex, maternal age, parity, gestational age, birth weight, mode of delivery, maternal risk factors, resuscitation, and type of milk were comparable between the groups ($p > 0.05$). At 8:00 AM, gastric residual volume (GRV) in the control group ranged from 0% to 12% of the feed volume, whereas all neonates in the test group had nil aspirates, amounting to 0%. This difference was statistically significant ($p = 0.032$). At 2:00 PM, GRV in the control group varied from 0% to 50%, while in the test group it ranged from 0% to 25%, showing a significant difference ($p = 0.004$). At 8:00 PM, the control group exhibited GRVs ranging from 0% to 21.7%, whereas the test group showed lower values ranging from 0% to 10%. This difference was also statistically significant ($p = 0.001$).Physiological parameters demonstrated enhanced stability in the test group. After feeding, respiratory rate and heart rate significantly decreased in the test group ($p < 0.001$), whereas the control group showed significant increase. Post-feed, the control group showed a non-significant drop in body temperature, while the test group exhibited a significant increase at 11 AM and 11 PM ($p < 0.001$). SpO_2 remained comparable. The Infant Position Assessment Tool (IPAT) scores were significantly higher in the KMC group post-feed, reflecting improved behavioural and positional stability ($p <$

0.001). Notably, neonates in the KMC group achieved full target feeds earlier than controls (*p* = 0.026), highlighting faster feeding adaptation. These findings suggest that orogastric feeding in the KMC position enhances feeding tolerance, physiological stability, and overall well-being than preterm neonates receiving orogastric feeds in supine position.

Conclusion - Kangaroo Mother Care (KMC) positioning significantly improved feeding tolerance in preterm neonates, as demonstrated by lower gastric residual volumes and better gastric emptying compared to the preterm neonates receiving orogastric feeding in supine position. In addition, neonates in the KMC group exhibited more stable vital signs, enhanced physiological regulation1 and greater comfort. These outcomes indicate that KMC is a more effective and holistic approach to feeding preterm neonates, particularly in resource-limited settings, supporting improved absorption, metabolism and overall neonatal care.

Keywords: orogastric Feeding, Kangaroo mother care , preterm neonate, IPAT score,vital signs

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

According to world health organization (WHO), Premature babies are neonates born before completing 37 weeks of gestation, starting from the first day of the mother's last menstrual period (LMP) [1] Prematurity significantly affects the normal physiological processes of alimentation, posing challenges to adequate nutrition, which in turn impacts overall development [2]. Neonatal mortality and low birth weight (LBW) are significant factors that adversely affect child survival and functional development. [3] Worldwide, an estimated 25 million LBW infants are born annually, with the vast majority (96%) being delivered in developing countries. [4] However, preterm birth stands out as the most crucial contributor to neonatal mortality, accounting for approximately 27% of the 4 million neonatal deaths that occur each year. [5] In India, 8 million LBW infants are born, demonstrating a high prevalence of preterm births and neonatal deaths due to prematurity. Neonatal deaths in small infants account for up to 80%, with 65% due to preterm births and 19% attributed to small for gestational age (SGA) infants. [6]

Premature infants face numerous challenges as they struggle to adapt to life outside the womb. Their underdeveloped organ systems make them more vulnerable to complications such as respiratory distress syndrome, intraventricular haemorrhage, sepsis, thrombocytopenia and retinopathy of prematurity [7] Due to their underdeveloped gastrointestinal system, these infants often experience digestive issues, as the peristalsis which helps move food to the stomach is not fully functional, requiring specialized nutritional support.[8] Feeding immaturity in preterm infants refers to difficulties in oral nutrition caused by factors like oral feeding impairments, gastroesophageal reflux, and systemic illnesses.[9] In infants born before 34 weeks, these challenges often stem from disrupted feeding patterns, neurological conditions, and general physiological immaturity. [10] Life-sustaining interventions in the NICU, such as oxygen therapy for respiratory conditions like respiratory distress syndrome (RDS) and bronchopulmonary dysplasia (BPD), as well as neurological injuries including intraventricular haemorrhage (IVH), periventricular leukomalacia (PVL) can further impair feeding abilities. Medical complications, including necrotizing enterocolitis (NEC) or craniofacial abnormalities, can exacerbate feeding difficulties, ultimately influencing long-term neurodevelopmental outcomes.

Given these challenges, specialized neonatal care is essential to improving the survival and long-term outcomes of preterm infants. (11) The primary goal of neonatal care is to provide adequate nutritional support that promotes growth and development similar to what would occur in the intrauterine period. This support is crucial for facilitating tissue development and ensuring overall health in this vulnerable population. [12-13]

Gastric tube feeding is a method of providing nutritional support by delivering milk directly into the stomach by inserting a flexible feeding tube. [14] This tube is carefully advanced through the infant's nasal or oral cavity, traversing the pharynx, and esophagus, and ultimately reaching the stomach. This ensures appropriate nutritional management while minimizing the risks associated with inadequate feeding in vulnerable neonates. Feeding by either employing orogastric (through the mouth) or nasogastric (through the nose) tubes is essential for providing trophic feeds in neonates until the infant develops sucking and swallowing reflexes. Enteral feeding is considered a vital component for the survival and growth of preterm infants. Consequently, these infants should be nourished through gavage (enteral) feeding as it assures the provision of essential nutrients necessary for their development. [15]

In neonatal intensive care units (NICU), preterm infants are often placed in controlled warmers that regulate temperature, humidity, light, and noise, creating an environment that simulates intrauterine conditions to prevent hypothermia and stabilize vital functions. Within these warmers, preterm infants are commonly positioned in the supine (on their back) position during gavage feeding, where milk is delivered directly into the stomach through a nasogastric or orogastric tube [16]. This position helps keep the infant secure and stable, minimizing the risk of temperature loss. However, while this positioning offers important benefits in supporting thermal regulation, it also carries potential risks. The supine position can sometimes increase the likelihood of regurgitation and aspiration, which may lead to complications such as apnea, aspiration pneumonia, and chronic lung disease. Moreover, this position may hinder gastric emptying due to the fluid-filled fundus and swallowed air, potentially interfering with proper digestion [17]. Despite these risks, the supine position remains the preferred choice in NICU settings because of its ability to support the infant's overall care needs.

Body positioning is crucial for effective gastric emptying, which directly influences gastric residual volume—a key indicator for assessing feeding tolerance and digestive health in preterm and low-birth-weight (LBW) infants. Monitoring gastric residual volume before each feeding is a standard practice to optimize nutritional management, as high residuals can hinder milk intake and compromise nutrition. [18] Several factors, including gestational age, postnatal age, feeding formula type, nutrient composition, medications, and positioning during feeding, all play a role in gastric emptying and residual capacity. Proper positioning not only supports thermal regulation but also ensures effective feeding and digestion by reducing the risk of complications such as reflux and aspiration. [19] Additionally, correct positioning helps improve respiratory function. In neonatal care, positioning is essential for optimizing feeding ability, sleep quality, and overall health. Nursing care which involves managing feed volumes, selecting appropriate formulas, monitoring feeding intervals and consistently checking residuals is critical for promoting optimal growth and health in preterm infants. [20] This emphasizes the importance of careful positioning as a fundamental nursing responsibility that significantly impacts the infant's development and well-being.

The prone position has been shown to enhance respiratory function and reduce regurgitation, more restful sleep, reduce crying, and making it beneficial in specific clinical scenarios [21]. These physiological improvements may decrease the amount of air introduced into the stomach during feeding, potentially reducing the incidence of regurgitation/gastroesophageal reflux, a condition that can contribute to complications such as apnea, aspiration pneumonia, and chronic lung disease. [22]

Kangaroo Mother Care (KMC) is a widely recognized and evidence-based approach that has been shown to improve outcomes for both infants and mothers. KMC involves direct skin-to-skin contact, where the preterm infant is positioned vertically between the mother’s breasts while she maintains a semi-reclining posture. In this position, the infant's head is gently turned to one side in a slightly extended position, with the hips flexed and abducted, arms flexed, and the abdomen aligned with the mother's epigastrium.

This method not only promotes bonding but also offers several physiological benefits. [23] When preterm infants are fed in the KMC position, especially during nasogastric (NG) feeding, the risk of aspiration is minimized and respiratory stability is enhanced. This position also promotes better lung expansion and improved oxygenation, which is vital for preterm infants with underdeveloped respiratory systems. [24] The semi-upright position in KMC helps optimize digestion and gastrointestinal motility leading to better feeding tolerance. The vertical position reduces the likelihood of gastric reflux making feeding more comfortable for the infant. These benefits make KMC an effective and advantageous method of feeding for preterm infants, contributing to their better nasogastric feeding and overall growth, development, and well-being. [25]

Despite numerous studies on preterm and LBW infants, the application of findings regarding optimal post-feeding positioning remains limited due to the lack of rigorous control or randomization in many of these studies. This has led to ongoing debates about the most effective positioning to improve outcomes.

Comparative research between KMC and the supine position suggests that gastric residual volumes are significantly lower in neonates fed in the KMC position, indicating better feeding tolerance. [26] However, while gastric residual volume measurements are widely used to guide enteral feeding progression, current evidence does not definitively support their role in reducing feeding intolerance or preventing necrotizing enterocolitis. Although proper positioning offers potential benefits in minimizing risks and enhancing respiratory and digestive health, there is limited literature comparing KMC position to the supine position in preterm infants, with few consistent studies available. [27]

This gap highlights the need for further research to better evaluate the relative benefits of these positions and refine neonatal care practices. Therefore, our current analysis aims to compare gastric feeding in preterm neonates (28 to 34 weeks of gestational age) receiving KMC versus the supine position. Additionally, we aim to compare vital signs and target feeds in these preterm neonates receiving orogastric feeding in the KMC position versus the supine position.

AIMS AND OBJECTIVES

PRIMARY OBJECTIVE:

1. To compare tolerance to orogastric feeding in preterm neonates of 28 to 34 weeks of gestational age in semi recline prone position receiving kangaroo mother care (KMC) versus preterm neonates in supine position receiving conventional care in open care neonates.

SECONDARY OBJECTIVE:

2. To compare the following in preterm neonates of 28 to 34 weeks of gestational age receiving orogastric feed in semi recline prone position receiving kangaroo mother care (KMC) versus preterm neonates in supine position receiving conventional care in open care neonates.

- Gastric residual volume.
- Vital signs.
- Pre and post feeding (3 hours post feed) Infant position assessment tool.
- Target feeds.

REVIEW OF LITERATURE

Definition:

Preterm birth is defined as any delivery occurring before the completion of 37 weeks of gestation.

The WHO defines preterm birth as any birth occurring before the completion of 37 weeks of gestation or fewer than 259 days from the first day of the mother's last menstrual period (LMP). [27] Based on gestational age, preterm birth is further categorized into three subgroups:

- Extremely preterm: Birth before 28 weeks of gestation.
- Very preterm: Birth between 28 weeks and less than 32 weeks of gestation.
- Moderate or late preterm: Birth between 32 weeks and less than 37 completed weeks of gestation.

This classification, based on gestational age, is the most widely utilized and accepted framework for defining preterm birth. [28-29]

Epidemiology of Preterm Birth:

Globally, approximately 15 million infants are born prematurely each year, with over 20 million born with low birth weight (LBW). The global prevalence of preterm birth (PTB) is 10.6%, with South Asia contributing to over one-third of this burden. [30] Preterm birth is the leading cause of neonatal mortality and the second leading cause of death in children under five. The Sustainable Development Goals (SDGs) seek to minimize preventable neonatal and under-five mortality by 2030, setting a target neonatal mortality rate of no more than 12 per 1,000 live births. [31] India faces a disproportionate burden of PTB, with an estimated 3.5 million preterm births in 2010, representing 23.4% of the global burden. [32] LBW is also a critical issue, with 15-20% of global births classified as LBW and South Asia particularly India, showing the highest prevalence. Despite a decrease in LBW rates in India, challenges persist in meeting SDG targets.[33] India's stillbirth rate is 3.8 per 1,000 live births, with LBW and PTB rates of 18% and 13%, respectively, higher than those in neighbouring countries like Sri Lanka, Nepal, and Myanmar. China's significantly lower LBW and PTB rates highlight the need for intensified efforts in India.[34]

Complications of Preterm Birth:

Preterm infants face a range of challenges during their stay in the NICU including cardiorespiratory issues, infections, and neurological complications, all while continuing to grow and meet the neurodevelopmental milestones necessary for discharge. [35] These infants are at high risk for respiratory morbidities and delays in neurological development which place a significant burden on the infants themselves, their families and the healthcare system. [36] Feeding difficulties are a common concern for preterm infants, arising from a combination of physiological and developmental factors that can impact their ability to feed efficiently.[37] These feeding challenges can also act as an early indicator of brain alterations linked to atypical motor and neurological development, which may further hinder their ability to establish normal feeding patterns and meet critical developmental milestones. Addressing these feeding issues is vital for promoting optimal growth and development in preterm infants during their NICU stay. [38]

Feeding Problems in Neonates:

Feeding difficulties refer to various conditions that result in insufficient oral nutrition, arising from factors such as oral feeding impairments, gastroesophageal reflux (GER), gastrointestinal issues, and systemic illnesses. [39] There is no standardized definition due to the diversity of causes. In preterm infants, extrauterine factors can disrupt the establishment of a normal feeding pattern, resulting in dysphagia or swallowing abnormalities. These issues may affect sucking, eating or airway protection, compromising the efficiency, adequacy, and safety of feeding. Dysphagia can result from anatomical anomalies, neurological dysfunction, or simply immaturity, especially in preterm infants. These infants show a wide range of symptoms and require diverse management approaches.

Preterm infants, particularly those born before 32 weeks of gestation, often undergo numerous life-sustaining interventions during their stay in the neonatal intensive care unit (NICU). These interventions can introduce repetitive noxious orofacial sensory stimuli at a critical stage of physiological maturation. Furthermore, during this crucial period of brain development, prolonged exposure to oxygen supplementation, necessitated by respiratory pathologies such as RDS and BPD, can further impact feeding outcomes.[40] Additionally, neurological injuries including IVH, PVL, or hypoxic brain injury can contribute to feeding dysfunction by disrupting the coordination of sucking, swallowing, and breathing. Other medical complications, such as NEC, complex surgical interventions, and congenital craniofacial abnormalities, may further influence oral sensory-motor development, potentially leading to dysphagia.

The intricate relationship between prematurity, pulmonary dysfunction, neurological compromise, and feeding difficulties plays a pivotal role in long-term neurodevelopmental outcomes.[41] Each of these factors independently contributes to developmental delays, yet their interplay can exacerbate feeding dysfunction.

Dysphagia, which can be categorized based on the phases of swallowing, often presents with overlapping pathophysiological mechanisms, further complicating its clinical identification and management. Feeding difficulties stem from impairments across the oral, pharyngeal, and esophageal phases.

- **Oral phase dysfunctions:**

Oral phase dysfunctions arise from prolonged use of endotracheal tubes, feeding tubes, and securing devices, leading to weak or disorganized sucking, ineffective bolus formation, and breastfeeding difficulties. [42]

- **Pharyngeal phase dysfunctions:**

Pharyngeal phase impairments involve immature swallowing-breathing coordination, increasing the risk of nasopharyngeal reflux, laryngeal penetration, or aspiration, often presenting with choking, apnea, bradycardia, and oxygen desaturation.

- **Esophageal phase dysfunctions:**

Peristalsis moves of esophagus that leads food toward the stomach, are not properly developed in the premature infants characterized by ineffective peristalsis and gastroesophageal reflux, contribute to feeding intolerance, odynophagia, and aspiration risks. [43]

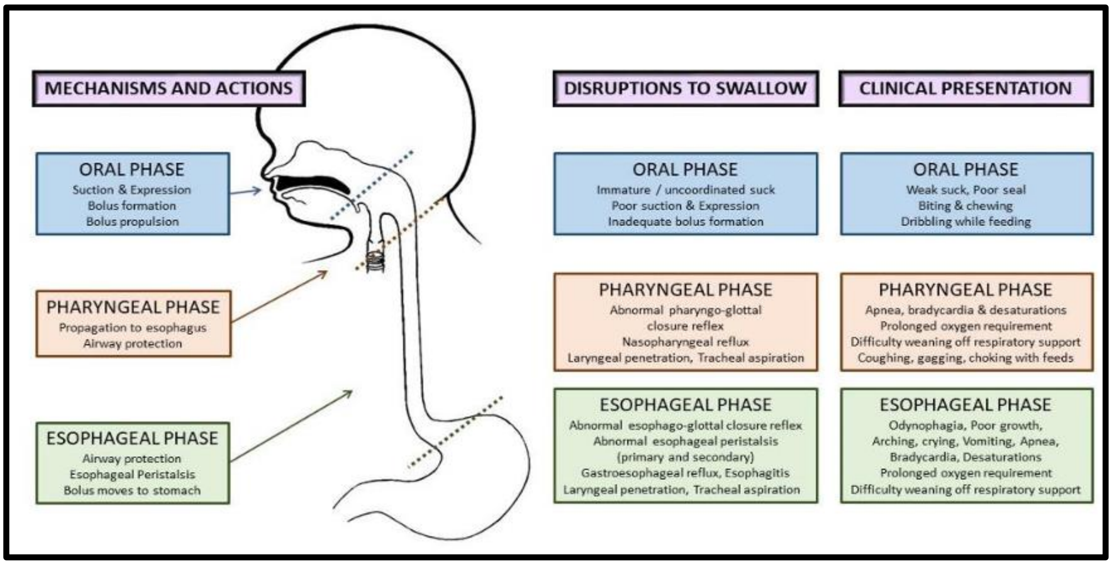


Figure no 1 : Etiopathophysiology of dysphagia in preterm neonates

Aspiration:

Aspiration in preterm infants can occur via anterograde (during swallowing), retrograde (from esophageal reflux), or silent aspiration, with deficits in pharyngoglottal and esophagoglottal reflexes further compromising airway protection. These issues lead to longer hospital stays, poor nutrition, respiratory problems, and impact long-term neurodevelopment. Feeding difficulties result from disruptions in feeding phases, requiring a multidisciplinary approach, early screening, personalized feeding plans, and close monitoring for aspiration risks. Ongoing research is needed to refine feeding protocols, balancing aspiration risks with the benefits of early feeding.[45]

Interventions to Enhance Sucking and Swallowing:

❖ **Initial Interventions:**

The primary interventions implemented as first-line strategies include non-nutritive sucking (NNS), modified positioning, the use of slow-flow nipples and external pacing administered by the caregiver. Two systematic reviews conducted in 2016 under the Cochrane Collaboration analysed randomized controlled trials (RCTs) evaluating the impact of oral stimulation on feeding outcomes in preterm infants.[46] One review demonstrated that oral stimulation significantly reduced the duration of hospitalization and parenteral nutrition dependency, whereas another review found a shortened duration to achieve full oral feeding in infants receiving non-nutritive sucking therapy. However, discrepancies between studies were noted, with some trials indicating no significant difference in feeding progression.

Following NICU interventions taken for the oral feeding: -

- Facilitation of Non-nutritive Sucking (breast or pacifier-based)
- Modified Positioning Strategies (e.g., side-lying positioning, swaddling for improved containment)
- Pacing Techniques (intermittent cessation of milk flow)
- Use of Slow-flow Nipples to regulate milk flow and prevent aspiration.[47]
- Sensorimotor Interventions (massage, kinesthetic manoeuvres)
- Early Oral Stimulation Implementation
- Cue-based Feeding Programs (feeding in response to hunger/satiety cues rather than scheduled intervals)
- Utilization of Supplemental Feeding Devices at Discharge (nasogastric [NG] and gastrostomy [GT] tubes)
- Multidisciplinary Feeding-focused Teams

Among these interventions, modified positioning techniques such as side-lying posture and swaddling have been proposed to enhance neonatal state regulation and feeding organization.

However, the universal applicability of these approaches remains inconclusive. Pacing techniques, involving either tilting the nipple to cease milk flow temporarily or removing the nipple intermittently, are particularly advantageous for neonates exhibiting uncoordinated suck-swallow-breath patterns.[48] Standard pacing practices involve pausing milk flow after every two to three sucks, which mitigates feeding-related stress, including desaturation episodes and bradycardia. Additionally, various specialized nipples with adjustable flow rates further optimize feeding efficiency based on individualized requirements.

a) Oral Physical Therapy and Motor-Based Interventions:

Oral therapy regimens for neonatal feeding aim to improve oral motor function and suck-swallow-respiration coordination. Studies by Lau and Fucile found that oromotor and sensorimotor interventions enhanced sucking, swallowing, and respiratory coordination in preterm infants, reducing the time to independent oral feeding by 8.3 days and shortening hospital stays by 6.9 days. The Premature Infant Oral Motor Intervention, based on Beckman’s method, also promotes feeding milestones through structured techniques like sucking facilitation and oral massage. [49] While promising, larger trials are needed to confirm their effectiveness.

b) Cue-Based Feeding: Evaluating Its Efficacy:

Cue-based gavage tube feeding is vital as it follows the infant's natural hunger and satiety cues creating a more individualized and less stressful feeding experience. This approach helps preterm infants transition from tube to oral feeding by gradually introducing oral stimuli, reducing the risk of feeding aversions and improving feeding skills. Based on neurodevelopmental models like NIDCAP, cue-based feeding accelerates the transition to full oral feeding, though it doesn’t significantly reduce

NICU stays. Studies show it benefits neonates with BPD without adverse effects. [50] While small milk volumes during gavage feeding have been tested, more research is needed to confirm its long-term benefits and effectiveness.

c) Invasive Therapies: The Role of Supplemental Feeding Tubes:

To reduce NICU stays, some centres discharge neonates with nasogastric (NG) tubes when oral immaturity is the primary barrier rather than medical instability. Home NG tube feeding programs have shown success, with 40% of infants achieving full oral feeding within two weeks and 65% within eight weeks, without increased readmissions or complications. Data from the Children's Hospital of Wisconsin also indicated that infants discharged with NG tubes had shorter hospital stays and lower readmission rates compared to those with gastrostomy (GT) tubes, with 77% transitioning to exclusive oral feeding within three months. These findings highlight the effectiveness of NG tube feeding in facilitating safe transitions to oral feeding while optimizing hospital resources. [51]

Challenges of Feeding in Preterm Neonates:

Preterm neonates face significant challenges in adapting to the external environment due to cardiorespiratory issues, neurological vulnerabilities, and developmental delays placing a strain on both families and healthcare systems. Feeding these infants is particularly difficult because of their underdeveloped oral motor skills, immature gastrointestinal systems, and neurological limitations. [52] Key challenges include:

1. **Oral Motor Immaturity**: Preterm infants often lack the ability to coordinate sucking, swallowing, and breathing, making it difficult for them to feed effectively.
2. **Gastrointestinal Issues**: Preterm infants may have delayed gastric emptying, weak peristalsis, and an immature gut, leading to feeding intolerance or reflux.[53]
3. **Respiratory Coordination**: Preterm infants may struggle to synchronize swallowing with breathing, increasing the risk of aspiration and respiratory complications.
4. **Increased Risk of Aspiration**: Poor coordination and weak reflexes can result in aspiration, which may lead to respiratory distress or infections. [54]
5. **Feeding Aversions**: Prolonged reliance on feeding tubes can lead to oral aversions, making the transition to full oral feeding more difficult.
6. **Nutritional Needs**: Preterm infants require more precise nutrition to support growth and development, and feeding may need to be carefully monitored to meet these needs. [55]
7. **Delayed Transition to Oral Feeding**: Many preterm infants take longer to transition from tube feeding to full oral feeding, which can prolong hospital stays and delay developmental milestones.

Maternal factors like malnutrition, illness, and stress can disrupt fetal development, leading to growth restrictions and feeding difficulties in preterm infants. Addressing these challenges requires standardized diagnostic frameworks, individualized interventions and a multidisciplinary approach to optimize feeding outcomes and reduce long-term complications. [56]

Nursing Interventions of Feeding:

Nursing interventions in feeding preterm neonates focus on supporting their development and ensuring safe, effective feeding practices. [57] Key interventions include:

1. **Monitoring and Assessing Feeding Progress**: Nurses closely monitor the neonate's feeding tolerance, weight gain, and signs of aspiration or discomfort during feedings.

2. **Providing Tube Feeding When Necessary**: For infants unable to feed orally, administer enteral feeds through nasogastric (NG) tubes while working to transition to oral feeding when the infant is developmentally ready.[58]

3. **Skin-to-Skin Contact**: Promoting kangaroo care (skin-to-skin contact) enhances bonding, reduces stress, and improves feeding outcomes by stabilizing the infant's temperature and promoting feeding readiness.[59]

4. **Parental Education and Involvement**: To educate parents on feeding techniques, proper tube care, and how to safely interact with their infant during feedings, fostering parental confidence and involvement.[60]

5. **Breastfeeding Support**: Nurses assist with breastfeeding or breast milk expression, providing guidance on positioning, latch, and milk production, supporting both maternal and infant needs.

These interventions help improve feeding outcomes, reduce complications, and support the overall development of preterm neonates. [61]

Assessment of Feeding:

Assessment of feeding in preterm neonates involves evaluating several key aspects to ensure safe and effective nutrition. Key components of the assessment include:

1. **Feeding Readiness**: Observing the infant's cues for hunger and satiety, as well as their ability to coordinate sucking, swallowing, and breathing.[62] Preterm infants may need to demonstrate improved oral motor skills before transitioning from tube to oral feeding.
2. **Sucking and Swallowing Coordination**: Assessing the infant's ability to coordinate sucking, swallowing, and breathing during feedings. [63] Difficulty with this coordination may indicate the need for further interventions or tube feeding.
3. **Tolerance to Feedings**: Monitoring the infant's tolerance to feedings, including signs of reflux, gagging, or vomiting. Any signs of feeding intolerance should be documented and addressed.
4. **Tube Placement and Positioning**: Regular checks to ensure proper NG tube placement and positioning to prevent dislodgement and reduce the risk of aspiration. Nurses often verify placement through methods like aspirating gastric contents.[64]
5. **Respiratory Status**: Observing for signs of respiratory distress, such as changes in respiratory rate or oxygen saturation levels, particularly during or after feeding. Respiratory issues can interfere with feeding efficiency.
6. **Oral and Gastrointestinal Development**: Assessing the infant's readiness to transition from NG feeding to oral feeding as their oral motor skills and gastrointestinal system mature. [65] This includes monitoring their ability to suck, swallow, and breathe in coordination.

The **Infant Position Assessment Tool (IPAT)** is used to assess the positioning of infants during and after feeding to ensure that their posture supports effective and safe feeding. Proper positioning is crucial for preterm infants and those with feeding difficulties, as it can affect their ability to suck, swallow, and breathe safely while feeding.[66]

The IPAT helps healthcare providers evaluate how the infant is positioned during and after feeding, taking into account factors such as:

1. **Head and Neck Alignment:** Ensuring that the infant's head is slightly flexed, with the chin tucked to allow for optimal swallowing and prevent aspiration.
2. **Trunk and Body Support:** Evaluating whether the infant's body is supported in a way that minimizes stress and fatigue, which can interfere with feeding efficiency.[67]
3. **Limbs Positioning:** Assessing whether the arms and legs are flexed, as this position can provide additional support and comfort to the infant during feeding.
4. **Mouth and Nipple Alignment:** Ensuring that the nipple is positioned correctly in the infant's mouth for an effective latch and proper sucking. [68]
5. **Overall Comfort and Posture:** Observing the infant's overall comfort level during feeding, as poor posture may lead to increased fatigue, disorganized feeding patterns, or aspiration risks.

By using the IPAT, clinicians can identify potential positioning issues and make necessary adjustments to improve the infant's ability to feed efficiently and safely. This tool is particularly important for preterm infants or those with feeding difficulties, as proper positioning can help facilitate better feeding outcomes and reduce the risk of complications like aspiration or inadequate nutrition.[69]

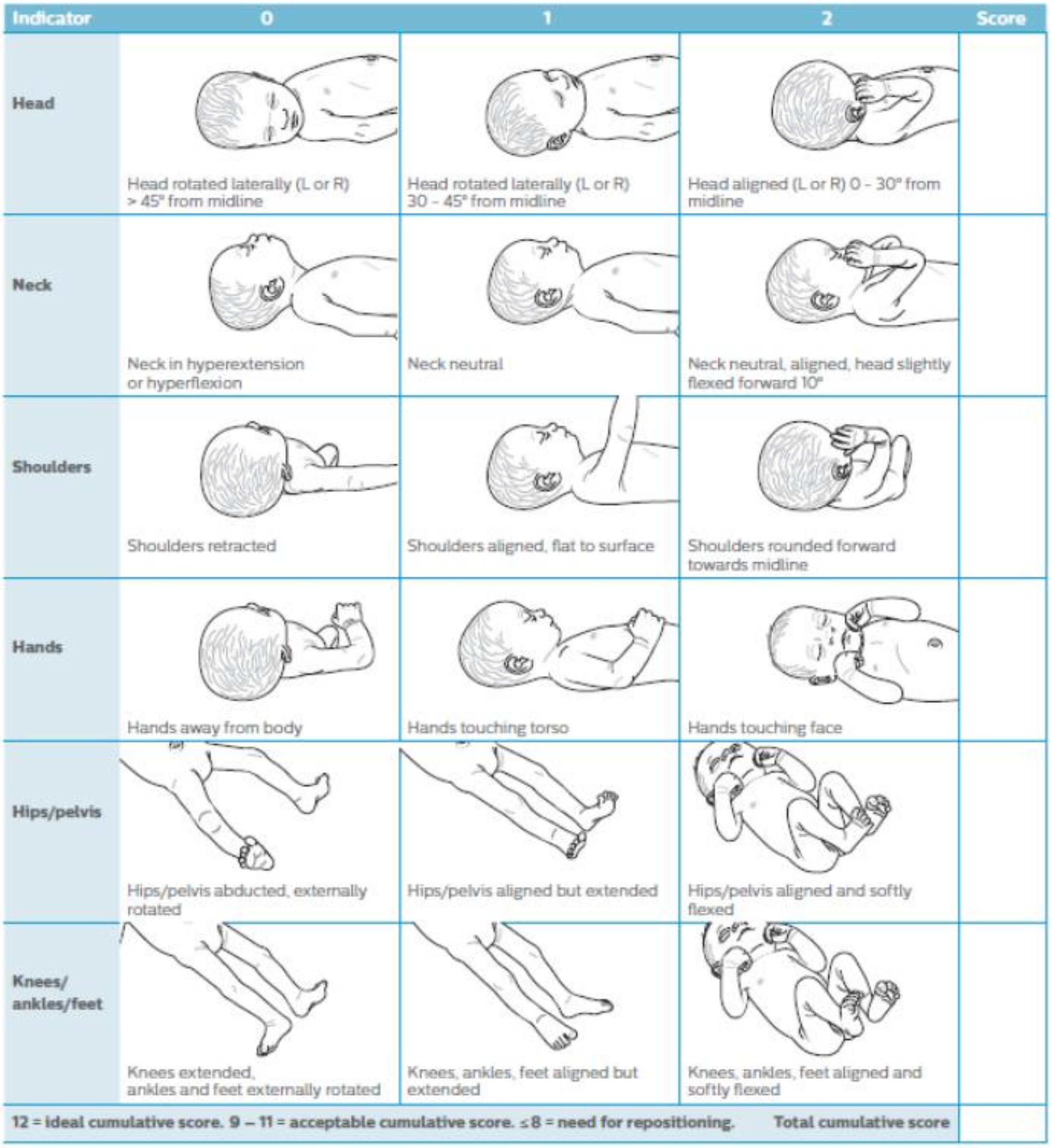


Figure no 2: Infant Position Assessment Tool

Enteral Feeding:

Enteral nutrition is the primary method for providing essential nutrients to neonates after birth. During fetal life, the ingestion of amniotic fluid helps in the structural and functional maturation of the gastrointestinal (GI) tract. [70] By 16 to 20 weeks of gestation, the GI tract is sufficiently mature to digest and absorb nutrients for growth and development. However, in preterm neonates, the immaturity of splanchnic circulation and GI motility can lead to ineffective digestion and absorption. This is due to the incomplete coordination of anterograde peristaltic contractions, with full functional maturation of the GI system occurring closer to term.

The early postnatal period is crucial for the development of the neonatal intestine. Interruptions in enteral feeding during this time can result in structural damage, including mucosal atrophy and impaired nutrient absorption.[71] Prolonged fasting leads to decreased gut hormone responses, reduced IgA levels, and increased inflammation. Studies in parenterally fed models show significant mucosal atrophy, including reduced villus height and crypt-villus mass. These findings highlight the importance of early and continuous enteral feeding in preterm neonates to maintain gut integrity and ensure long-term gastrointestinal health.[72]

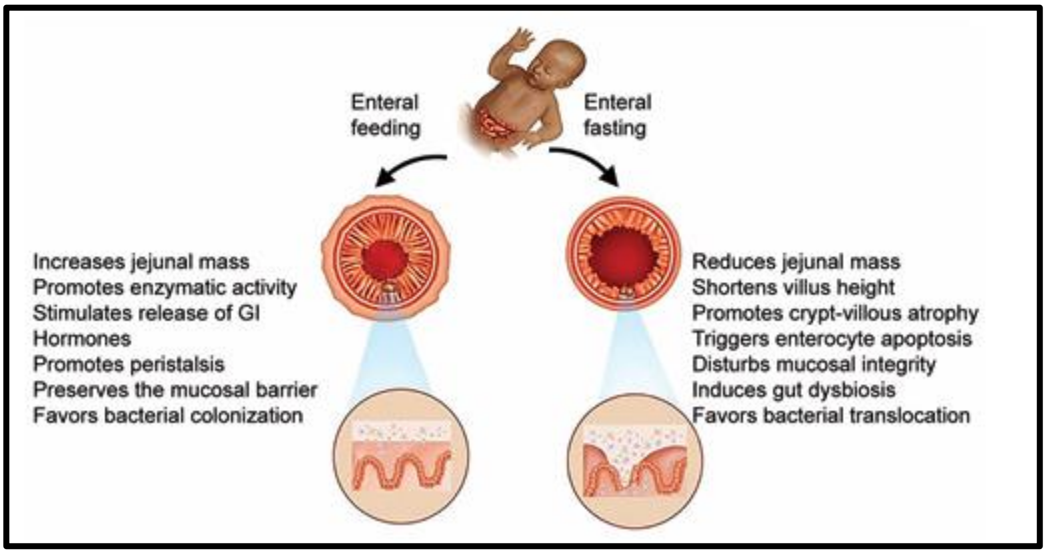


Figure no: 3- The impact of enteral fasting on mucosal development, endocrine changes, and intestinal functions. [73]

Early enteral nutrition is crucial for preterm LBW infants to prevent extra-uterine growth retardation and improve neurodevelopment. Due to immature sucking-swallowing coordination and respiratory distress, direct oral feeding is delayed, and gavage feeding via nasogastric (NG) or orogastric (OG) tubes is commonly used in NICUs. [74] While both methods ensure adequate nutrition, there is no clear consensus on the superior route, and practices vary widely. OG tubes help maintain nasal patency in obligatory nose-breathing neonates, while NG tubes are often easier to secure and less prone to displacement.

1) Nasogastric (NG) Feeding

NG feeding involves inserting a tube through the nose into the stomach, making it easier to secure and less likely to be displaced. This method is commonly preferred in NICUs because healthcare providers find it simpler to place and maintain. However, since neonates are obligatory nose breathers, the presence of an NG tube can partially obstruct the nasal passages, leading to increased airway resistance and making breathing slightly more difficult.[75] Studies have shown that NG tube insertion can trigger physiological stress responses, including episodes of bradycardia (a decrease in heart rate) and desaturation (a drop in oxygen levels), potentially causing respiratory distress.

2) Orogastric (OG) Feeding

OG feeding involves placing the tube through the mouth into the stomach, which keeps the nasal passages clear and helps maintain normal breathing patterns in neonates. This method can be beneficial for preterm infants who rely on unobstructed nasal airflow. However, OG tubes are more prone to frequent displacement, as they are not as securely positioned as NG tubes. [76]

Both methods have their advantages and challenges, and the choice between NG and OG feeding often depends on individual patient needs, NICU protocols and the clinical judgment of healthcare providers. A standardized approach, considering NICU-specific practices, nurse-neonate ratios, and long-term developmental outcomes, is needed to optimize feeding strategies for preterm infants. [77]

Feeding Positioning:

Neonatal positioning during and after feeding plays a critical role in optimizing nutritional tolerance and overall physiological stability. Different positions influence various aspects of neonatal health, such as respiration, gastrointestinal function, and feeding efficiency. Different positions have different effects-

a) Supine Position

The supine position, where the infant lies on their back, is the standard recommended position for neonatal sleep due to its association with a reduced risk of sudden infant death syndrome (SIDS). [78] However, in preterm infants, particularly those with feeding intolerance, the supine position may not be the most favourable for digestion and gastrointestinal motility. Studies suggest that gastric emptying may be delayed in the supine position, leading to increased gastric residual volumes and a higher likelihood of regurgitation and feeding intolerance. Despite these concerns, the supine position remains widely used for safety reasons, especially in neonatal intensive care units (NICUs). [79]

b) Prone Position

The prone position, where the infant is placed on their stomach, has been found to provide several advantages, particularly in improving respiratory function and reducing regurgitation. Research has demonstrated that preterm infants in the prone position exhibit improved oxygenation, better diaphragmatic movement, and more stable respiratory patterns. [80] Additionally, gastric emptying is enhanced, as evidenced by lower gastric residual volumes when compared to the supine position. A study conducted by Chen SS et al. found that preterm infants in the prone position had significantly reduced gastric residual volumes, suggesting improved feeding tolerance. However, despite these benefits, prone positioning is not recommended for routine post-feeding care due to its association with an increased risk of SIDS, particularly when infants are left unsupervised. [81]

c) Kangaroo Mother Care (KMC) and the Kangaroo Mother Care Position

Kangaroo Mother Care (KMC), introduced by Colombian paediatrician Edgar Rey in 1978, is a care method for low-birth-weight and preterm infants that focuses on skin-to-skin contact between the infant and caregiver. While traditionally provided by the mother, KMC can also be practiced by the father or other family members, ensuring continued care and promoting exclusive breastfeeding. Key components of KMC include:

1. **Skin-to-skin contact** – The infant is held upright against the caregiver's chest for thermal and physiological regulation.
2. **Exclusive breastfeeding** – Encourages direct breastfeeding, aiding in weight gain and bonding.[82]
3. **Early discharge** – KMC promotes earlier discharge, reducing hospital costs and infections, regardless of gestational age or birth weight.

The Kangaroo Position, a key component of Kangaroo Mother Care (KMC), involves placing the infant in a vertical position between the caregiver’s breasts. The baby’s head is turned to one side with a slightly extended posture. [83] The infant's hips are flexed and abducted, while the arms are also flexed. The baby’s abdomen is positioned at the level of the caregiver’s epigastrium. This position has been associated with various benefits, including improved thermoregulation, fewer episodes of apnea and bradycardia, and more stable transcutaneous oxygen levels. The close physical contact with the mother provides a calming effect on the baby’s autonomic nervous system, helping to stabilize heart rate and respiratory patterns.

Furthermore, the upright or semi-upright position during NG (nasogastric) feeding helps reduce the risk of aspiration and improves respiratory stability. [84] The comfort provided by KMC also stimulates better digestion and gastrointestinal motility, leading to better feeding tolerance and reduced instances of reflux.

The advantages of Kangaroo Mother Care extend beyond immediate physiological benefits. KMC fosters long-term growth, development, and bonding between the preterm infant and the mother, creating a nurturing environment that is crucial for the baby’s overall well-being and recovery. A Cochrane review highlighted that KMC significantly improves neonatal outcomes by increasing exclusive breastfeeding rates at discharge, reducing the risk of mortality, lowering rates of nosocomial infections and sepsis, preventing hypothermia, decreasing the duration of hospital stays, and promoting better weight gain and head circumference growth.

While both prone positioning and KMC have been shown to improve gastric emptying and reduce feeding intolerance, there remains a lack of homogeneous studies directly comparing these two interventions. [85] Given that KMC provides additional physiological and emotional benefits, including improved maternal confidence, enhanced bonding, and a lower risk of hospital readmission, it is increasingly being recognized as a preferred approach in resource-limited settings. However, further research is needed to establish definitive guidelines on positioning strategies that optimize feeding tolerance while ensuring neonatal safety.

The present study aims to address this knowledge gap by comparing the effects of KMC and supine positioning on feeding tolerance in preterm neonates. [86] Understanding these associations is crucial for refining neonatal care protocols and improving survival rates, particularly in settings with limited healthcare resources.

PREVIOUS STUDIES:

1. **Arghya Roy Naskar et al. [87]** conducted a single-center, non-randomized cross-over clinical analysis to compare prone and Kangaroo Mother Care (KMC) positioning in preterm neonates (28-32 weeks gestational age) during orogastric tube feeding. A total of 110 neonates were assessed for gastric residual volume, vital signs (heart rate, respiratory rate, SpO_2, body temperature, capillary blood glucose), and comfort scores using a standardized scale.

   After three hours, KMC demonstrated lower heart (147.5±4.3 vs. 151.08±9.1 bpm) and respiratory rates (52.8±2.9 vs. 55.6±4.9 cpm), better glycemic control (97.27 vs. 72.73 mg/dL), higher comfort scores (11.2±1.1 vs. 10.1±2.0), and lower gastric residuals (0.03±0.05 vs. 0.13±0.12 mL) compared to prone positioning. The study was limited by its short duration (12 months) and lack of randomization, suggesting the need for future randomized, long-term studies. The findings conclude that KMC is more physiologically stable, comfortable, and beneficial for feeding, absorption, and metabolism in preterm neonates.

2. **Richmond CM et al.** [88] conducted a randomized triple crossover study to evaluate the effects of infant positioning and feed-rate interventions on respiratory events and oxygen saturation in spontaneously breathing preterm infants (<32 weeks gestation) in a neonatal unit. A total of 68 infants underwent three conditions: (A) control (supine/flat with gravity bolus feeds), (B) position intervention (propped/prone), and (C) feed-rate intervention (continuous pump feeds) over three consecutive days.

   Propped/prone positioning significantly reduced apneic, bradycardic, and desaturation events and improved oxygen saturation levels ($p<0.001$), while feed-rate intervention showed no significant difference from the control. Limitations included missing data (<5%), unachieved sample size due to the COVID-19 pandemic, and lack of control for sleep state, which could impact results. The findings highlight the benefits of prone positioning but must be weighed against SIDS risk as infants approach discharge. Further studies are needed to evaluate developmental implications and the efficacy of targeted interventions during feeding times only.

3. **Çaka SY et al.** [89] conducted a randomized trial to assess the impact of Kangaroo Mother Care (KMC) on feeding intolerance (FI) in preterm infants. A total of 168 infants (KMC: 84, Standard Care (SC): 84) were studied in a NICU between June and November 2020. After stabilizing vital signs, both groups were fed in the same position, with KMC applied for 1-hour post-feeding in the intervention group, while SC infants were placed prone. KMC infants had significantly higher body temperatures and O_2 saturations, lower respiratory and heart rates, shorter transition to full enteral feeding, and less FI ($p<0.05$), though no difference was

found in weight gain or hospital stay (p>0.05). The study confirms KMC as a safe and beneficial practice improving digestive function in preterm infants.

4. **Özdel D et al.**[90] compared the effects of prone and Kangaroo Mother Care (KMC) positioning during intragastric tube feeding in preterm infants (28-36 weeks) on gastric residual volume, vital signs, and comfort. The study involved 30 preterm infants in a NICU, fed in both positions with vital signs and comfort scores recorded at 30 minutes and gastric residual volume measured at 3 hours. Results showed a lower heart rate and better comfort scores in the KMC position, though no significant difference in gastric residual volume was found. The study concludes that KMC reduces heart rate, improves comfort, and decreases distress, offering a less stressful feeding experience for preterm infants.

Importance of study:

The study comparing tolerance to orogastric feeding in preterm neonates of 28 to 34 weeks gestational age in KMC position versus supine position is important as it builds upon previous research exploring the effects of neonatal positioning on feeding outcomes. Previous studies have demonstrated the positive effects of KMC on vital signs, comfort, and overall well-being in preterm infants, while supine positioning has been widely recommended for its potential to reduce the risk of sudden infant death syndrome. This hospital-based randomized controlled trial will provide valuable insights into the direct comparison of these positions in terms of feeding tolerance, offering evidence to guide clinical practice and improve care strategies for preterm neonates. By addressing this gap, the study could enhance neonatal care protocols, potentially improving feeding success and comfort for preterm infants, especially in resource-limited settings.

MATERIALS AND METHODS

Source of Data: Neonates with a gestational age of 28-34 weeks who required orogastric feeding and were admitted to the Neonatal Intensive Care Unit (NICU) at KLE Dr. Prabhakar Kore Charitable Hospital, Belagavi.

Study Design: The present study was a randomized control trial.

Study Duration: The present was carried out for a period of 6 months

Sample Size: The Effects of Kangaroo Mother Care on Feeding Intolerance in Preterm Infants Journal of Tropical Paediatrics.

Sample Size Calculation

The mean heart rate before and after were considered of KMC and supine groups. The effect size was found to be 0.84.

$$\mathbf{n = 2(Z\ \alpha/2 + Z\ \beta)^2\ [1 + (n - 1)\ \delta\ ] / n\ [ES]}$$

Where:

- n = number of times measurements are taken = 3

- **δ** = correlation (considering correlation to be 0.6)

- ES = effect size = 0.84

- α = 5%, Z_{α/2} = 1.96

- β = 10%, Z_β = 1.26

Substituting the values in the formula:

n = 18.79 ≈ 19 (rounded off to 20)

Final Sample Size:

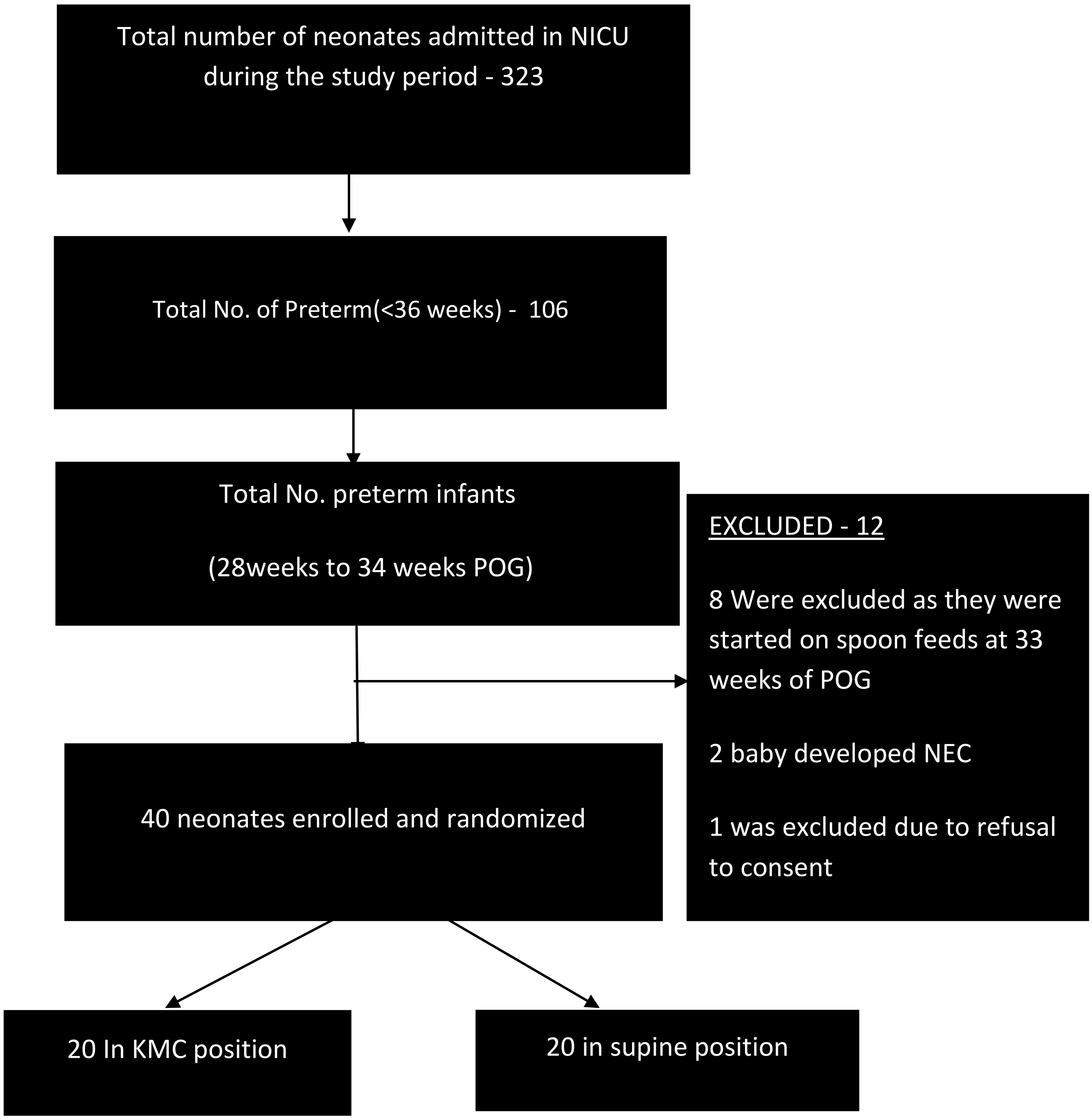
- KMC group = 20
- Control group = 20
- Total sample size = 40

Inclusion criteria: -

1. Gestational age of 28-34 weeks.
2. APGAR score at birth of ≥6.
3. Stable physiological parameters (heart rate, respiratory rate, SpO2, body temperature,).
4. Ability to tolerate gavage feeding.
5. Neonates whose parents provided consent.

Exclusion criteria: -

1) Necrotizing enterocolitis, or Neonates with congenital malformations
2) Neonates who developed intraventricular haemorrhage, convulsions
3) Exhibited unstable vital signs.
4) On mechanical ventilation or Continuous Positive Airway Pressure (CPAP) were excluded from the study.



Study Methodology:

The study was a hospital-based clinical randomized control trial conducted in the Neonatal Intensive Care Unit (NICU) of the Department of Paediatrics at KLE Dr. Prabhakar Kore Charitable Hospital, Belagavi. The study population consisted of neonates born between 28 and 34 weeks of gestational age.

The study received ethical approval from the Institutional Ethics Committee of the Department of Paediatrics, ensuring compliance with ethical guidelines and research standards. Prior to enrolment, written informed consent was obtained from the parents of all neonates participating in the study, emphasizing the commitment to voluntary participation and transparency in research practices.

All stable preterm neonates aged 28 to 34 weeks gestational age who were admitted to the NICU were included based on the specified inclusion criteria.

On the first day of feeding, the selected neonates underwent simple randomization to ensure an unbiased allocation to the intervention and control groups. This process resulted in two distinct groups: Group A and Group B.

Group A consisted of neonates admitted to NICU, who were placed in the KMC during intervention. In contrast. Consenting mothers were asked to identify one relative to act as surrogates for providing skin-to-skin contact if the mother was unable to provide KMC. The nominated surrogates were provided with study details and informed about the intervention group assignment. During KMC, the infant was placed naked on the KMC providers chest, wearing a cap, diaper ,socks and was secured firmly with a binder to ensure a patent airway. Routine care was provided in skin-to-skin contact.

Group B included neonates admitted in NICU, who were placed in supine position in warmer and their routine care was provided by the nursing staff. Feeding for these neonates was also administered by the nurses.

Each neonate was given a prescribed amount(as per NICU protocol) of expressed breast milk via an orogastric tube based on their respective positions. Vital signs including heart rate, respiratory rate, SpO2 and body temperature and comfort score were assessed 10 minutes before feeding for both groups of neonates in the supine position. After this initial assessment, the neonates were positioned according to their respective groups and orogastric feeding was initiated 10 minutes later. The neonates remained in their assigned positions for three hours. At the end of this period, their vital signs were reassessed.

After three-hour post-feeding period, all neonates were reassessed for their comfort scores while placed in the supine position. Postprandial gastric residual volume was measured by gently aspirating gastric contents from the orogastric tube into a 2 mL syringe three hours after feeding. All data, including Gastric residual volume, vital signs and comfort scores were recorded for 3 feeds in 24 hours at 6-hour intervals: 8 am, 2 pm, and 8 pm(+/- 15mins). Feeds continued in the respective positions until target feeds were reached.

All measurements were documented in pre-designed and pre-validated scorecards. The parameters documented included:

1) Volume of expressed breast milk fed: Recorded at 8 am, 2 pm, and 8 pm(+/- 15mins).
2) Volume of gastric aspirate or three-hour postprandial gastric residual volume: Assessed at 11 am, 5 pm, and 11 pm(+/- 15mins).
3) Vital signs (respiratory rate, heart rate, SpO_2, body temperature) were measured 10 minutes before feeding (7:50 am, 1:50 pm, and 7:50 pm(+/- 15mins)) and three hours post-feeding (11 am, 5 pm, and 11 pm(+/- 15mins)).

4) Comfort scores: Evaluated using the Infant Position Assessment Tool (IPAT) at 10 minutes before feeding (7:50 am, 1:50 pm, and 7:50 pm(+/- 15mins)) and three hours post-feeding (11 am, 5 pm, and 11 pm(+/- 15mins))
5) Day of achieving target feeds.

Infant Position Assessment Tool (IPAT): -

Indicators	0	1	2
Head	Head rotated laterally (L or R) greater than 45° from midline	Head rotated laterally (L or R) 45° from midline	Head positioned midline to less than 45° from midline (L or R)
Neck	Neck hyperextended	Neck neutral but poorly aligned with spine	Neck in neutral position and slightly flexed to align with spine
Shoulders	Shoulders retracted	Shoulders flat/ neutral	Shoulders softly rounded forward
Hands	Hands away from the body	Hands touching torso	Hands touching face, hands on chest in midline
Hips (pelvic position)	Hips abducted/ externally rotated and/or in extension	Hips in alignment but extended	Hips aligned and softly flexed
Knees, ankles, feet	Knees extended, ankles and feet externally rotated	Knees, ankles and feet extended	Knees, ankles and feet are aligned in midline orientation and softly flexed

Figure no 4: Infant Position Assessment Tool

The IPAT has a maximum score of 12 points and a minimum score of 0. An optimal IPAT score ranges between 10 and 12 points, while an ideal acceptable score is ≥9 points. Scores of ≤8 points indicate that the neonate requires positioning support, which offers containment, promotes flexion, and ensures proper body alignment.

For each neonate, the average of the three readings for all parameters was calculated in both positions (supine and KMC). This approach ensured a comprehensive and reliable dataset for each participant, allowing for accurate comparisons between the two positions.

Figure no 5 - Preterm neonate receiving orogastric feeding in the KMC position (Test group)

Figure no 6 - Preterm neonate receiving orogastric feeding in the supine position(Control group)

RESULTS

During the study period, a total of 323 neonates were admitted to the Neonatal Intensive Care Unit (NICU). Among these, 106 were preterm infants born at less than 36 weeks of gestational age, of which 52 infants were between 28 and 34 weeks of Gestation. A total of 40 preterm neonates were enrolled and randomized into the study, following the exclusion of 12 preterm neonates for various reasons: 8 were excluded for having begun spoon feeds at 33 weeks of PMA, 2 developed necrotizing enterocolitis (NEC), 1 declined to provide consent, and 1 unfortunately passed away. Ultimately, the study comprised 20 preterm neonates assigned to test group in whom feeding was administered in Kangaroo Mother Care (KMC) position and 20 to the control group in whom feeding was administered in supine position in the warmer.

In this study, preterm neonates placed in the Kangaroo Mother Care (KMC) position were designated as the test group, while those placed in the supine position constituted the control group. The following section will present the results of this investigation, comparing the outcomes between the test and control groups to evaluate the effectiveness of KMC in preterm neonates.

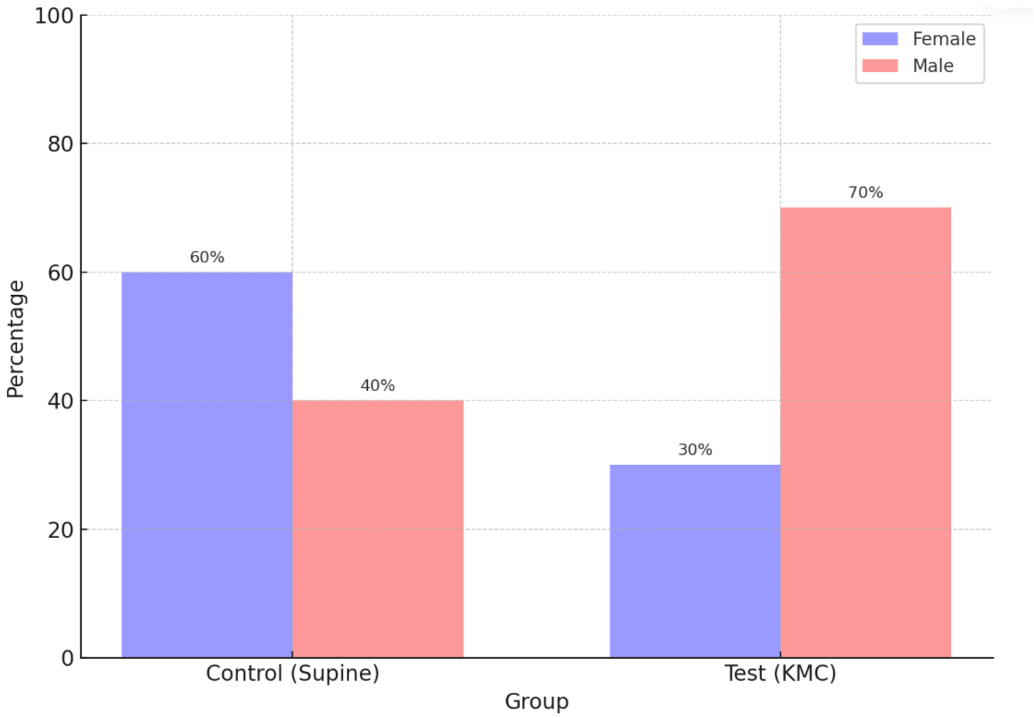
Comparison of the sex of the child in both groups:

In the control group, most preterm neonates were female with 12 (60%), whereas in the test group most were males with 18 (70%).The difference in sex distribution between the groups was not statistically significant ($p = 0.057$), making the distribution comparable in both groups.

Table 1: Comparison of Sex of the child in both groups

	Control/Test		Total	Chi-square test
	Control Group	**Test Group**		
Female	12(60%)	6(30%)	18(45%)	Test value 3.636;
Male	8(40%)	14(70%)	22(55%)	d.f. 1;
Total	20(100%)	20(100%)	40(100%)	p value 0.057

Figure 7: Bar Graph Comparing Sex of the child Between the Two Groups



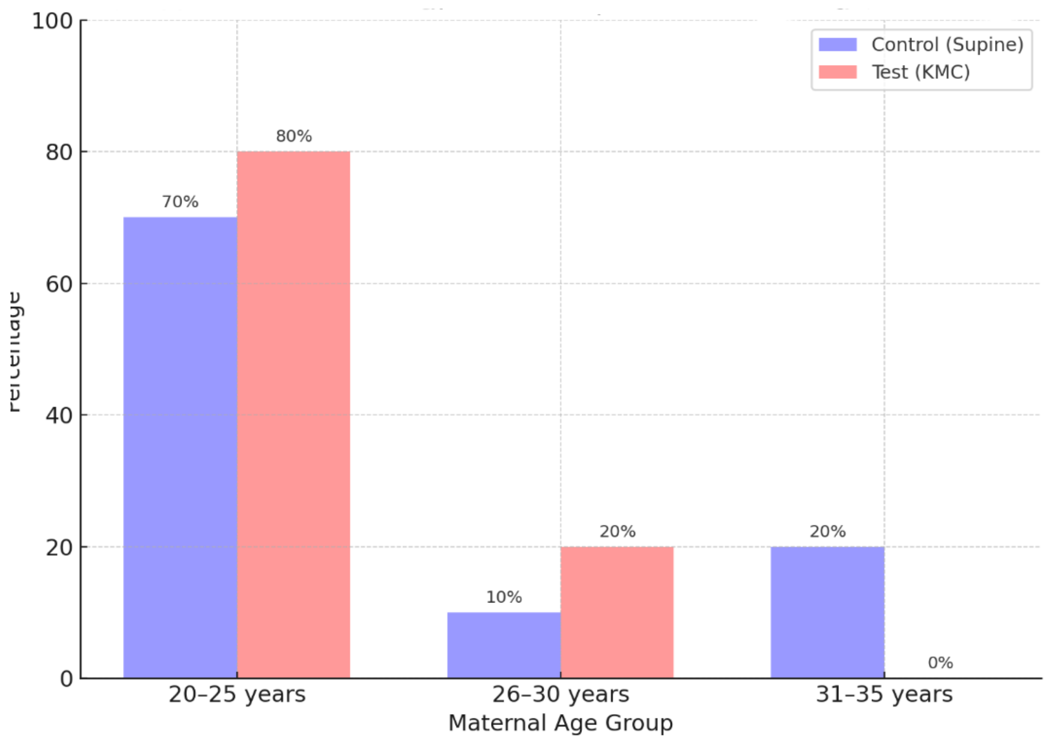
Comparison of the maternal age group in both groups:

The majority of mothers in both the control group and the test group were aged 20 to 25 years (70% and 80% respectively). The difference in maternal age distribution between the groups was not statistically significant (p = 0.091), making the groups comparable in this regard.

Table 2: Comparison of the maternal age group in both groups

	Control/Test		Total	Chi-square test
	Control Group	Test Group		
20 to 25 years old	14(70%)	16(80%)	30(75%)	Test value 4.800; d.f. 2; p value 0.091
26 to 30 years old	2(10%)	4(20%)	6(15%)	
31 to 35 years old	4(20%)	0(0%)	4(10%)	
Total	20(100%)	20(100%)	40(100%)	

Figure 8 : Bar Graph Comparing Maternal Age Between the Two Groups



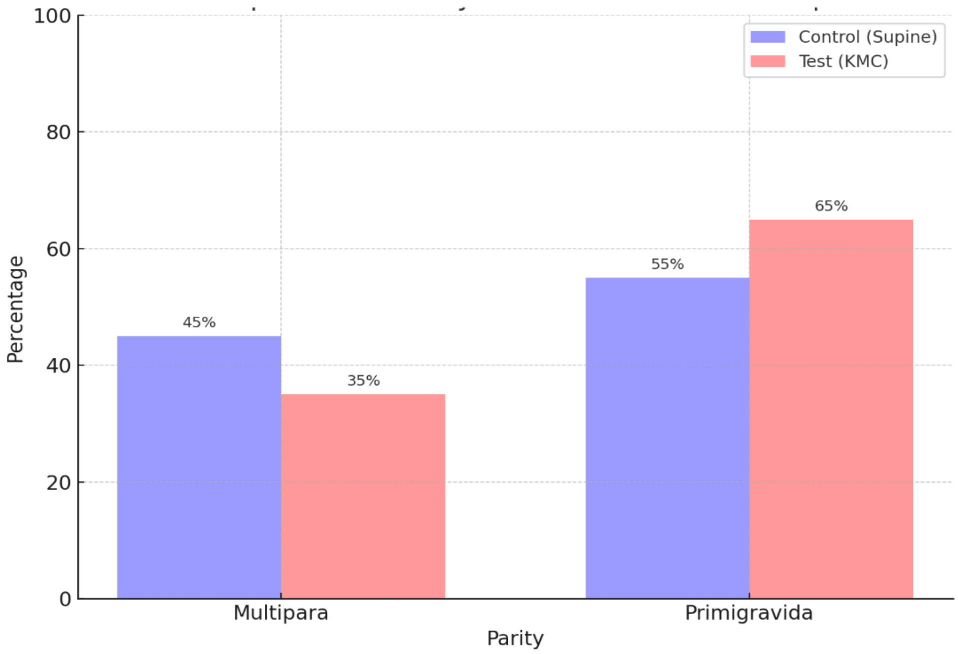
Comparison of parity in both groups:

The majority of mothers in both the control and test groups were primigravida, with 11 (55%) in the control group and 13 (65%) in the KMC group. The difference in parity between the groups was not statistically significant (p = 0.519), making the groups comparable in this regard.

Table 3: Comparison of the parity in both groups

	Control/Test		Total	Chi-square test
	Control Group	Test Group		
Multipara	9(45%)	7(35%)	16(40%)	Test value 0.417;
Primigravida	11(55%)	13(65%)	24(60%)	d.f. 1;
Total	20(100%)	20(100%)	40(100%)	p value 0.519

Figure 9 : Bar Graph Comparing Parity Between the Two Groups



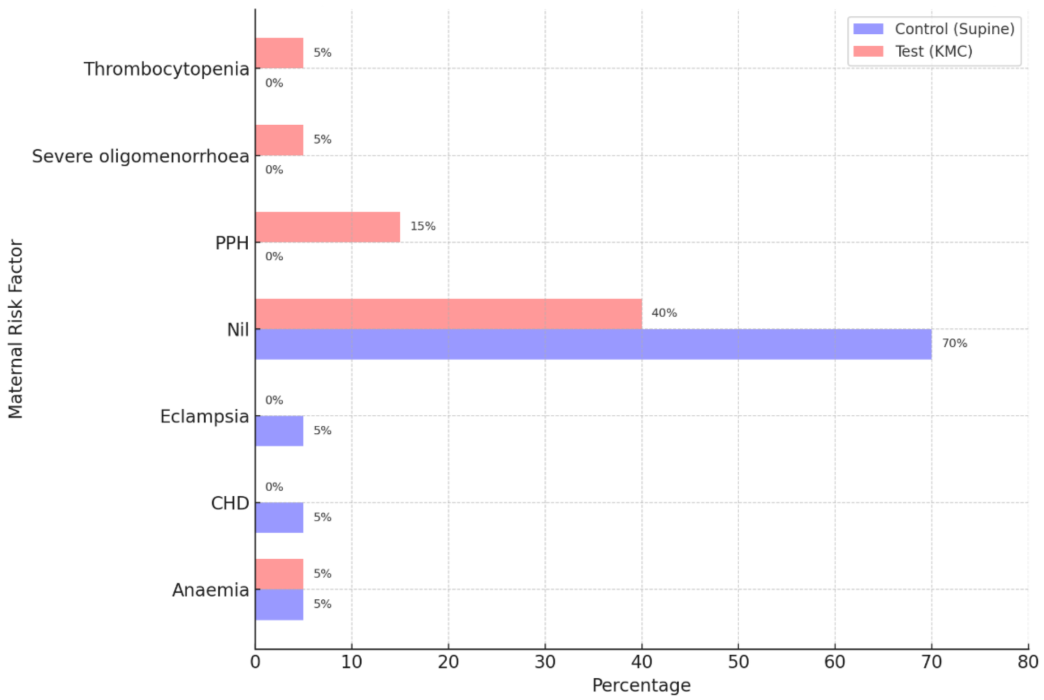
Comparison of maternal risk factors in both groups:

Among the 40 mothers, 18 had risk factors (6 in the control group and 12 in the test group), while 22 (55%) had none (14 in the control group and 8 in the test group). Anaemia was present in 1(5%). mother from each group Eclampsia was observed in 4(20%) mothers in the control group and 6 (30%) mothers in the test group. Postpartum haemorrhage (PPH) occurred in 3 (15%) mothers in the test group. Additionally, severe oligohydramnios was present in 1(5%) mother in the test group, and gestational thrombocytopenia was noted in 1(5%) mother in the test group. The difference in maternal risk factors were not statistically significant (p value- 0.291)

Table 4: Comparison of the Maternal risk factors in both groups

	Control/Test		Total	Chi-square test
	Control Group	Test Group		
Anaemia	1(5%)	1(5%)	2 (5%)	Test value 9.636 d.f. 8; p value 0.291
CHD	1(5%)	0(0%)	1(2.5%)	
Eclampsia	4(5%)	6(30%)	10(35%)	
Nil	14(70%)	8(40%)	22(55%)	
PPH	0(0%)	3(15%)	3(7.5%)	
Severe oligomenorrhoea	0(0%)	1(5%)	1 (2.5%)	
Thrombocytopenia	0(0%)	1(5%)	1(2.5)	
Total	20(100%)	20(100%)	40	

Figure 10 : Bar Graph Comparing Maternal Risk Factors Between the Two Groups



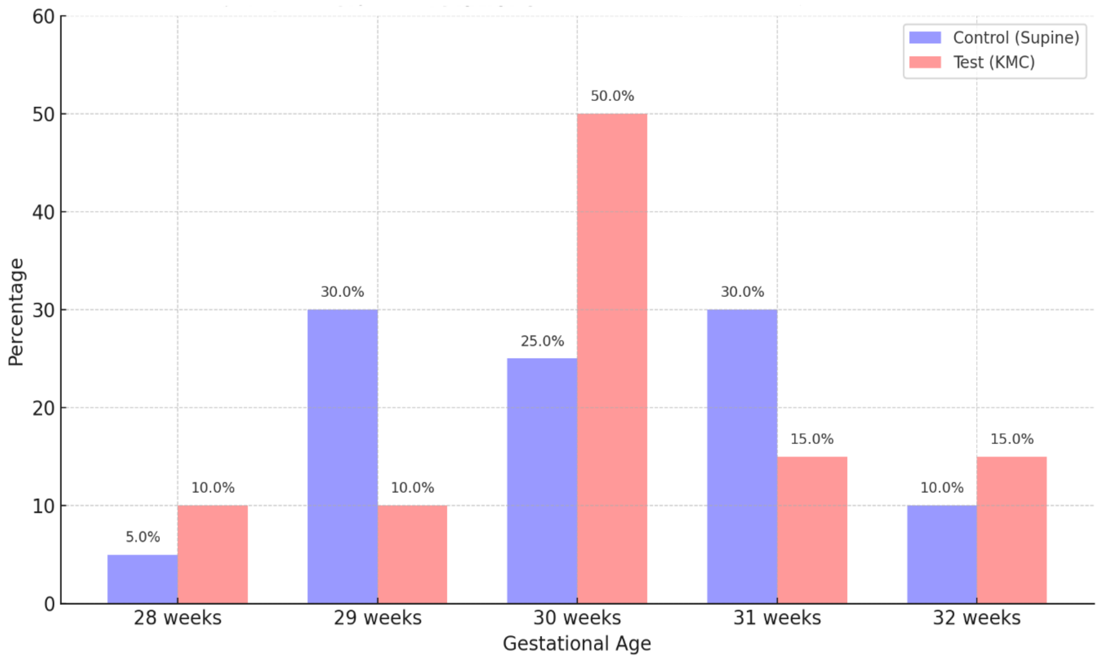
Comparison of gestational age in both groups:

In the test group, the majority were born at 30 weeks of gestation, with 10(50%) preterm neonates .In the control group, most preterm neonates were distributed between 29 to 31 weeks of gestation, with 6 born at 29 weeks, 5 at 30 weeks and 6 at 31 weeks. The difference in gestational age between the groups was not statistically significant (p = 0.267), making the groups comparable in this regard.

Table 5: Comparison of the gestational age in both groups

	Control/Test		Total	Chi-square test
	Control Group	Test Group		
28 weeks	1 (5.0%)	2 (10.0%)	3 (7.5%)	Test value 5.200 d.f. 2; p value 0.267
29 weeks	6 (30.0%)	2 (10.0%)	8 (20.0%)	
30 weeks	5 (25.0%)	10 (50.0%)	15 (37.5%)	
31 weeks	6 (30.0%)	3 (15.0%)	9 (22.5%)	
32 weeks	2 (10.0%)	3 (15.0%)	5 (12.5%)	
Total	20	20	40	
	100.0%	100.0%	100.0%	

Figure11: Bar Graph Comparing Gestational Age Between the Two Groups



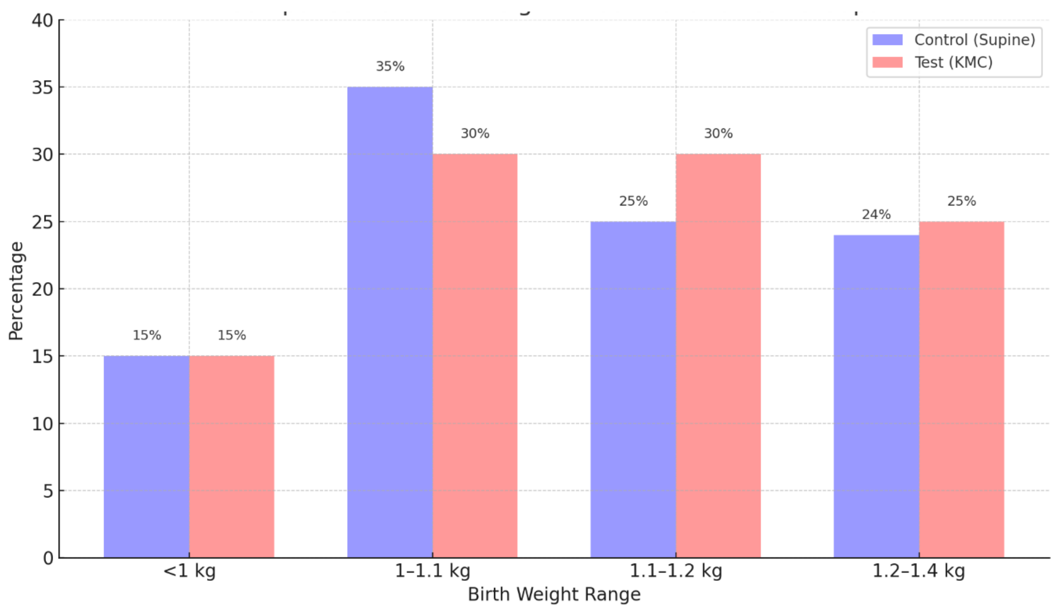
Comparison of birth weight in both groups:

Preterm Neonates in both the control group and the test group had birth weights ranging from less than 1 kg to 1.4 kg. The majority, 13 (32.5%) weighed between 1.0 and 1.1 kg (7 in the control group and 6 in the test group). Birth weights between 1.1 and 1.2 kg were recorded in 11 (27.5%) preterm neonates (5 in the control group and 6 in the test group). A total of 10 (25%) preterm neonates weighed between 1.2 and 1.4 kg (5 in the control group and 5 in the test group). A smaller group of 6 (15%) preterm neonates had birth weights below 1 kg (3 in the control group and 3 in the test group), with the lowest birth weight of 820 grams recorded in the test group. The mean birth weight was 1.1 kg. The difference in birth weight distribution between the groups was not statistically significant ($p = 0.983$), indicating that the birth weight distribution was comparable in both groups.

Table 6: Comparison of the birth weight in both groups

	Control/ Test		Total	Chi-square test
	Control Group	Test Group		
<1 kg	3(15%)	3(15%)	6(15%)	Test value 0.168 d.f. 3; p value 0.983
1 to 1.1 kg	7(35%)	6(30%)	13(32.5%)	
1.1 to 1.2 kg	5(25%)	6(30%)	11(27.5%)	
1.2 to 1.4kg	5(24%)	5(25%)	10(25%)	
Total	20(100%)	20(100%)	40(40%)	

Figure 12: Bar Graph Comparing Birth Weight Between the Two Groups



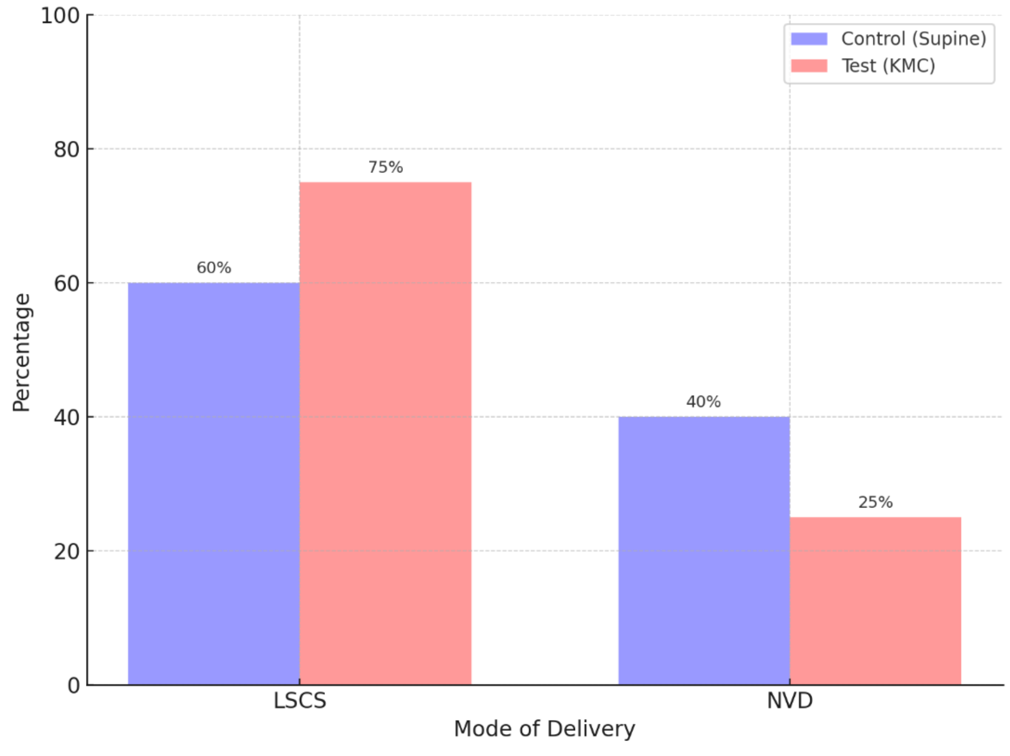
Comparison of mode of delivery in both groups:

The majority of deliveries in both the control and test groups were via LSCS, with 12 (60%) in the control group and 15 (75%) in the test group. A smaller percentage of deliveries were via NVD, with 8 (40%) in the control group and 5 (25%) in the test group. The difference in the mode of delivery between the groups was not statistically significant (p = 0.311), indicating that the distribution of the mode of delivery was comparable in both groups.

Table 7: Comparison of the Mode of delivery in both groups

	Control/ Test		Total	Chi-square test
	Control Group	Test Group		
LSCS	12(60%)	15(75%)	27(67.5%)	Test value 1.026
NVD	8(40%)	5(25%)	13(32.5%)	d.f. 1;
Total	20(100%)	20(100%)	40(100%)	p value 0.311

Figure 23: Bar Graph Comparing Mode of delivery Between the Two Groups



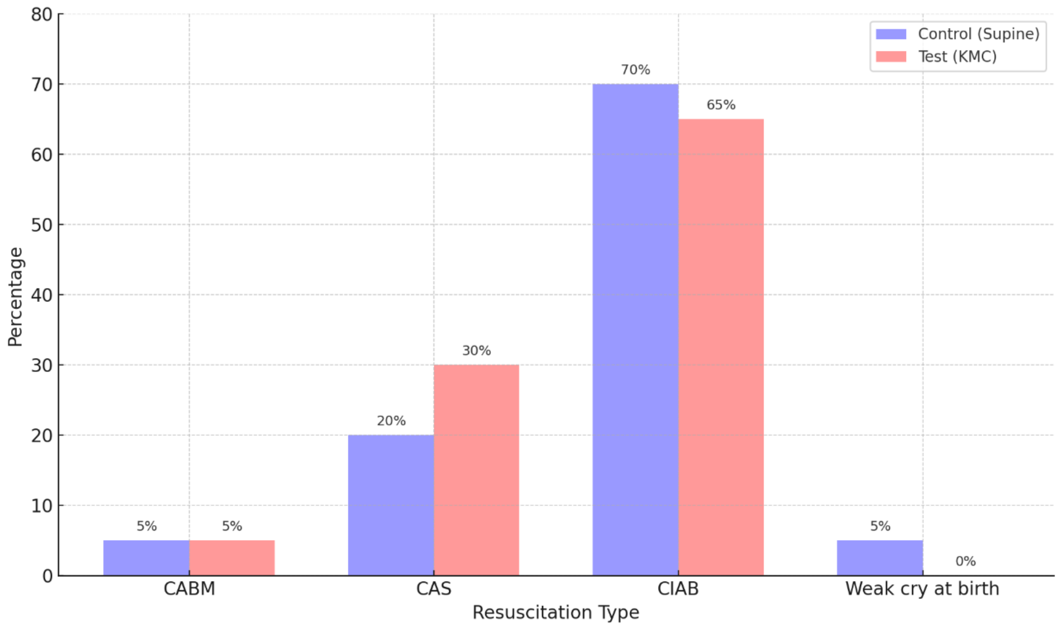
Comparison of the resuscitation in both groups:

The majority of preterm neonates cried immediately after birth (CIAB), with 14 (70%) in the control group and 13 (65%) in the test group, requiring no active resuscitation. A total of 10 preterm neonates required stimulation, including 4 (20%) in the control group and 6 (30%) in the test group. Two preterm neonates cried after bag and mask ventilation (CABM), with 1 (5%) in each group. Additionally, 1 (5%) in the control group had a weak cry at birth. Subsequently, in the NICU, 3 preterm neonates in the control group required mechanical ventilation — 2 due to respiratory distress syndrome (RDS) and 1 with a weak cry at birth. In the test group, only 1 preterm neonate required mechanical ventilation due to RDS, and this baby had required bag and mask ventilation at birth. The difference in resuscitation methods between the groups was not statistically significant ($p = 0.697$), indicating that the resuscitation distribution was comparable in both groups.

Table 8: Comparison of the resuscitation in both groups

	Control/Test		Total	Chi-square test
	Control Group	Test Group		
CABM	1(5%)	1(5%)	2(5%)	Test value 1.437 d.f. 3; p value 0.697
CAS	4(20%)	6(30%)	10(25%)	
CIAB	14(70%)	13(65%)	27(67.5%)	
Weak cry at birth	1(5%)	0(0%)	1(2.5%)	
Total	20(100%)	20(100%)	40(100%)	

Figure 34: Bar Graph Comparing Resuscitation Between the Two Group



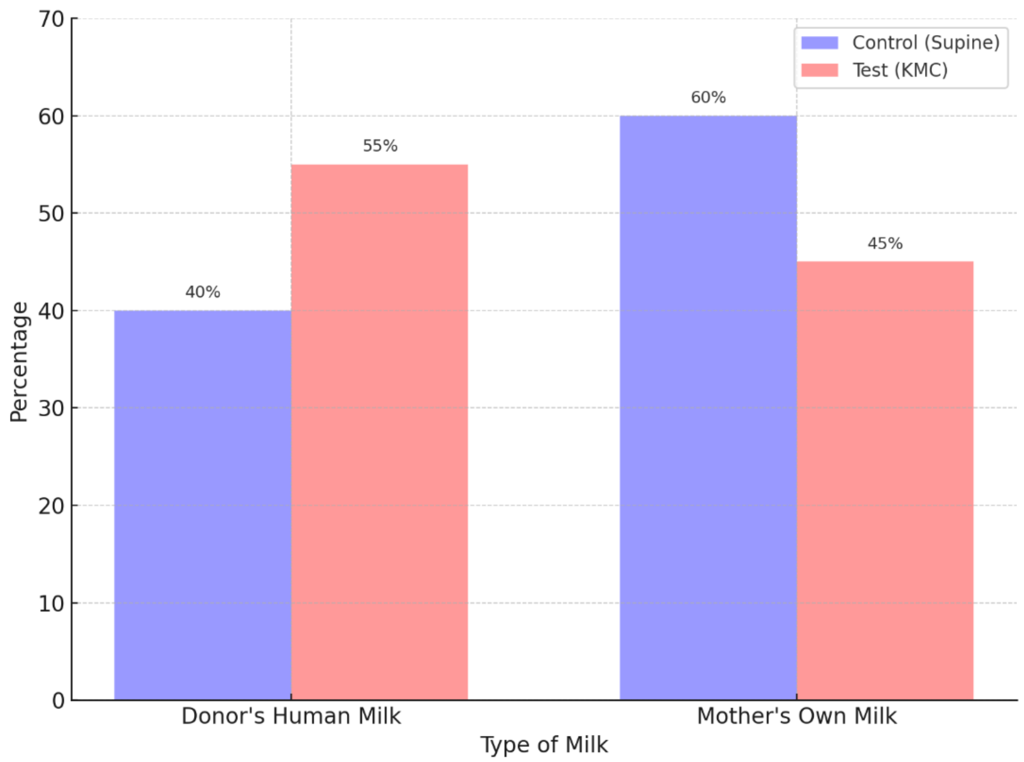
Comparison of the Type of milk in both groups:

The majority of preterm neonates in both the control and test groups received their mother’s own milk, with 12 (60%) in the control group and 9 (45%) in the test group. Donor human milk was given to 8 (40%) in the control group and 11 (55%) in the test group. The difference in the type of milk between the groups was not statistically significant (p = 0.342), indicating of the milk administered was comparable in both groups.

Table 9: Comparison of the Type of milk in both groups

	Control / Test		Total	Chi-square test
	Control Group	Test Group		
Donor's Human Milk	8(40%)	11(55%)	19(47.5%)	Test value 0.902
Mother's own milk	12(60%)	9(45%)	21(52.5%)	d.f. 1;
Total	20(100%)	20(100%)	40(100%)	p value 0.342

Figure 45: Bar Graph Comparing Type of milk Between the Two Groups



Comparison of Nil Gastric Residual Volume Between Two Groups:

Table10- Comparison of Nil Gastric Residual Volume Between two groups

	Control Group: Preterm neonates receiving Orogastric Feeding in Supine Position	**Test Group**: Preterm neonates receiving Orogastric Feeding in KMC Position	P - value
8AM	15 (75%)	20 (100%)	0.0471
2PM	2(10%)	16 (80%)	<0.001
8PM	0 (0%)	9 (45%)	0.001

The above table shows a greater number of preterm neonates had nil gastric aspirate in the Test group when compared to the preterm neonates in the control group ,the number being 20,16,9 in the test group vs 17,2,1 in the control group 3 hours after feeds given at 8AM (p value - 0.0471), 2PM (p value - < 0.001) and 8PM (p value - 0.001). This difference is statistically significant. Of the remaining preterm neonates who had gastric aspirates the volume of the aspirate ranged from 0.2 cc to 1.5 cc with 6 preterm neonates in the control group having an aspirate of 1cc when compared to 2 preterm neonates in test group. The table also shows that there was better tolerance to feeds given at 8AM when compared to 2 PM and 8 PM in both the groups. Probably due to the volume of feeds being increased at 2PM and 8PM.

Comparison of the Amount of Breast Milk Fed in Both Groups with Post Prandial Gastric Residual Volume-After 3 Hours in Both Group

Table 11 - Comparison of Gastric Residual Volume (GRV) in Preterm Neonates in Control Group

	Time	Nil	o.2 cc	0.3 cc	0.4 cc	0.5 cc	0.6cc	0.8cc	1 cc	1.3 cc	1.5 cc	Total
Control	8 AM	17	2	0	0	0	1	0	0	0	0	20
	2 PM	2	4	3	1	6	0	1	3	0	0	20
	8 PM	0	1	2	0	3	3	4	3	1	1	20

Table 12 - Comparison of Gastric Residual Volume (GRV) in Preterm Neonates in Test Group

	Time	Nil	o.2 cc	0.3 cc	0.4 cc	0.5 cc	0.6cc	0.8cc	1 cc	1.3 cc	1.5 cc	Total
Test	8 AM	20	0	0	0	0	0	0	0	0	0	20
	2 PM	16	2	0	0	0	0	0	2	0	0	20
	8 PM	9	4	2	2	0	0	3	0	0	0	20

- Statistically significant difference observed at 8 AM ($p = 0.032$), 2 PM ($p = 0.004$), and 8 PM ($p = 0.001$).

- In both the control and test groups, preterm neonates received different volumes of feeds as per the protocol followed in NICU – ranging from 2 to 5 cc of breast milk at 8:00 AM, 2cc to 6cc at 2PM and 2cc to 8cc at 8PM.
- Three hours after feeding at 8AM:the Gastric residual volume in the preterm neonate of control group varied from nil (0cc) to 0.6cc which amounted to 0% to 12%. The number of preterm neonates having nil aspirates were 17 ,2 preterm neonates having 0.2cc and 1 having 0.6 cc gastric residual. In contrast in the test group, all 20 Preterm neonates had nil aspirates (0 cc),which amounted 0%. This difference was statistically significant (p = 0.032), indicating that preterm neonates receiving orogastric feeding in the KMC position (test group) exhibit more efficient gastric emptying and improved feeding tolerance compared to those fed in the routine supine position (control group).
- Three hours after feeding at 2PM : The Gastric residual volume in the preterm neonate of control group varied from nil (0cc) to 1cc which varying from to 0% to 50% of the volume of the feed given. The number preterm neonates having nil aspirates in the control group were 2. In contrast to 16 preterm neonates in the test group who had nil aspirates .Of the remaining 4 preterm neonates in the test group had 0.2cc and 1cc aspirate , which amounted from 0 % to 25% of the feed given . This difference was statistically significant (p = 0.004), with the preterm neonates receiving orogastric feeding in KMC position (test group) exhibiting greater feeding tolerance and reduced gastric residual volumes compared to the preterm neonates receiving orogastric feeding in routine supine position (control group).
- Three hours after feeding at 8PM: Preterm neonates in the control group had gastric residual volumes between 0.2 cc to 1.5 cc of the volume of the feed

given which varying from 0% to 21.7% and no neonates had nil aspirates,.In contrast in the Test group, 9 Preterm neonates had nil aspirates (0 cc) and others ranged from 0.2cc to 0.8 cc ,which amounted from 0 % to 10% of the volume of the feeds given.The difference was statistically significant (p = 0.001),across all time points with the preterm neonates receiving orogastric feeding during KMC position (test group) exhibiting greater feeding tolerance and reduced gastric residual volumes compared to the preterm neonates receiving orogastric feeding in routine supine position (control group).

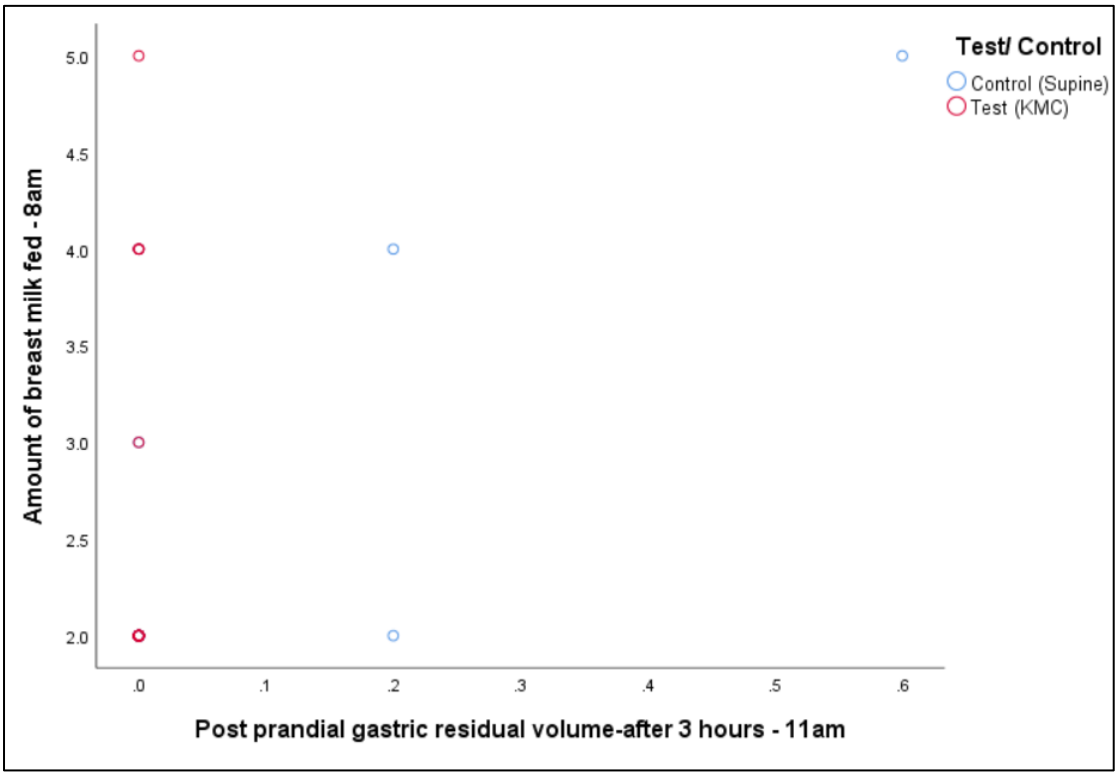


Figure no 16 – Scatter Plot Diagram Showing the Relationship Between Breast Milk Feed at 8 AM and post-GRV at 11 AM

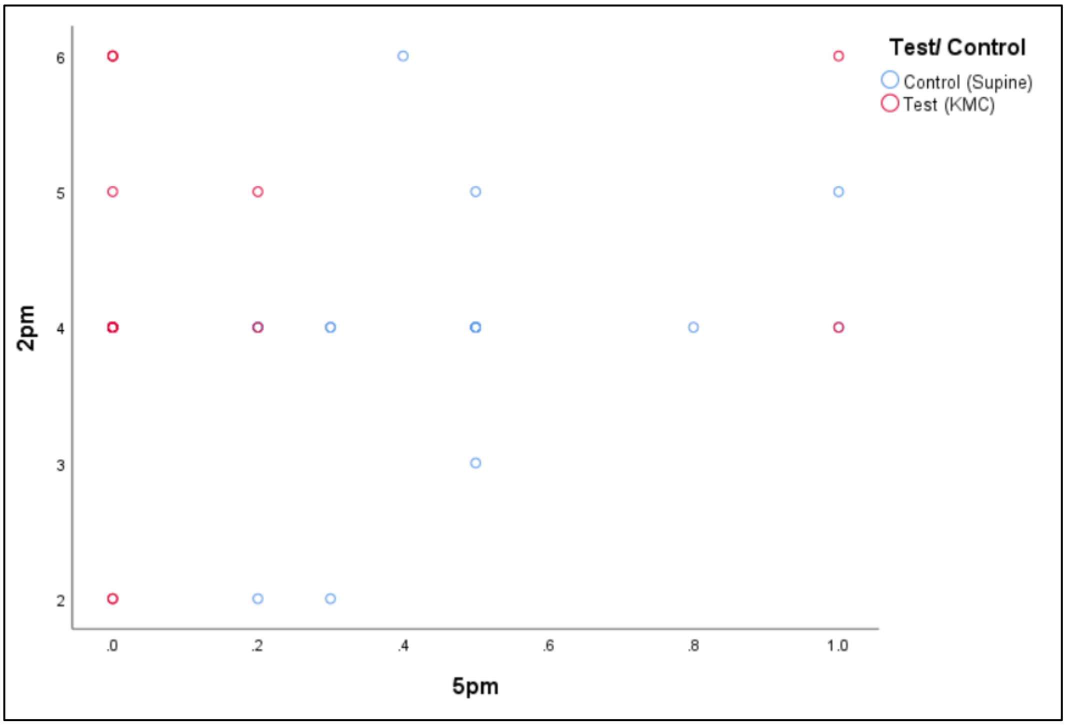


Figure no 17 – Scatter Plot Diagram Showing the Relationship Between Breast Milk Feed at 2 PM and post-GRV at 5PM

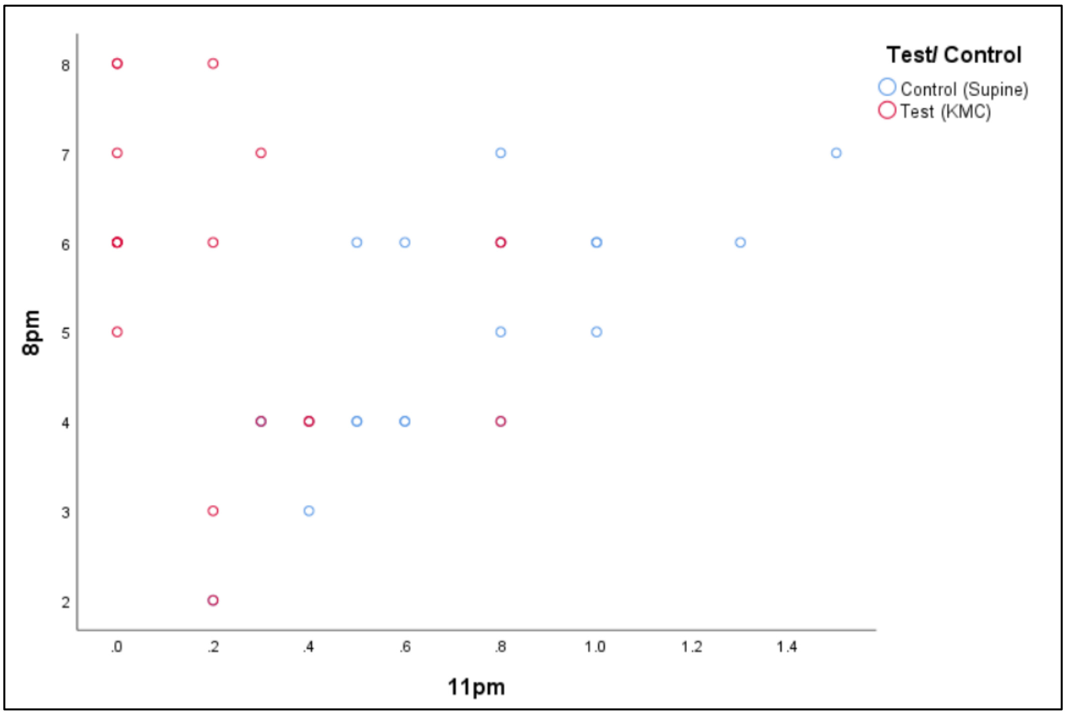


Figure no 18 – Scatter Plot Diagram Showing the Relationship Between Breast Milk Feed at 8 PM and post-GRV at 11 PM

Comparison of Heart Rate Before and 3 Hours After Feeding in Both Groups:

Table 13 - CONTROL - Mean Heart Rate (BPM) before and after Feeding Comparison

Time	Before feed HR Mean ± SD	Time	After feed HR Mean ± SD	T test – p value
8 AM	147.55 ± 3.7	11 AM	149.1 ± 4.5	0.366
2PM	151.9 ± 3.6	5 PM	153.35 ± 5.5	0.269
8 PM	151.2 ± 4.9	11 PM	153.35 ± 5.5	<0.001

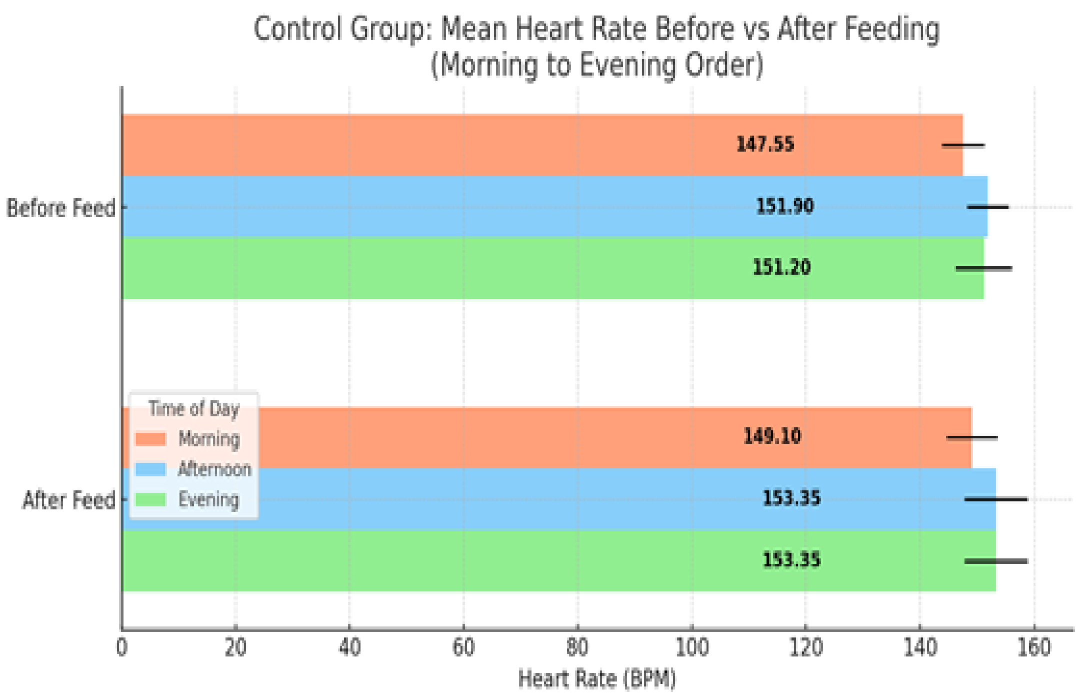


Figure 19 - Bar Graph Showing Pre- and Post-Feeding Mean Heart Rate in Control Group

Table 14 - Test (KMC) - Mean Heart Rate (BPM) before and after Feeding Comparison

Time	Before feed HR Mean ± SD	Time	After feed HR Mean ± SD	T test – p value
8 AM	146.5 ± 4.4	11 AM	144.05 ± 4.2	0.014
2 PM	150.0 ± 4.5	5 PM	147.70 ± 5.2	0.003
2 PM	146.55 ± 3.9	11 PM	144.20 ± 5.0	0.043

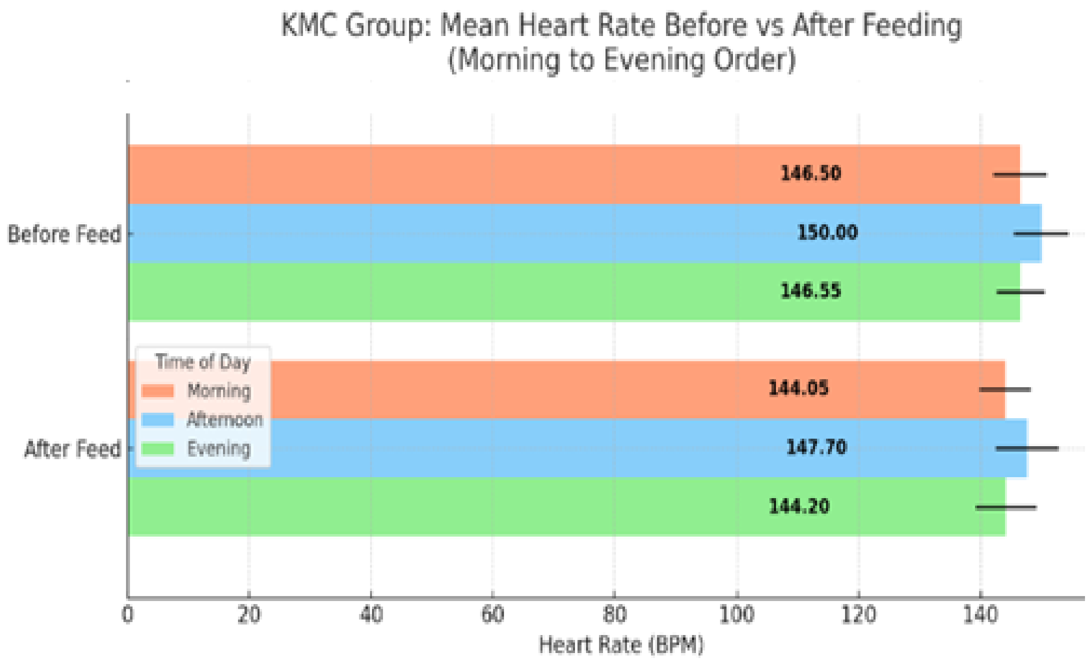


Figure 20 - Bar Graph Showing Pre- and Post-Feeding Mean Heart Rate in Test Group

The table above shows the change in heart rate before and 3 hours after orogastric feeding, given at three scheduled time sessions: Heart rate (HR) was assessed at 8 AM, 2 PM, and 8 PM (10 minutes prior to the scheduled feeds) and at 11 AM, 5 PM, and 11 PM (3 hours after the feed). It was observed that preterm neonates in the control group receiving orogastric feeding in supine position had an increase in heart rate 3 hours after feed at all time points , with a statistically significant increase in HR at 11 PM (p-value < 0.001).

In comparison, preterm neonates in the test group receiving orogastric feeding in KMC position did not show an increase in mean HR 3 hours after feed all time points . Instead, there was a decrease in mean HR after each feed at all time points — 11 AM ($p = 0.014$), 5 PM ($p = 0.003$), and 11 PM ($p = 0.043$), indicating better autonomic stability in the test group compared to the control group.

Comparison of Respiratory Rate Before and 3 Hours After Feeding in Both Groups:

Table 15 – CONTROL (Supine) - Mean Respiratory Rate before and after Feeding Comparison

Time	Before feed RR Mean ± SD	Time	After feed RR Mean ± SD	T test – p value
8 AM	53.85 ± 3.08	11 AM	56.65 ± 2.62	<0.001
2 PM	56.65 ± 2.6	5 PM	57.15 ± 1.9	<0.001
8 PM	56.15 ± 1.5	11 PM	60.4 ± 1.7	<0.001

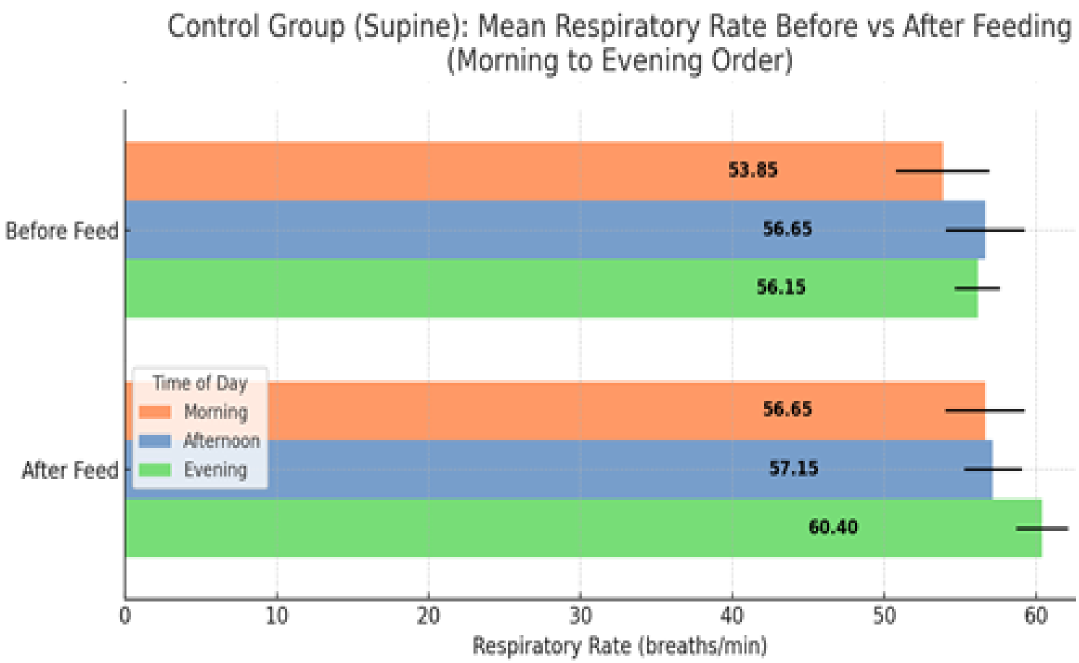


Figure 21 - Bar Graph Showing Pre- and Post-Feeding Mean Respiratory Rate in Control Group

Table 16 - Test (KMC) - Mean Respiratory Rate before and after Feeding Comparison

Time	Before feed RR Mean ± SD	Time	After feed RR Mean ± SD	T test – p value
8 AM	53.1 ± 2.39	11 AM	50.25 ± 3.74	0.013
2 PM	52.35 ± 2.9	5 PM	50.25 ± 3.7	0.007
8 PM	51.15 ± 1.9	11 PM	49.3 ± 4.1	0.002

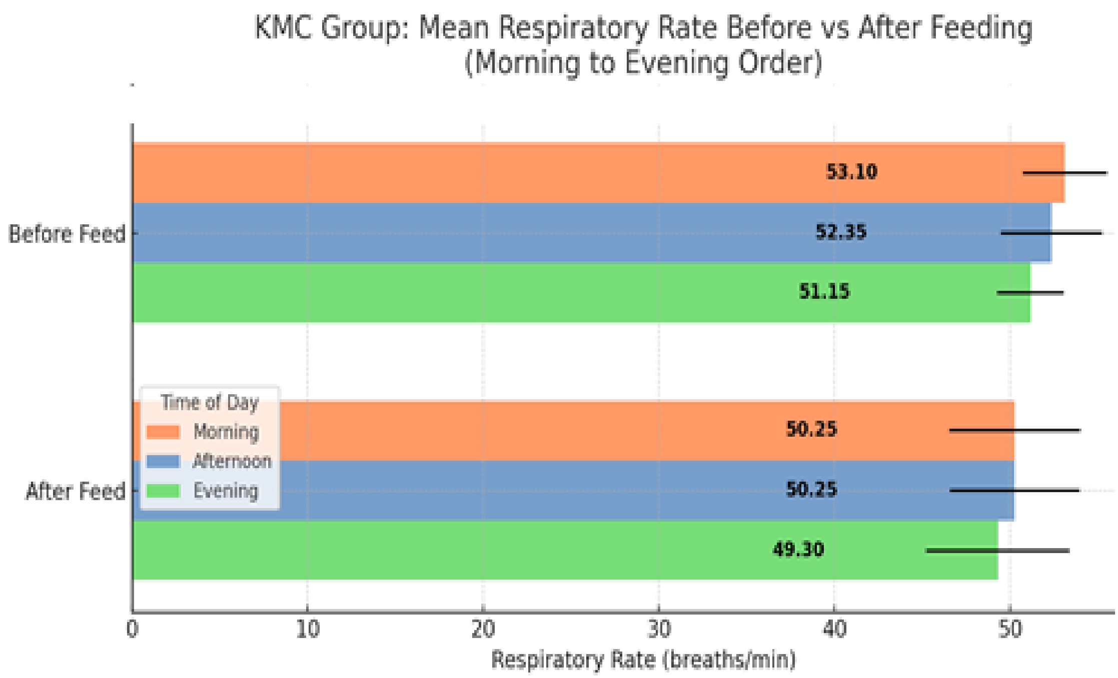


Figure 22 - Bar Graph Showing Pre- and Post-Feeding Mean Respiratory Rate in Test Group

The table above shows the change in respiratory rate before and 3 hours after orogastric feeding, given at three scheduled time sessions: Respiratory rate (RR) was assessed at 8AM, 2 PM, and 8 PM (10 minutes prior to the scheduled feeds) and at 11 AM, 5 PM and 11 PM (3 hours after the feed). It was observed that preterm neonates in the control group receiving orogastric feeding in supine position had an increase in respiratory rate 3 hours after feed at all time points , with a statistically significant increase in RR (p-value < 0.001). In comparison, preterm neonates in the test group receiving orogastric feeding in KMC position did not show an increase in mean respiratory rate 3 hours after feed at all time points. Instead, there was a significant decrease in mean respiratory rate after each feed was observed at **11 AM (p = 0.013)**, **5 PM (p = 0.007)**, and **11 PM (p = 0.002)**, indicating better respiratory stability in the test group compared to the control group, suggesting enhanced respiratory regulation with KMC position.

Comparison of SpO_2 Before and 3 Hours After Feeding in Both Groups:

Table 17 - CONTROL(Supine) - Mean SpO2 (%) before and after Feeding Comparison

Time	Before feed SpO2 (%) Mean ± SD	Time	After feed SpO2 (%) Mean ± SD	T test – p value
8 AM	98 ± 0.1	11 AM	97.7 ± 0.9	0.310
2 PM	98± 0.4	5 PM	97.4 ± 1.12	0.240
8 PM	98.06 ± 0.25	11 PM	98.35 ± 1.03	0.230

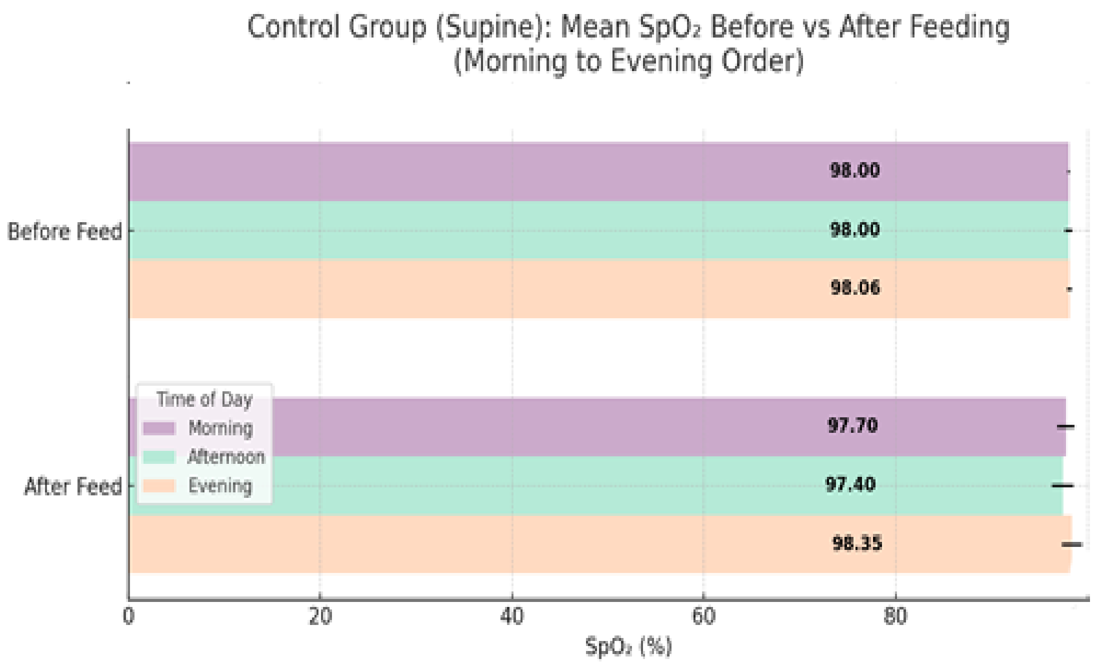


Figure 23 - Bar Graph Showing Pre- and Post-Feeding Mean SpO2 (%) in Control Group

Table 18 - Test (KMC) - Mean SpO2 (%) before and after Feeding Comparison

Time	Before feed SpO2 (%) Mean ± SD	Time	After feed SpO2 (%) Mean ± SD	T test – p value
8 AM	98.45 ± 0.9	11 AM	97.9 ± 1.1	0.250
2 PM	97.1 ± 0.5	5 PM	97.9 ± 1.1	0.331
8 PM	97.6 ± 0.9	11 PM	97.8 ± 1.1	0.062

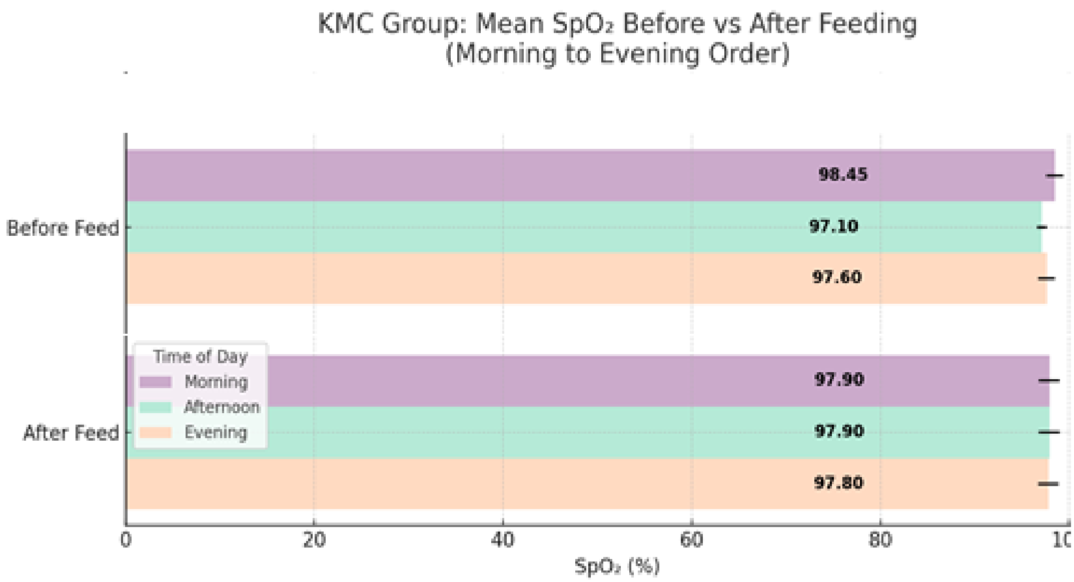


Figure 24 - Bar Graph Showing Pre- and Post-Feeding Mean SpO2 (%) in Test Group

The mean SpO_2 in the preterm neonates of the Control group at 8 AM, 2 PM, 8 PM ,5 PM, and 11 AM, 5 PM ,11AM were 98%, 97.7%, 98%, 97.4%, 98.06%, and 98.35%, respectively. The corresponding figures in the Test (KMC) group were 98.45%, 97.9%, 97.1%, 97.9%, 97.6%, and 97.8%, respectively. No significant difference in SpO_2 was observed between the Test and Control groups at any of the time points.

Comparison of Temperature Before and 3 Hours After Feeding in Both Groups:

Table 19 -CONTROL(Supine) - Mean Body Temperature (°C) before and after Feeding Comparison

Time	Before feed Temperature (°C) Mean ± SD	Time	After feed Temperature (°C) Mean ± SD	T test – p value
8 AM	36.9 ± 0.2	11 AM	36.79 ± 0.2	0.041
2 PM	36.5 ± 0.22	5 PM	36.5 ± 0.1	0.249
8 PM	37.3 ± 0.1	11 PM	36.4 ± 0.1	0.134

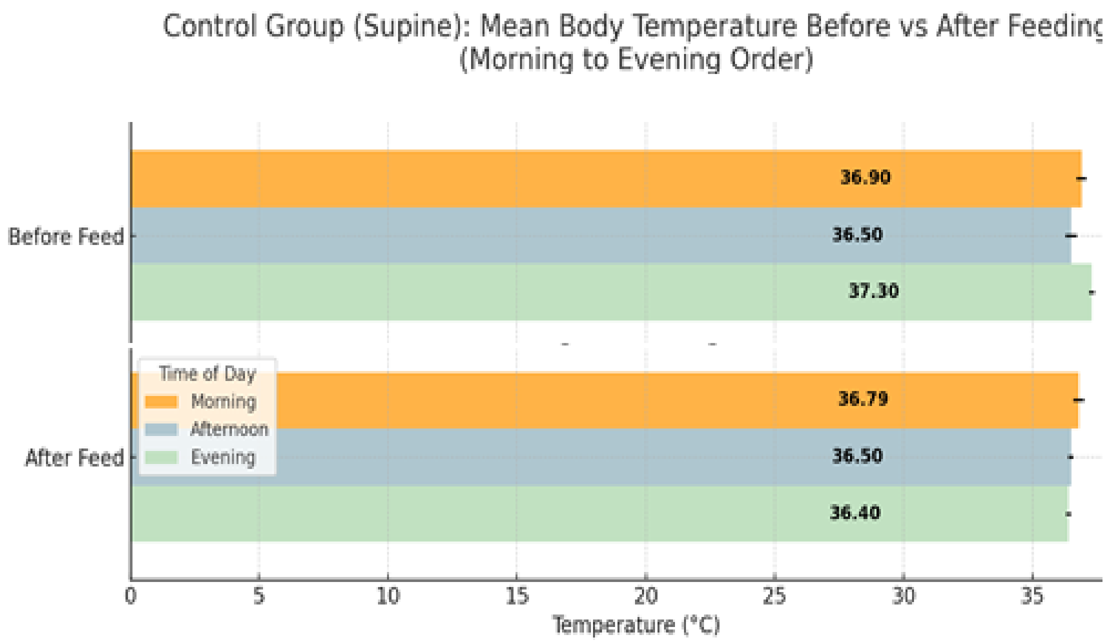


Figure 25 - Bar Graph Showing Pre- and Post-Feeding Mean Body Temperature (°C) before in Control Group

Table 20 - Test (KMC)- Mean Body Temperature (°C) before and after Feeding Comparison

Time	Before feed Temperature (°C) Mean ± SD	Time	After feed Temperature (°C) Mean ± SD	T test – p value
8 AM	36.64 ± 0.2	11 AM	36.73 ± 0.2	<0.001
2 PM	36.65 ± 0.15	5 PM	36.8 ± 0.3	0.070
8 PM	36.37 ± 0.3	11 PM	37.1 ± 0.2	<0.001

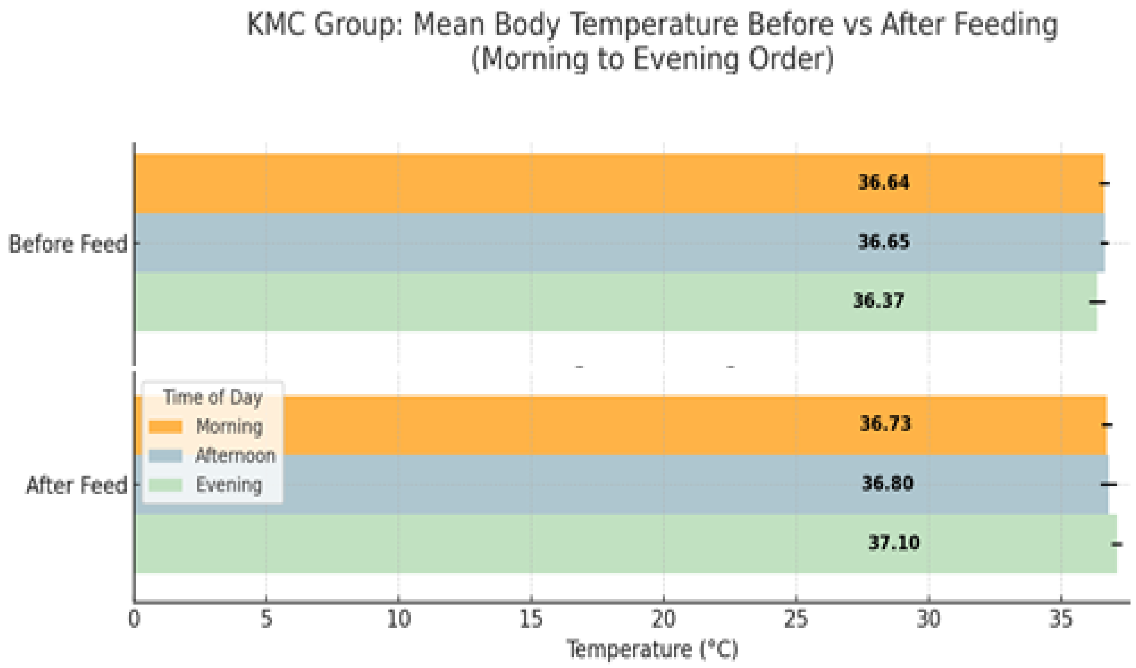


Figure 26 - Bar Graph Showing Pre- and Post-Feeding Mean Body Temperature (°C) before in Test Group

The table shows that in the control group, there was a decrease in mean body temperature after feeding, with a noticeable drop at 11 AM and 11 PM. However, this change was not statistically significant. In Test group the results showed an increase in body temperature at all time points 3 hours after feed with 11am and 11 pm post feed being statistically significant (p value <0.001). None of the preterm neonates in the test group had a drop in body temperature after orogastric feeds.

INFANT POSITION ASSESSMENT TOOL 10 MINS BEFORE FEED:

The Infant Position Assessment Tool (IPAT) score was evaluated 10 minutes before feeding -

At 8 AM, The majority of preterm neonates in both groups scored 11, with 11 in the control group and 10 in the test group. A slightly lower number of preterm neonates scored 10, with 8 in the control group and 9 in the test group. Only 1 preterm neonate in each group scored 9. The difference between the two groups was not statistically significant (p = 0.948).

At 2 PM, The majority of preterm neonates in both groups scored 10, with 13 in the control group and 11 in the test group. A smaller proportion scored 11, with 5 in the control group and 8 in the test group, while 9 was the least common score, recorded in 2 preterm neonates from the control group and 1 from the test group. Despite the test group having more preterm neonates scoring 11, the difference remained not statistically significant (p = 0.551).

At 8 PM, The majority of preterm neonates in both groups scored 10, with an equal number in the control and test groups . Fewer preterm neonates scored ≥11, with 2 in the control group and 8 in the test group, while 9 was recorded in 8 preterm neonates from the control group and 2 from the test group. While there was a trend toward higher scores in the test group, the difference was not statistically significant (p = 0.109).

Table 21 : IPAT score [10 mins before feed]

		Test/ Control		Total	Chi-square test
		Control (Supine)	**Test (KMC)**		
8 am	**9**	1 (5.0%)	1 (5.0%)	2 (5.0%)	Test value 0.106 d.f. 2; p value 0.948
	10	8 (40.0%)	9 (45.0%)	17 (42.5%)	
	11	11 (55.0%)	10 (50.0%)	21 (52.5%)	
2 PM	**9**	2 (10%)	1 (5%)	3 (7.5 %)	P value – 0.551
	10	13 (65%)	11 (55%)	24 (60%)	
	11	5 (25%)	13 (32.5 %)	13 (32.5 %)	
8 PM	**9**	8 (40%)	2 (10.0%)	10 (25%)	P value- 0.109
	10	10 (50.0%)	10 (50.0%)	20 (50.0%)	
	≥ 11	2 (10.0%)	8 (40%)	10 (25%)	

INFANT POSITION ASSESSMENT TOOL 3 HOURS AFTER FEED:

At 11:00 AM,all the preterm neonates scored IPAT score between 8 to ≥11. The majority of preterm neonates in the control group scored 8 (10 in control vs. 1 in test), whereas the majority in the test group scored ≥11 (16 in test vs. 0 in control). The difference between the groups at this time point was highly significant (p < 0.001), indicating that preterm neonates in the test group had higher IPAT scores.

Similar findings At 5:00 PM, majority of the preterm neonates in the control group scored ≤8 (17 in control vs. 2 in test), while the majority in the test group scored ≥11 (15 in test vs. 0 in control). The difference between the two groups at this time point was also highly significant ($p < 0.001$).

Similar observations were made at 11:00 PM, with most preterm neonates in the control group scoring ≤8 (17 in control vs. 3 in test), while the majority in the test group scored ≥11 (15 in test vs. 0 in control). The difference between the two groups at this time point was highly significant ($p < 0.001$).

Preterm neonates who received orogastric feeds in the KMC position (test group) consistently showed higher IPAT scores compared to those in the supine position (control group), indicating that they were more comfortable and settled throughout the feeding period. Higher IPAT scores reflect better behavioural responses, which may indicate greater comfort and improved well-being in preterm neonates receiving KMC.

The number of preterm neonates with an IPAT score of 10 or ≥10 was markedly higher in the test group compared to the control group—17, 18, and 17 preterm neonates in the test group versus 1, 0 and 1 in the control group. This difference was highly statistically significant ($p < 0.001$). These findings indicate significantly greater comfort and improved feeding tolerance in preterm neonates receiving orogastric feeds in the KMC position(test) compared to those in the supine position(supine).

Table 22: IPAT score= [3 hours after feed] - 11am

		Test/ Control		**Total**	Chi – Square test
		Control (Supine)	**Test (KMC)**		
11 AM	**8**	10 (50.0%)	1 (5.0%)	11 (27.5%)	Test value 28.026 d.f-5; **P value- <0.001**
	9	9 (45.0%)	2 (10.0%)	11 (27.5%)	
	10	1 (5.0%)	1 (5.0%)	2 (5.0%)	
	≥ 11	0 (0.0%)	16(80%)	16 (40%)	
5 PM	**≤ 8**	17 (85%)	2(10%)	19 (47.5%)	**P value- <0.001**
	9	3(15.0%)	0 (0%)	3 (7.5%)	
	10	0 (0%)	3 (15.0%)	3 (7.5%)	
	≥ 11	0 (0.0%)	15 (75%)	15 (37.5 %)	
11 PM	**≤ 8**	17 (85%)	3 (15%)	20 (50%)	**P value- <0.001**
	9	2 (10.0%)	1 (5.0%)	3 (7.5%)	
	10	1 (5.0%)	1 (5.0%)	2 (5.0%)	
	≥ 11	0 (0.0%)	15 (75.0%)	15 (37.5%)	

STARTING DAY OF FEEDS:

In both the control (supine) and test (KMC) groups, the initiation of orogastric feeding varied across the first week. On Day 1, feeds were initiated in 7 preterm neonates from each group. By Day 2, 6 preterm neonates in the control group vs 8 preterm neonates in the test group had started feeding. On Day 3 (2 in control vs. 1 in test), Day 4 (1 in control vs. 2 test), Day 5 (1 in control), Day 6 (1 in each group), and Day 7 (2 vs 1). Overall, the distribution of feed initiation was similar between groups, with the majority of neonates (70% in control, 75% in test) starting feeds by Day 2. This indicates that the timing of feed initiation was comparable between the two groups.

Table 23: Starting Day of feeds

		Test/ Control		Total	Chi-square test
		Control (Supine)	Test (KMC)		
Starting Day of feeds	Day 1	7 (35.0%)	7 (35.0%)	14 (35.0%)	Test value 2.286 d.f. 6; p value 0.892
	Day 2	6 (30.0%)	8 (40.0%)	14 (35.0%)	
	Day 3	2 (10.0%)	1 (5.0%)	3 (7.5%)	
	Day 4	1 (5.0%)	2 (10.0%)	3 (7.5%)	
	Day 5	1 (5.0%)	0 (0.0%)	1 (2.5%)	
	Day 6	1 (5.0%)	1 (5.0%)	2 (5.0%)	
	Day 7	2 (10.0%)	1 (5.0%)	3 (7.5%)	
Total		20	20	40	
		100.0%	100.0%	100.0%	

DAY OF REACHING FULL TARGET FEEDS:

It is observed that the number of preterm neonates reaching target feeds from day 4 to day 7 were significantly higher in the test group than the control group preterm neonates . The figure having 5 vs none on day 4,6 vs 1 on day 5, 4 vs 3 on day 6 and 1vs 6 on day 7 totalling 16 preterm neonates in the test group vs 10 preterm neonates in the control group reaching target feeds on day 7 (p =0.026). Beyond Day 7, 10 neonates in the control group and 4 in the test group achieved full feeds. Among these neonates, a preterm neonate in the control group, born at 28 weeks of gestation with a birth weight of 820 grams and requiring mechanical ventilation for 5 days, was initiated on enteral feeds on Day 7 and reaching full feeds by Day 15. In contrast, a neonate in the test group, born at 28 weeks and 6 days with a birth weight of 990 grams, who also required mechanical ventilation for 5 days, began feeds on Day 7 and achieved full feeds by Day 11. These findings indicate that preterm neonates receiving orogastric feeding in KMC position achieved full target feeds earlier, reflecting improved feeding tolerance and enhanced gastrointestinal adaptation than preterm neonates receiving orogastric feeding in supine position .

Table 24: Day of Reaching Full Target Feeds

		Test/ Control		Total	
		Control (Supine)	**Test (KMC)**		
Day of full Target feeds	**Day 4**	0(0.0%)	5(25.0%)	5 (12.5%)	**Test value 20.419** **d.f. 10;** **p value 0.026**
	Day 5	1(5.0%)	6(30.0%)	7 (17.5%)	
	Day 6	3(15.0%)	4(20.0%)	7 (17.5%)	
	Day 7	6(30.0%)	1(5.0%)	7 (17.5%)	
	Day >7	10(40%)	4(20%)	14 (35%)	
Total		20	20	40	
		100.0%	100.0%	100.0%	

DISCUSSION

Around 15 million babies are born preterm globally each year, with India contributing significantly to this burden. Preterm neonates often require specialized care in the Neonatal Intensive Care Unit (NICU) due to complications such as respiratory distress, hypothermia, and feeding difficulties. Kangaroo Mother Care (KMC) is one of the most effective interventions for preterm care, involving skin-to-skin contact and exclusive breastfeeding, which help promote physiological stability, weight gain, and a reduced risk of infections. However, KMC is ideally recommended to be started after stabilization of the neonate. Recent studies have shown that immediate KMC (iKMC) which is initiated as soon as possible, even before stabilization of the baby has shown to decrease mortality and that the benefits of KMC can be extended to unstable LBW babies. Studies indicate that even in critically ill neonates, KMC helps maintain body temperature, reduces stress, and enhances overall outcomes, making it a vital component of neonatal care in intensive care settings.

Feeding plays a vital role in the survival and growth of preterm neonates. Due to their immature sucking and swallowing reflexes, orogastric feeding is the preferred method of providing nutrition in the neonatal intensive care unit (NICU). However, preterm infants often face challenges related to underdeveloped gastrointestinal function, making feeding tolerance a critical factor in achieving successful enteral nutrition. Optimal neonatal nutrition and effective management of feeding tolerance are thus essential for promoting adequate growth, minimizing complications, and improving overall outcomes.

While the supine position is the most commonly used posture for orogastric feeding, alternative positions such as the left lateral have also been explored in clinical practice, primarily to optimize gastric emptying and reduce the risk of aspiration. Despite the growing global adoption of Kangaroo Mother Care (KMC) for its established benefits in thermoregulation, bonding, and physiological stability, there is limited evidence regarding its impact on feeding practices. Specifically, very few studies have evaluated the safety, tolerance, and clinical outcomes of orogastric feeding administered while the neonate is held in the KMC position.

To address this knowledge gap, the present study aims to assess and compare feeding tolerance and related clinical outcomes in preterm neonates (28 to 34 weeks of gestational age) receiving orogastric feeding in the Kangaroo Mother Care (KMC) position versus the conventional supine position, through a hospital-based randomized controlled trial. The primary objective of the study is to compare tolerance to orogastric feeding between the two positions. Secondary objectives include evaluating physiological stability by monitoring vital signs, assessing comfort levels using the Infant Position Assessment Tool (IPAT) score before and after feeding and determining the duration required to achieve the target feed volume. This study seeks to generate evidence that can inform and advance neonatal care practices with an emphasis on safe and effective feeding strategies.

RANDOMISATION OF GROUPS: In our study, randomization of participants into 2 groups was executed successfully, with an equal distribution across the groups. Each group comprised of 20 participants, representing 50% of the total study population. This equal distribution was crucial as it ensured that each group had the same potential for receiving the intervention, thereby minimizing bias and enabling a fair comparison of outcomes across the groups.

NEONATAL FACTORS

Comparison of Sex Distribution in Both Groups:

The present study observed a higher percentage of females in the control group (60%) and a higher percentage of males in the test group (70%), although the difference was not statistically significant (p = 0.057). Similar trends were reported by Ludington-Hoe et al.[92], who conducted a randomized controlled trial on KMC positioning and found no significant differences in neonatal sex distribution, supporting comparability across intervention and control groups. A systematic review by Boundy et al.[94] also indicated that the benefits of KMC are not influenced by sex, ensuring unbiased representation. Furthermore, Conde-Agudelo & Díaz-Rossello et al.[98], in their meta-analysis, demonstrated no gender-specific bias in response to KMC, reinforcing that sex distribution, although variable, typically does not significantly influence outcomes. Sharma et al.[93] noted similar gender distributions in their comparative study, validating that randomization effectively balances demographic factors like sex. Nyqvist et al.[99], through observational studies, affirmed that neonatal outcomes in KMC are independent of gender distribution, thus aligning with the findings of the current study.

Comparison of Birth Weight in Both Groups:

The neonates in both groups had similar birth weight distributions, with the majority falling between 1.0 and 1.1 kg and no statistically significant difference found (p = 0.983). This mirrors findings by Ludington-Hoe et al.[92], who noted that KMC can be safely practiced in neonates weighing as low as 800 grams, with comparable tolerance outcomes. Ramanathan et al.[100] also found that neonates within this weight range did not experience increased feeding intolerance when managed in

KMC position. Boundy et al.[94] emphasized that KMC improves outcomes in low-birth-weight neonates, particularly those under 1.5 kg, suggesting that even the smallest neonates can safely be included in such trials. Sharma et al.[105] found similar weight-based inclusion criteria in their study, affirming the generalizability of results in this weight band. Finally, Bergh et al.[108] provided clinical guidelines on implementing KMC in neonates weighing <1.5 kg, validating the weight range and tolerance considerations.

Comparison of Resuscitation in Both Groups:

The majority of neonates in both groups required only routine care (CIAB), with no significant differences in resuscitation methods ($p = 0.697$). These findings are comparable to those of Boundy et al., who documented that most neonates managed with KMC post-delivery did not require extensive resuscitative efforts. Sharma et al.[105] also observed similar distributions of resuscitation needs in their comparative study of KMC and conventional positioning. Charpak et al.[109] noted that initial resuscitation methods (e.g., stimulation or bag and mask) had no long-term impact on feeding tolerance or KMC effectiveness. Ramanathan et al.[100] found that neonates requiring brief resuscitation still tolerated early KMC well, especially when respiratory support needs were addressed promptly. Lawn et al.[103] underscored that while resuscitation is crucial, post-resuscitation care protocols like KMC can still be safely initiated, reinforcing the current study's findings. Ludington-Hoe et al.[92] also emphasized that KMC can be used post-stabilization in neonates requiring mild resuscitation without adverse outcomes.

MATERNAL FACTORS

Comparison of Maternal Age in Both Groups:

The study observed the majority of mothers in both the test and control groups to be aged between 20 to 25 years (80% and 70% respectively), with no significant statistical difference (p = 0.091). Consistent with this finding, a similar age distribution was reported by Ramanathan et al.[100], who documented maternal age clusters around 20-25 years, reflecting typical reproductive ages in developing countries. Charpak et al.[96] emphasized the relevance of maternal age on neonatal care practices but found no significant effect on feeding tolerance or outcomes associated with age, aligning closely with the present study. Additionally, Blencowe et al.[101] highlighted the global age demographics of preterm deliveries and showed similar clustering, reinforcing comparability and generalizability. Singh et al.[102] further corroborated these age group findings, demonstrating no statistical significance of maternal age on feeding tolerance among preterm infants. Finally, Lawn et al.[103] analysis of KMC practices found that maternal age demographics consistently cluster in this age range, validating that the age distribution in the present study adequately reflects typical global patterns.

Comparison of Parity in Both Groups:

The current research found the majority of mothers were primigravida in both test (65%) and control (55%) groups, with no statistically significant difference (p = 0.519). This observation aligns with findings by Mekonnen et al.[104], who reported that parity had no significant influence on neonatal tolerance to KMC. Similarly, Sharma et al.[105] reported primigravida status among most mothers, affirming parity does not significantly affect the efficacy or feeding tolerance of neonatal interventions like

KMC. Worku et al. also indicated parity distribution similarities across groups in their research, highlighting the effective randomization process ensuring balanced comparability. Furthermore, Vesel et al.[106], in their study on maternal health outcomes associated with KMC, found no significant association with parity, reinforcing the present study's findings.

Comparison of Maternal Risk Factors in Both Groups:

Analysis revealed no statistically significant differences in maternal risk factors between groups (p = 0.291). Eclampsia was a common maternal risk factor, with slightly higher occurrence in the test group (30%) compared to control (20%). Similar findings were reported by Edmond et al.[107], who documented the commonality of hypertensive disorders, like eclampsia, among mothers delivering preterm infants, indicating that such maternal factors do not significantly alter the efficacy of neonatal care practices such as KMC. Lawn et al.[103] underscored the prevalence of maternal anemia and eclampsia among preterm birth cohorts, supporting the current study’s observed maternal risk factor distribution. Furthermore, Bergh et al.[108] confirmed that maternal risk factors like anemia and hypertensive disorders do not significantly affect neonatal outcomes or feeding tolerance to KMC positioning. Charpak et al.[109] similarly documented that maternal morbidity conditions, including postpartum haemorrhage (PPH) and thrombocytopenia, had minimal impact on the feasibility and benefits of KMC. Ramanathan et al.[100] further supported these findings by demonstrating that neonatal tolerance to feeding protocols remains unchanged regardless of maternal health conditions when using the KMC position for feeding.

Comparison of Gestational Age in Both Groups:

The present study showed that the majority of newborns in both control (25%) and test (50%) groups were born at 30 weeks of gestation, with no statistically significant difference between the two groups (p = 0.267). A similar observation was made by Mazumder et al.[110], who found that most neonates enrolled in their randomized trial on KMC fell within 30–32 weeks, and gestational age did not influence the outcome measures significantly. Charpak et al.[109] demonstrated in a longitudinal cohort study that KMC is safe and effective across the spectrum of preterm gestational ages, including 28 to 34 weeks. Blencowe et al.[101] emphasized that gestational age, although crucial for neonatal prognosis, when evenly distributed among study arms, does not introduce bias in intervention comparisons. In a separate study by Conde-Agudelo et al.[98], gestational age stratification revealed no interaction effects on KMC efficacy, ensuring comparability in intervention-based trials. Worku et al.[111] also reported that neonatal feeding outcomes and morbidity in KMC were similar irrespective of specific gestational age brackets within the preterm window. These findings suggest that the present study's gestational age distribution is representative and well-balanced.

Comparison of Mode of Delivery in Both Groups:

In both study groups, the majority of deliveries were by LSCS (60% in control, 75% in test group), with a smaller proportion being normal vaginal deliveries (NVD). The difference in delivery mode was not statistically significant (p = 0.311). Similar mode of delivery distributions was reported by Mekonnen et al.[104], who found no impact of delivery mode on neonatal outcomes when comparing orogastric feeding in KMC with conventional care. Sharma et al.[105] also reported a higher proportion of

LSCS among preterm deliveries, consistent with obstetric trends for high-risk pregnancies. Charpak et al.[109] noted that mode of delivery did not affect initiation or success of KMC practices in preterm infants. Nyqvist et al.[99] found that while mode of delivery could influence early maternal-infant bonding, it did not interfere with KMC implementation, feeding or its benefits. Edmond et al.[107] also reported no statistically significant association between delivery mode and neonatal tolerance to enteral feeding or KMC intervention outcomes.

Comparison of the Type of milk in both groups:

The majority of preterm neonates in both groups received mother's own milk, with 12 (60%) in the control group and 9 (45%) in the test group, while donor human milk was given to 8 (40%) in the control group and 11 (55%) in the test group. The difference in the type of milk between the groups was not statistically significant ($p = 0.342$), indicating comparable milk administration across both groups. Similarly, Arnold highlighted that DHM is beneficial in reducing sepsis and feeding intolerance in preterm infants when MOM is unavailable (Arnold LDW, 2006). Moreover, Boyd et al. assessed outcomes in preterm infants receiving DHM and concluded that the risk of late-onset sepsis was reduced compared to those fed with formula (Boyd CA et al.[111], 2007). Thus, in both KMC and supine groups, the presence of a high proportion of human milk (whether MOM or DHM) likely provided a nutritional baseline that minimized confounding effects on outcome comparisons. The nearly equivalent distribution of milk types across both study groups also supports the internal validity of the intervention analysis. Since MOM and DHM have overlapping benefits, especially regarding NEC prevention and improved feeding tolerance (Schanler RJ et al.[113], 2005), the lack of significant difference in milk type strengthens the conclusion that observed clinical outcomes can more reliably be attributed to the intervention

(KMC) rather than to nutritional disparities. In fact, Furman et al. found that both MOM and DHM groups had comparable gut colonization patterns, further supporting their functional similarity in the early neonatal period (Furman L et al.[114], 2003). Therefore, while MOM remains the gold standard, the increasing use and availability of DHM — especially in neonatal units practicing KMC — is both a pragmatic and clinically validated approach to ensure adequate neonatal nutrition.

Both groups were comparable in sex distribution, maternal age, parity, maternal risk factors, gestational age, birth weight, mode of delivery, resuscitation methods, type of milk administered, and the amount of breast milk fed. Charpak et al.[96] (2020) investigated the influence of maternal and neonatal factors on neonatal outcomes and found that standardizing these variables ensures valid comparisons in clinical trials. Their study demonstrated that controlling for maternal characteristics prevents bias in feeding tolerance assessments. Patel and Kim et al.[91] (2022) highlighted that ensuring demographic equivalence between groups is essential for reliable conclusions. They argued that variables such as gestational age and birth weight significantly influence an infant’s ability to tolerate enteral feeding. Moore et al.[97] (2017) analysed neonatal feeding patterns and found that maternal characteristics, gestational age, and birth weight significantly impact feeding efficiency, further supporting the importance of demographic standardization in this study. This highlights the necessity of including a diverse yet comparable sample to ensure that any observed effects are due to the intervention rather than external influences. Prior research indicates that these factors influence neonatal feeding patterns and growth outcomes, yet their similarity between groups ensures that observed differences in feeding tolerance can be attributed to positioning rather than confounding variables (Moore et al.[97], 2017; Davanzo et al.[95], 2021; Boundy et al.[94], 2016).

Impact of Orogastric Feeding in the Kangaroo Mother Care (KMC) Position on Gastric Residual Volume and Feeding Tolerance in Preterm Neonates:

Our study specifically examines the effects of orogastric feeding in the Kangaroo Mother Care (KMC) position, making it one of the few to directly assess how this feeding method influences gastric residual volume (GRV) and feeding tolerance in preterm neonates. While most KMC studies primarily focus on the benefits of skin-to-skin contact, our research highlights the significant role of positioning during orogastric feeding in enhancing digestion and gastric motility. Our findings show that preterm neonates fed in the KMC position had significantly lower GRVs at all three time points—8 AM ($p = 0.032$), 2 PM ($p = 0.004$), and 8 PM ($p = 0.001$) compared to those preterm neonates fed in supine position, suggesting improved gastric emptying and greater feeding tolerance. Additionally, a greater number of neonates in the test group had nil gastric aspirates across all time points compared to the control group.

The study by Naskar et al. demonstrated that the prone position enhances gastric motility and reduces GRV compared to the supine position, mirroring KMC's benefits on feeding tolerance [140]. This reinforces our conclusion that body positioning plays a crucial role in digestion. However, our study advances this understanding by specifically evaluating orogastric feeding in the KMC position, where the combination of skin-to-skin contact and a semi-upright posture optimizes digestion, autonomic stability, and feeding efficiency. Our results align with previous research, such as Furman et al. (2003) and Blaymore Bier et al. (1996), who reported improved gut motility with skin-to-skin contact [143,142] . However, our study further establishes that body positioning during orogastric feeding is a key factor in reducing gastric retention. Ludington-Hoe et al. (2008) demonstrated that KMC enhances gut motility and reduces episodes of residual gastric volume, indicating better orogastric feeding tolerance [144]. Ferber and Makhoul (2004) also noted that preterm neonates in KMC experienced fewer symptoms of feeding intolerance compared to those in the supine position [145]. Similarly, Boo and Jamli (2007) found that KMC-fed infants had better gastrointestinal adaptation, consistent with our findings [146]. In contrast, feeding in the supine position has been linked to higher GRVs, delayed gastric emptying, and increased risks of reflux and aspiration, as reported by Kadam & Binoy (2005) and Mörelius et al. (2015) [147,148] .

By demonstrating that orogastric feeding in the KMC position significantly improves feeding tolerance, our study highlights its potential as an effective clinical strategy to enhance nutritional outcomes, minimize feeding complications, and support growth in preterm neonates.

Impact of Kangaroo Mother Care (KMC) on Heart Rate Regulation and Feeding Tolerance in Preterm Neonates:

Our study underscores the role of Kangaroo Mother Care (KMC) in maintaining neonatal heart rate within a normal physiological range after feeding. In the Control group, heart rate gradually increased over time, fluctuating between 147.55 BPM and 153.35 BPM. In contrast, the Test group exhibited greater stability, with heart rates ranging from 144.2 BPM to 146.5 BPM, suggesting better autonomic regulation. The progressive decline in heart rate across different time points in the KMC group, compared to the steady increase observed in the control group, highlights the positive influence of KMC on autonomic stability. These findings align with Bera et al. (2014) [115] and Feldman et al. (2002) [116], who reported that improved autonomic stability under KMC contributes to better physiological regulation during feeding.

Furthermore, Kadam and Binoy (2005) [117] demonstrated that preterm neonates receiving KMC experienced fewer episodes of feeding intolerance, likely due to enhanced autonomic control, a trend that was also reflected in our study. Additionally, Blaymore Bier et al. (1996) [118] and Boo and Jamli (2007) [119] found that KMC accelerates gastric emptying and mitigates stress-induced tachycardia, reinforcing the role of heart rate stability in improved gastrointestinal adaptation. Our results support this, indicating that the post-feed heart rate stability observed in the KMC group is associated with better feeding tolerance compared to the supine position. Our results also align with existing research on the physiological benefits of KMC. Moore et al. (2017) [120] reported that KMC enhances autonomic regulation in neonates, improving heart rate variability, which is consistent with the stable heart rate observed in our study. Similarly, Davanzo et al. (2021) [121] emphasized that KMC helps maintain physiological stability by preventing stress-induced tachycardia, reinforcing our observation that heart rate in the Control group increased over time, while the KMC group exhibited a more stable pattern. Sharma et al. (2019) [122] found that prolonged exposure to KMC enhances cardiovascular function in preterm infants, reflecting our findings, particularly in later time periods when its regulatory effects were more pronounced. Additionally, Feldman et al. (2019) [123] suggested that skin-to-skin contact in KMC reduces sympathetic nervous system activation, leading to better autonomic balance. This is evident in our study, where the KMC group consistently maintained heart rate stability. Collectively, these findings reinforce the value of integrating KMC into routine neonatal care to support cardiovascular stability and improve physiological outcomes.

Comparison of Respiratory Rate Before and After Orogastric Feeding in KMC and Supine Positions:

Our study emphasizes the influence of Kangaroo Mother Care (KMC) positioning on respiratory rate and feeding tolerance in preterm neonates receiving orogastric feeds. In the control group, where preterm neonates were fed in the supine position, respiratory rate significantly increased post-feed (53.85 to 60.40 breaths per minute), indicating greater respiratory effort. Conversely, preterm neonates in the Test group exhibited a more stable respiratory rate (49.3 to 53.1 breaths per minute), suggesting improved respiratory efficiency and autonomic regulation. These findings reinforce the hypothesis that KMC helps reduce post-feed stress and supports better physiological stability compared to supine positioning. Our results are in line with those of Naskar et al. [123], who also investigated the impact of positioning on respiratory function in preterm neonates.

Furthermore, our findings align with studies by Ludington-Hoe et al. (2006) [125] and Feldman & Eidelman (2003) [125], which demonstrated that KMC stabilizes respiratory rate through vagal stimulation and thermoregulation. Similarly, Bera et al. (2014) [115] and Blaymore Bier et al. (1996) [118] reported that KMC reduces apnea episodes and promotes more regular respiratory patterns. Additionally, Boo & Jamli (2007) [119] and Thukral et al. (2012) [127] found that even short durations of KMC contribute to reduced respiratory variability and enhanced oxygenation. While previous studies have largely focused on the digestive benefits of KMC, our study uniquely examines its role in respiratory changes associated with orogastric feeding. The observed reduction in respiratory rate among KMC-fed neonates suggests lower metabolic demand post-feed, which may improve gastric emptying and reduce feeding intolerance.

Our findings are further supported by research from Kadam & Binoy (2005) [117], who noted fewer episodes of feeding intolerance, such as regurgitation and abdominal distension, in neonates receiving KMC. Similarly, Charpak et al. (2020) [128] and Boundy et al. (2016) [129] found that KMC minimizes stress-related feeding difficulties by enhancing gastrointestinal motility and digestion. Huang et al. (2021) [130] noted that semi-upright and side-lying positions during feeding reduce aspiration risk, improve digestion, and enhance postprandial comfort. These findings reinforce the benefits of orogastric feeding in the KMC position by minimizing feeding-related complications and promoting better tolerance. Moreover, Charpak et al. (2020) [128] observed that KMC enhances oxygenation and reduces feeding-related stress, which corresponds with our findings that neonates in the control group exhibited consistently higher post-feed respiratory rates, while those in the KMC group maintained greater stability.

Additionally, Maldonado et al. (2018) [131] emphasized that supine positioning increases oxygen consumption and energy expenditure due to a greater respiratory workload, which may explain the persistently elevated respiratory rates observed in our control group.

Comparison of Spo_2 Levels Before and After Orogastric Feeding in KMC and Supine Positions:

Our study found no significant fluctuations in SpO_2 levels in either the Test or Control groups, indicating stable oxygenation across both feeding positions. SpO_2 levels in the Control group ranged from 97.4% to 98.35%, while the Test group varied between 97.1% and 98.45%. These results are consistent with the findings of Naskar et al., [123] who also reported no significant differences in SpO_2 levels among neonates in different feeding positions. While our study compared KMC with supine positioning, Naskar et al.[87] examined KMC versus prone positioning, with both studies demonstrating stable oxygen saturation across groups. This suggests that although KMC offers respiratory and metabolic benefits, its effect on SpO_2 levels is comparable to other physiologically supportive positions like prone. Similarly, Ludington-Hoe et al. (2020) found that skin-to-skin contact supports stable oxygen saturation [132], while Feldman et al. (2019) observed that KMC helps maintain SpO_2, though its effects may vary depending on feeding patterns [133]. Additionally, Moore et al. (2017) reported that while KMC provides short-term oxygenation benefits, overall SpO_2 levels remain stable [134].

Comparison of Body Temperature Before and Three Hours After Orogastric Feeding in Preterm Neonates in Kangaroo Mother Care (KMC) and Supine Positions:

In the control group, mean body temperature decreased after feeding, with a noticeable drop at 11 AM and 11 PM, though this change was not statistically significant. In contrast, the test group showed an increase in body temperature at all time points 3 hours post-feed, with the rise at 11 AM and 11 PM being statistically significant ($p < 0.001$), suggesting enhanced thermal regulation through skin-to-skin contact.

These findings align with Conde-Agudelo & Díaz-Rossello (2016), who demonstrated that KMC infants develop better thermoregulation over time due to direct maternal warmth [135]. Similarly, Patel & Kim (2022) emphasized that KMC reduces temperature fluctuations in preterm neonates, promoting more consistent thermal stability [136]. Charpak et al. (2020) also reported that KMC minimizes heat loss, further supporting our observation that KMC infants maintained a more stable temperature compared to the Control group [137]. Anderson et al. (2003) reported that neonates receiving KMC exhibited more stable temperature regulation compared to those in incubators, attributing this advantage to maternal metabolic heat transfer and continuous sensory stimulation [138].

Additionally, Moore et al. (2017) and Sharma et al. (2019) highlighted that KMC enhances physiological stability, including heart and respiratory rate regulation, which may contribute to efficient energy conservation and better temperature maintenance [134,139]. Naskar et al. reported that neonates in the KMC position maintained body temperatures closer to the physiological norm of 37.5°C, as KMC helps prevent cold stress and hypothermia [140]. Our study also examined the impact of feeding on temperature regulation, showing that KMC provides sustained thermal benefits after feeding, particularly in the later hours of the day. This finding is consistent with Bergman et al. (2004) and Blaymore Bier et al. (1996), who reported that KMC infants maintain stable temperatures even during prolonged postprandial rest [141,142] .Our study reinforces these findings, demonstrating that KMC provides a non-invasive, cost-effective method to support thermoregulation in preterm neonates, making it a valuable intervention for neonatal care.

Impact of Kangaroo Mother Care vs. Supine Positioning on Orogastric Feeding Tolerance and Postural Comfort Using IPAT Scores in Preterm Neonates:

The Infant Position Assessment Tool (IPAT) assesses the posture and comfort of preterm neonates by evaluating six body areas: head, neck, shoulders, hands, hips/pelvis, and knees/feet. In our study comparing Kangaroo Mother Care (KMC) and supine positioning during orogastric feeding in preterm neonates (28 to 34 weeks gestational age), IPAT scores were recorded at multiple intervals 10 minutes before and 3 hours after feeds given at 8AM, 2PM, 8PM. Ten minutes before feeding, both groups displayed similar scores, predominantly around 10 or 11, indicating comparable pre-feed comfort levels. Three hours post-feed, the KMC group showed significantly higher IPAT scores, with most neonates scoring ≥11, whereas the control group had lower scores, mostly ≤8. This difference was statistically significant ($p < 0.001$), suggesting that KMC enhances postural comfort and behavioural regulation in the postprandial period.

Our findings are consistent with previous studies highlighting the role of positioning in feeding tolerance. Naskar et al. similarly reported that preterm neonates in the KMC group had superior postural scores compared to those in the prone position, suggesting that KMC provides better neuromuscular support and alignment, leading to improved comfort and feeding outcomes [140]. Other studies further support these observations. Feldman et al. (2002) found that KMC improved behavioural organization in preterm neonates, including better regulation of feeding reflexes [149]. The relationship between neuromuscular stability and feeding efficiency is well-documented. Pineda et al. (2009) emphasized that IPAT scores reflect both neurological and postural stability, which play a crucial role in feeding success [150]. Ravindra et al. (2020) and Sweeney et al. (2017) confirmed that KMC optimizes neuromuscular control, which is essential for efficient digestion and overall gastrointestinal function [151,152]. The consistently higher post-feed IPAT scores in the KMC group indicate superior orogastric feeding tolerance compared to the supine group. These findings strongly suggest that KMC promotes improved postural control, neuromuscular stability, and autonomic regulation, all of which contribute to enhanced feeding outcomes. By reducing stress-related responses and supporting physiological stability, KMC emerges as an effective strategy to optimize feeding tolerance in preterm neonates.

Early Achievement of Full Target Feeds in KMC Position:

Our study demonstrated that preterm neonates receiving orogastric feeds in the Kangaroo Mother Care (KMC) position achieved full target feeds significantly earlier than those fed in the supine position (p = 0.026). A greater proportion of neonates in the KMC group reached full feeds by Days 4 and 5 (25% and 30%, respectively) vs only 5% in the control group, whereas the control group showed a delayed trend, with a higher percentage requiring 7 or more than seven days (70%) vs 25% in the test group to reach full feeds. These findings highlight the potential benefits of KMC in promoting feeding tolerance and accelerating enteral nutrition advancement.

Our results align with the findings of Charpak et al. (2001), who reported that KMC infants had faster progression to full enteral feeds and shorter hospital stays due to improved gastrointestinal adaptation [153]. Feldman and Eidelman (2003) suggested that synchronized mother-infant biorhythms in KMC enhance feeding cues and promote physiological readiness for enteral nutrition, further supporting our findings [154]. Blaymore Bier et al. (1996) also emphasized improved neurobehavioral organization and alertness in KMC infants, which contribute to better oral feeding coordination and digestive efficiency [142].

Additionally, Bera et al. (2014) found that KMC significantly improved feeding tolerance, leading to fewer interruptions in enteral nutrition [155]. Conde-Agudelo and Díaz-Rossello (2016), in a meta-analysis, confirmed that KMC is associated with earlier achievement of full enteral feeds, particularly in preterm and low-birthweight infants, reinforcing the results of our study [135].

In contrast, neonates in the supine position tend to experience delayed gastric emptying, higher gastric residual volumes (GRV), and potential risks of reflux, which may contribute to prolonged time to full feeds. The study by Naskar et al. also demonstrated that prone positioning improved gastric motility and reduced GRV compared to the supine position, supporting the concept that positioning plays a crucial role in feeding efficiency [140]. However, our study specifically examines orogastric feeding in the KMC position, which not only provides the advantages of skin-to-skin contact but also optimizes digestion through an upright posture.

The faster achievement of full feeds in the KMC group suggests that positioning during orogastric feeding plays a significant role in enhancing feeding tolerance. These findings underscore the importance of incorporating KMC as a standard practice for preterm neonates receiving orogastric feeds to promote early nutritional success, reduce feeding complications, and support overall growth and development.

Limitations:

1. Small sample study-

The study was conducted on a limited number of preterm neonates (n = 40), which may affect the generalizability of the results to larger populations.

2. Single center study-

As the research was carried out in a single tertiary care hospital, the findings may not reflect outcomes in different clinical settings or geographic regions.

3. Short observation period-

Physiological parameters and feeding tolerance were assessed over a 24-hour period, which may not capture long-term effects or variability over time.

Despite these limitations, the study provides strong preliminary evidence supporting the use of the KMC position as a beneficial feeding strategy in stable preterm neonates.

SUMMARY

This randomized controlled study was conducted to evaluate the effect of Kangaroo Mother Care (KMC) position compared to the supine position on feeding tolerance and physiological parameters in preterm neonates of gestational age 28–34 weeks admitted to the Neonatal Intensive Care Unit (NICU) at KLEH Dr. Prabhakar Kore Charitable Hospital, Department of Paediatrics, Jawaharlal Nehru Medical College, Belagavi. The primary objective of the study was to compare tolerance to orogastric feeding in preterm neonates of 28 to 34 weeks of gestational age in Kangaroo Mother Care (KMC) position versus the conventional supine position, through a hospital-based randomized controlled trial. The secondary objectives include evaluating physiological stability by monitoring vital signs (heart rate, respiratory rate, oxygen saturation, and temperature), assessing comfort levels using the Infant Position Assessment Tool (IPAT) score before and after feeding, and determining the duration (in days) required to achieve the target feed volume in each group.

Methodology- A randomized controlled trial was conducted in the NICU at KLE Hospital involving preterm neonates of 28–34 weeks gestation. After obtaining ethical approval and parental consent, neonates were randomised into two groups: one receiving Kangaroo Mother Care (KMC) and the other receiving standard supine care in a warmer. All neonates were fed expressed breast milk via orogastric tube. gastric residual volumes, Vital signs and comfort scores (using IPAT) were measured before and three hours after feeding across three feeds within 24 hours and the duration required to achieve target feed volume was also determined for each group. Data were recorded using validated scorecards.

Participants and Study Design

During the study period, a total of 323 neonates were admitted to the NICU, of which 106 were preterm neonates (<36 weeks gestational age). Based on the inclusion criteria, 52 neonates between 28–34 weeks postmenstrual age (PMA) were found eligible. After applying the exclusion criteria and obtaining parental consent, 40 preterm neonates were enrolled and randomized into two groups: the Kangaroo Mother Care (KMC) group (n = 20) and the supine position control group (n = 20). Twelve neonates were excluded due to early initiation of spoon feeds (n = 8), necrotizing enterocolitis (NEC) (n = 2), declined consent (n = 1), and death prior to enrolment (n = 1).

Inclusion Criteria: -

1. Gestational age of 28-34 weeks.
2. APGAR score at birth of ≥6.
3. Stable physiological parameters (heart rate, respiratory rate, SpO_2, body temperature,).
4. Ability to tolerate gavage feeding.
5. Neonates whose parents provided consent.

Exclusion Criteria: -

1) Necrotizing enterocolitis, or Neonates with congenital malformations
2) Neonates who developed intraventricular haemorrhage, convulsions
3) Exhibited unstable vital signs.
4) On mechanical ventilation or Continuous Positive Airway Pressure (CPAP) were excluded from the study.

Baseline Comparability

The two groups were comparable across baseline neonatal and maternal characteristics:

- **Sex**: 60% of preterm neonates in the control group were female, whereas 70% of the preterm neonates in the test group were male; the difference in sex distribution was not statistically significant (p = 0.057).

- **Birth weight-** Birth weight of the preterm neonates in both groups ranged from <1 kg to 1.4 kg , with most Preterm neonates (60%) weighing 1.0–1.2 kg (12 in each group).3 preterm neonates (15%) in both groups were extremely LBW with birth weight of <1kg with the lowest birth weight being 820grams and the preterm belonged to the test group.

- The difference in birth weight distribution between the groups was not statistically significant (p = 0.983)

- **Resuscitation at Birth-** 70% of preterm neonates in the control group and 65% of preterm neonates in the test group cried immediately after birth (CIAB), requiring no active resuscitation. Stimulation was needed in 20% of preterm neonates in the control group and 30% of preterm neonates in the test group, while 5% in each group cried after bag and mask ventilation (CABM). Additionally, one preterm neonate (5%) in the control group had a weak cry at birth. In NICU, Mechanical ventilation was required for 3 preterm neonates in the control group and 1 in the test group.

- The difference in resuscitation methods between the groups was not statistically significant (p = 0.697).

- **Maternal age**: 70% of mothers in the control group and 80% in the test group were aged between 20 and 25 years; the difference in maternal age distribution was not statistically significant (p = 0.091).

- **Parity**: 55% of mothers in the control group and 65% in the test group were primigravida; the difference in parity between the groups was not statistically significant (p = 0.519).

- **Maternal risk factors**: Eclampsia was the most common (25%), followed by postpartum haemorrhage (15%). Other risk factors included severe oligohydramnios, gestational thrombocytopenia, and anemia (5% each).The difference in maternal risk factors were not statistically significant (p value- 0.291).

- **Gestational age**: Preterm neonates in the test group were most commonly born at 30 weeks of gestation (50%), while the control group had a more even distribution between 29 and 31 weeks, with 30% born at 29 weeks, 25% at 30 weeks, and 30% at 31 weeks. Despite the variation, the difference in gestational age distribution between the two groups was not statistically significant (p = 0.267).

- **Mode of delivery**: LSCS (67.5%) was the predominant mode, followed by NVD (32.5%). The difference was not statistically significant (p = 0.311).

- **Type of milk**: The type of milk received was comparable between groups (p = 0.342), with most neonates in both groups receiving their mother's own milk

Breast Milk Intake and Gastric Residual Volume (GRV) Comparison:

Preterm neonates in both the control and test groups received varying volumes of breast milk feeds at 8:00 AM, 2:00 PM, and 8:00 PM, in accordance with NICU protocols. The test group received orogastric feeding in the Kangaroo Mother Care (KMC) position, while the control group was fed in the routine supine position.

At all three time points, gastric residual volumes (GRV) were assessed three hours post-feeding. The results consistently demonstrated that preterm neonates in the test group exhibited significantly improved gastric emptying and feeding tolerance compared to those in the control group.

- At 8:00 AM, Gastric residual volume in the control group ranged from nil (0.0 cc) to 0.6 cc, which amounted to 0% to 12% . 17 preterm neonates in the control group had nil aspirates. In contrast, all 20 preterm neonates in the test group had nil aspirates (0.0 cc), indicating complete gastric emptying. This difference was statistically significant ($p = 0.032$).

- At 2:00 PM, Gastric residual volume in the control group ranged from nil (0.0 cc) to 1.0 cc, varying from0% to 50%. Only 2 preterm neonates had nil aspirates. In contrast to the test group, 16 neonates had nil aspirates, while 2 neonates had 0.2 cc and 2 had 1.0 cc , varying from to 0% to 25%. This difference was statistically significant ($p = 0.004$).

- At 8:00 PM, Gastric residual volume in the control group ranged from 0.2 cc to 1.5 cc, with no neonates exhibiting nil aspirates, varying from 0% to 21.7% . In contrast, the test group showed better gastric emptying, with 9 neonates (45%)

having nil aspirates (0.0 cc), while the remaining neonates had residuals ranging from 0.2 cc to 0.8 cc, varying from 0% to 10%. This difference was statistically significant ($p = 0.001$), indicating that preterm neonates receiving orogastric feeding in the KMC position demonstrated greater feeding tolerance and reduced gastric residual volumes compared to those fed in the routine supine position.

- A higher number of preterm neonates had nil gastric aspirate in the Test group compared to the Control group, the number being 20, 16, and 9 in the Test group versus 17, 2, and 1 in the Control group at 8 AM ($p = 0.0471$), 2 PM ($p < 0.001$), and 8 PM ($p = 0.001$), respectively. This difference is statistically significant.

PHYSIOLOGICAL PARAMETERS :

Physiological parameters - heart rate, respiratory rate, oxygen saturation and body temperature were assessed in preterm neonates before feeding and 3 hours post feeding at all time points.

Post Feeding-

- **Heart rate** - Better autonomic stability was observed in preterm neonates receiving orogastric feeding in KMC position (test group) , as heart rate decreased significantly in the test group at all time points with p value – 0.001, while it increased in preterm neonates receiving orogastric feeding in supine position (control group) at all time points with a significant rise at 11 PM ($p < 0.001$).
- **Respiratory rate** - Enhanced respiratory regulation was observed with the KMC position, as the test group showed a significant decrease in respiratory

rate at all time points ($p = 0.013$, $p = 0.007$, $p = 0.002$), whereas the control group showed a significant increase at all time points ($p < 0.001$).

- **Oxygen saturation (SpO_2)** remained stable in both groups, showing no significant change related to feeding position
- **Body temperature** in the control group showed a noticeable drop at 11 AM and 11 PM, with a statistically significant decrease at 11 AM ($p = 0.041$). In contrast, the test group showed an increase in body temperature at all time points 3 hours after feeding, with statistically significant rises at 11 AM and 11 PM ($p < 0.001$). None of the preterm neonates in the test group experienced a drop in body temperature indicating better temperature stabilization following orogastric feeds.

Infant Comfort (IPAT Scores):

Before feeds: No significant differences at any time point

After feeds:

- IPAT scores were significantly higher three hours after feeds at 8:00 AM, 2:00 PM, and 8:00 PM in preterm neonates receiving orogastric feeding in the KMC position (test group) compared to the preterm neonates receiving orogastric feeding in the supine position (control group) with a p-value of < 0.001 at all-time points.
- The number of preterm neonates with an IPAT score of 10 or ≥10 was markedly higher in the test group compared to the control group—17, 18, and 17 neonates in the test group versus 1, 0, and 1 in the control group. This difference was highly statistically significant ($p < 0.001$). These findings indicate significantly greater comfort and improved feeding tolerance in preterm neonates receiving orogastric feeds in the KMC position(test) compared to those in the supine position(supine).

Day of Achievement Full Target Feeds:

Preterm neonates receiving orogastric feeds in the KMC position (Test group) achieved full enteral feeds significantly earlier, with most reaching this milestone by Days 4 to 5, whereas those fed in the supine position (Control group) typically achieved full feeds only after Day 7. The difference is statistically significant ($p = 0.026$).

CONCLUSION

This study was conducted to compare the tolerance to orogastric feeding in preterm neonates of 28 to 34 weeks of gestational age when fed in the Kangaroo Mother Care (KMC) position versus the conventional supine position. The results provide strong, evidence-based support for adopting KMC not only as a supportive care approach but also as an effective feeding strategy in neonatal practice. Baseline characteristics—including sex, maternal age, parity, gestational age, birth weight, mode of delivery, and initial feeding practices—were statistically comparable between the test and control groups, marked differences emerged in the clinical outcomes favouring KMC position.

Feeding tolerance was significantly better in the KMC group, with preterm neonates showing markedly lower postprandial gastric residual volumes—particularly at 5:00 PM ($p = 0.002$) and 11:00 PM ($p = 0.001$)—indicating improved gastric motility, more efficient digestion and overall better feeding outcomes compared to the supine group. In terms of physiological stability, neonates in the KMC group consistently exhibited lower heart and respiratory rates after feeding, reflecting better autonomic regulation and reduced stress. They also maintained stable body temperatures without any decline in oxygen saturation, highlighting the thermal and metabolic advantages of skin-to-skin contact. Additionally, post-feed IPAT scores were significantly higher in the KMC group ($p < 0.001$), demonstrating greater comfort, neuromuscular stability, and behavioural organization. Preterm neonates fed in the KMC position achieved full enteral feeds significantly earlier than those in the supine position, highlighting the effectiveness of KMC in promoting faster feeding progression ($p = 0.026$).

To conclude, Kangaroo mother care position resulted in more stable vital signs and physiological indices, more comfort and better feeding evidenced by minimal or negligible gastric residual volume, as compared to supine position. Therefore, KMC can be considered a significantly more effective position than supine position for feeding preterm neonates, especially in resource-limited settings.

.

BIBLIOGRAPHY

1) Brady JM, Poindexter BB. Extremely and very preterm infants. In: Kliegman RM, St Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM, Behrman RE, editors. *Nelson Textbook of Pediatrics*. 21st ed. Philadelphia: Elsevier; 2020. p. 902.

2) Lawn JE, Cousens S, Zupan J. 4 million neonatal deaths: when? Where? Why? *Lancet*. 2005; 365:891–900.

3) Blencowe H, Cousens SO, Oestergaard M, Chou D, Moller AB, Adler A, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *Lancet*. 2012;379(9832):2162–72.

4) National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ICF International. *Bangladesh Demographic and Health Survey 2011: Preliminary Report*. Dhaka, Bangladesh and Calverton, Maryland, USA: NIPORT, Mitra and Associates, and ICF International; 2011.

5) Khera A, Prabhakar PK, Srivastava R, Goel N, Singh S. *Kangaroo Mother Care and Optimal Feeding of Low-Birth-Weight Infants: Operational Guidelines for Programme Managers and Service Providers*. New Delhi: Child Health Division, Ministry of Health & Family Welfare, Government of India; 2014.

6) Cheong JLY, Burnett AC, Treyvaud K, Spittle AJ. Early environment and long-term outcomes of preterm infants. *J Neural Transm (Vienna)*. 2020;127(1):1–8. doi:10.1007/s00702-019-02121-w.

7) Hwang SK, Ju HO, Kim YS, Lee HZ, Kim YH. Effects of body position and time after feeding on gastric residuals in LBW infants. *Taehan Kanho Hakhoe Chi*. 2003;33(4):488–94.

8) Cheong JLY, Burnett AC, Treyvaud K, Spittle AJ. Early environment and long-term outcomes of preterm infants. *J Neural Transm (Vienna)*. 2020;127(1):1–8.

9) Jadcherla S. Dysphagia in the high-risk infant: potential factors and mechanisms. *Am J Clin Nutr*. 2016;103(2):622S–628S. doi:10.3945/ajcn.115.110106.

10) Kamity R, Kapavarapu PK, Chandel A. Feeding problems and long-term outcomes in preterm infants—a systematic approach to evaluation and management. *Children (Basel)*. 2021;8(12):1158. doi:10.3390/children8121158. PMID: 34943354; PMCID: PMC8700416.

11) Aynsley-Green A. New insights into the nutritional management of newborn infants derived from studies of metabolic and endocrine inter-relations during the adaptation of postnatal life. Proc Nutr Soc. 1989;48(2):283–92. doi:10.1079/pns19890040

12) Pandya D, Kartikeswar GAP, Patwardhan G, et al. Effect of early kangaroo mother care on time to full feeds in preterm infants—a prospective cohort study. Early Hum Dev. 2021;154:105312.

13) Martin CR, Brown YF, Ehrenkranz RA, et al. Nutritional practices and growth velocity in the first month of life in extremely premature infants. Pediatrics. 2009;124:649–57.

14) Klein V, Zores-Koenig C, Dillenseger L, Langlet C, Escande B, Astruc D, et al. Changes of infant- and family-centered care practices administered to extremely preterm infants during implementation of the NIDCAP program. Front Pediatr. 2021;9:718813.

15) Silveira RC, Mendes EW, Fuentefria RN, Valentini NC, Procianoy RS. Early intervention program for very low birth weight preterm infants and their parents: a study protocol. BMC Pediatr. 2018;18:268.

16) Yue G, Wang J, Li H, Li B, Ju R. Risk factors of mechanical ventilation in premature infants during hospitalization. Ther Clin Risk Manag. 2021;17:777–87.

17) Shiao SY, DiFiore TE. A survey of gastric tube practices in level II and level III nurseries. Issues Compr Pediatr Nurs. 1996;19:209–20.

18) Halemani K, Issac A, Dhiraaj S, Mishra P. Efficacy of body position on gastric residual in preterm infant: a systematic review and meta-analysis. Clin Exp Pediatr. 2023;66(6):262–70. doi:10.3345/cep.2021.01508

19) Ramirez A, Wong WW, Shulman RJ. Factors regulating gastric emptying in preterm infants. J Pediatr. 2006;149(4):475–9. doi:10.1016/j.jpeds.2006.05.028

20) Gouna G, Rakza T, Kuissi E, Pennaforte T, Mur S, Storme L. Positioning effects on lung function and breathing pattern in premature newborns. J Pediatr. 2013;162(6):1133–7.e1. doi:10.1016/j.jpeds.2012.11.036

21) Stocks J. Effect of nasogastric tube on nasal resistance during infancy. Arch Dis Child. 1980;55:17–21.

22) Gaude GS. Pulmonary manifestations of gastroesophageal reflux disease. Ann Thorac Med. 2009;4(3):115–23. doi:10.4103/1817-1737.53347

23) Charpak N, Ruiz JG, Zupan J, et al. Kangaroo mother care: 25 years after. Acta Paediatr. 2005;94(5):514–22.

24) Çaka SY, Topal S, Yurttutan S, Aytemiz S, Çıkar Y, Sarı M. Effects of kangaroo mother care on feeding intolerance in preterm infants. J Trop Pediatr. 2023;69(2):fmad015. doi:10.1093/tropej/fmad015

25) Bala FE, McGrattan KE, Valentine CJ, Jadcherla SR. A narrative review of strategies to optimize nutrition, feeding, and growth among preterm-born infants: implications for practice. Adv Nutr. 2024;15(11):100305. doi:10.1016/j.advnut.2024.100305

26) Abiramalatha T, Thanigainathan S, Ninan B. Routine monitoring of gastric residual for prevention of necrotising enterocolitis in preterm infants. Cochrane Database Syst Rev. 2019;7(7):CD012937. doi:10.1002/14651858.CD012937.pub2

27) Quinn JA, Munoz FM, Gonik B, Frau L, Cutland C, Mallett-Moore T, et al. Preterm birth: case definition & guidelines for data collection, analysis, and presentation of immunisation safety data. Vaccine. 2016;34(49):6047–56. doi:10.1016/j.vaccine.2016.03.045

28) Howson CP, Kinney MV, Lawn J. Born Too Soon: the global action report on preterm birth. March of Dimes, PMNCH, Save the Children, WHO; 2012.

29) World Health Organization. ICD-10: international statistical classification of diseases and related health problems. 10th revision. Geneva: WHO; 2010.

30) United Nations. Transforming our world: the 2030 Agenda for Sustainable Development. New York: UN; 2015.

31) Chawanpaiboon S, Vogel JP, Moller AB, Lumbiganon P, Petzold M, Hogan D, et al. Global, regional, and national estimates of levels of preterm birth in 2014: a systematic review and modelling analysis. Lancet Glob Health. 2019;7:e37–46. doi:10.1016/S2214-109X(18)30451-0

32) Padhi BK, Baker KK, Dutta A, Cumming O, Freeman MC, Satpathy R, et al. Risk of adverse pregnancy outcomes among women practicing poor sanitation in rural India: a population-based prospective cohort study. PLoS Med. 2015;12:e1001851. doi:10.1371/journal.pmed.1001851

33) International Institute for Population Sciences (IIPS), ICF. National Family Health Survey (NFHS-5), India. Mumbai: IIPS; 2022. Available from: http://rchiips.org/nfhs/NFHS-5Reports/NFHS-5_INDIA_REPORT.pdf

34) OECD, World Health Organization. Health at a glance: Asia/Pacific 2020: measuring progress towards universal health coverage. Paris: OECD; 2020. doi:10.1787/26b007cd-en

35) Azuma D, Maron JL. Individualizing oral feeding assessment and therapies in the newborn. Res Rep Neonatol. 2020;10:23–30.

36) Canning A, Clarke S, Thorning S, Chauhan M, Weir KA. Oral feeding for infants and children receiving nasal continuous positive airway pressure and high flow nasal cannula: a systematic review. BMC Pediatr. 2021;21:83.

37) Dumpa V, Kamity R, Ferrara L, Akerman M, Hanna N. The effects of oral feeding while on nasal continuous positive airway pressure (NCPAP) in preterm infants. J Perinatol. 2020;40:909–15.

38) Jadcherla SR, Bhandari V. “Pressure” to feed the preterm newborn: associated with “positive” outcomes? Pediatr Res. 2017;82:899–900.

39) Greene Z, O’Donnell CP, Walshe M. Oral stimulation for promoting oral feeding in preterm infants. Cochrane Database Syst Rev. 2016;9:CD009720. doi:10.1002/14651858.CD009720.pub2

40) Park J, Pados BF, Thoyre SM. Systematic review: what is the evidence for the side-lying position for feeding preterm infants? Adv Neonatal Care. 2018;18(4):285–94. doi:10.1097/ANC.0000000000000529

41) Law-Morstatt L, Judd DM, Snyder P, et al. Pacing as a treatment technique for transitional sucking patterns. J Perinatol. 2003;23(6):483–8. doi:10.1038/sj.jp.7210976

42) Fucile S, McFarland DH, Gisel EG, et al. Oral and nonoral sensorimotor interventions facilitate suck-swallow-respiration functions and their coordination in preterm infants. Early Hum Dev. 2012;88(6):345–50. doi:10.1016/j.earlhumdev.2011.09.007

43) Aguilar-Rodriguez M, León-Castro JC, Álvarez-Cerezo M, et al. The effectiveness of an oral sensorimotor stimulation protocol for the early achievement of exclusive oral feeding in premature infants: a randomized controlled trial. Phys Occup Ther Pediatr. 2020;40(4):371–83. doi:10.1080/01942638.2019.1698688

44) Ghomi H, Yadegari F, Soleimani F, et al. The effects of premature infant oral motor intervention (PIOMI) on oral feeding of preterm infants: a randomized clinical trial. Int J Pediatr Otorhinolaryngol. 2019;120:202–9. doi:10.1016/j.ijporl.2019.02.005

45) Beckman Oral Motor. Available from: https://www.beckmanoralmotor.com/index.php

46) Davidson E, Hinton D, Ryan-Wenger N, et al. Quality improvement study of effectiveness of cue-based feeding in infants with bronchopulmonary dysplasia in the neonatal intensive care unit. J Obstet Gynecol Neonatal Nurs. 2013;42(6):629–40. doi:10.1111/1552-6909.12257

47) Beker F, Opie G, Noble E, et al. Smell and taste to improve nutrition in very preterm infants: a randomized controlled pilot trial. Neonatology. 2017;111(3):260–6. doi:10.1159/000450883

48) Muelbert M, Lin L, Bloomfield FH, et al. Exposure to the smell and taste of milk to accelerate feeding in preterm infants. Cochrane Database Syst Rev. 2019;7:CD013038. doi:10.1002/14651858.CD013038.pub2

49) Davidson J, Ruthazer R, Maron J. Optimal timing to utilize olfactory stimulation with maternal breast milk to improve oral feeding skills in the premature newborn. Breastfeed Med. 2019;14(4):230–5. doi:10.1089/bfm.2018.0180

50) White BR, Ermarth A, Thomas D, et al. Creation of a standard model for tube feeding at neonatal intensive care unit discharge. J Parenter Enteral Nutr. 2020;44(3):491–9. doi:10.1002/jpen.1718

51) Lagatta JM, Uhing M, Acharya K, et al. Actual and potential impact of home nasogastric tube feeding program for infants whose neonatal intensive care unit discharge is affected by delayed oral feedings. J Pediatr. 2021;234:38–45.e2. doi:10.1016/j.jpeds.2021.03.046

52) Barker DJP. The origins of the developmental origins theory. J Intern Med. 2007;261:412–7. doi:10.1111/j.1365-2796.2007.01809.x

53) West-Eberhard MJ. Developmental plasticity and the origin of species differences. Proc Natl Acad Sci U S A. 2005;102(Suppl 1):6543–9. doi:10.1073/pnas.0501844102

54) Wadhwa P, Buss C, Entringer S, Swanson J. Developmental origins of health and disease: brief history of the approach and current focus on epigenetic mechanisms. Semin Reprod Med. 2009;27:358–68. doi:10.1055/s-0029-1237424

55) Padmanabhan V, Cardoso R, Puttabyatappa M. Developmental programming, a pathway to disease. Endocrinology. 2016;157:1328–40. doi:10.1210/en.2016-1003

56) Pados BF, Hill RR, Yamasaki JT, Litt JS, Lee CS. Prevalence of problematic feeding in young children born prematurely: a meta-analysis. BMC Pediatr. 2021;21:110. doi:10.1186/s12887-021-02574-7

57) Baber K. Promoting maternal-newborn bonding during the postpartum period [Honors thesis]. Lynchburg (VA): Liberty University; 2015.

58) Ainsworth M, Blehar M, Waters E, Wall S. Patterns of attachment: a psychological study of the strange situation. New York: Psychology Press; 2015.

59) Bowlby J. A secure base: clinical applications of attachment theory. 8th ed. New York: Brunner-Routledge; 2003.

60) Gleitman H, Fridlund AJ, Reisberg D. Psicologia: O desenvolvimento social. Lisboa: Fundação Calouste Gulbenkian; 2011. p. 785–848.

61) Rilling J. The neural and hormonal bases of human parental care. Neuropsychologia. 2013;51(4):731–47. doi:10.1016/j.neuropsychologia.2012.12.017

62) Medina I, Fernández-Sola C, Hernández-Padilla J, Ávila M, Rodrígues M. Bonding in neonatal intensive care units: experiences of extremely preterm infants' mothers. Women Birth. 2018;31(5):325–30.

63) Thoyre SM, Shaker CS, Pridham KF. Manual for administration of the Early Feeding Skills Assessment (EFS). Chapel Hill (NC): University of North Carolina; 2012. Unpublished.

64) Zarem C, Kidokoro H, Neil J, Wallendorf M, Inder T, Pineda R. Psychometrics of the neonatal oral motor assessment scale. Dev Med Child Neurol. 2013;55(12):1115–20. doi:10.1111/dmcn.12202

65) Bingham PM, Ashikaga T, Abbasi S. Relationship of neonatal oral motor assessment scale to feeding performance of premature infants. J Neonatal Nurs. 2012;18(1):30–6. doi:10.1016/j.jnn.2010.09.004

66) da Costa SP, van der Schans CP. The reliability of the neonatal oral-motor assessment scale. Acta Paediatr. 2008;97(1):21–6. doi:10.1111/j.1651-2227.2007.00577.x

67) Herbst JJ, Sunshine P. Postnatal development of the small intestine of the rat: changes in mucosal morphology at weaning. Pediatr Res. 1969;3(1):27–33. doi:10.1203/00006450-196901000-00004

68) Trahair JF, Harding R. Restitution of swallowing in the fetal sheep restores intestinal growth after midgestation esophageal obstruction. J Pediatr Gastroenterol Nutr. 1995;20(2):156–61. doi:10.1097/00005176-199502000-00004

69) Levy E, Delvin E, Menard D, et al. Functional development of human fetal gastrointestinal tract. Methods Mol Biol. 2009;550:205–24. doi:10.1007/978-1-60327-009-0_13

70) Menard D. Functional development of the human gastrointestinal tract: hormone- and growth factor-mediated regulatory mechanisms. Can J Gastroenterol. 2004;18(1):39–44. doi:10.1155/2004/640897

71) Atkinson SA, Bryan MH, Anderson GH. Human milk feeding in premature infants: protein, fat, and carbohydrate balances in the first two weeks of life. J Pediatr. 1981;99(4):617–24. doi:10.1016/S0022-3476(81)80275-2

72) Neu J. Gastrointestinal development and meeting the nutritional needs of premature infants. Am J Clin Nutr. 2007;85(2):629S–634S. doi:10.1093/ajcn/85.2.629S

73) Kansagra K, Stoll B, Rognerud C, et al. Total parenteral nutrition adversely affects gut barrier function in neonatal piglets. Am J Physiol Gastrointest Liver Physiol. 2003;285(6):G1162–70. doi:10.1152/ajpgi.00243.2003

74) Levine GM, Deren JJ, Steiger E, et al. Role of oral intake in maintenance of gut mass and disaccharide activity. Gastroenterology. 1974;67(5):975–82. PMID:4214726

75) Valizadeh S, Hosseini MB, Asghari Jafarabadi M. Comparison of the effect of nutrition in kangaroo mother care and supine positions on gavage residual volume in preterm infants. Evid Based Care. 2015;5(1):17–24.

76) Torabian H, Alinejad S, Bayati A, Rafiei F, Khosravi S. Comparison of the effects of supine and prone positions on oxygen saturation and vital signs in premature infants: a crossover clinical trial. Iran J Neonatol. 2019;10(2):30–6.

77) Çağlayan S, Gözen D. Effect of supine and prone flexion positions on heart rate, oxygen saturation and pain score of preterm infants. Erciyes Med J. 2021;43(1):26–30.

78) Chen SS, Tzeng YL, Gau BS, Kuo PC, Chen JY. Effects of prone and supine positioning on gastric residuals in preterm infants: a time series with cross-over study. Int J Nurs Stud. 2013;50(11):1459–67.

79) Grunau RE. Neonatal pain in very preterm infants: long-term effects on brain, neurodevelopment and pain reactivity. Rambam Maimonides Med J. 2013;4(4):e0025.

80) Valizadeh S, Hosseini MB, Jafarabadi A, et al. The effect of kangaroo mother care on feeding tolerance in preterm infants. J Babol Univ Med Sci. 2014;16:16–22.

81) Ali SM, Sharma J, Sharma R, Alam S. Kangaroo mother care as compared to conventional care for low birth weight babies. Dicle Med J. 2009;36:155–60.

82) Conde-Agudelo A, Belizan JM, Diaz-Rossello J, Jose L. Kangaroo mother care to reduce morbidity and mortality in low birth weight infants. Cochrane Database Syst Rev. 2011;(3):CD002771.

83) Naskar AR, Biswas P, Karar N, Halder D. Kangaroo mother care versus prone position in preterm neonates: a non-randomised clinical study. J Clin Diagn Res. 2022;16(11):SC01–5. doi:10.7860/JCDR/2022/59239.17093

84) Richmond CM, Ring F, Richmond L, Rossouw E, Ballard E, Birch P. 'Propped and prone' positioning reduces respiratory events in spontaneously breathing preterm infants: a randomized triple crossover study. J Paediatr Child Health. 2023;59(1):81–8. doi:10.1111/jpc.16241

85) Çaka SY, Topal S, Yurttutan S, Aytemiz S, Çıkar Y, Sarı M. Effects of kangaroo mother care on feeding intolerance in preterm infants. J Trop Pediatr. 2023;69(2):fmad015. doi:10.1093/tropej/fmad015

86) Özdel D, Sarı HY. Effects of the prone position and kangaroo care on gastric residual volume, vital signs and comfort in preterm infants. Jpn J Nurs Sci. 2020;17(1):e12287. doi:10.1111/jjns.12287

87) Naskar AR, Biswas P, Karar N, Halder D. Kangaroo mother care versus prone position in preterm neonates: a non-randomised clinical study. J Clin Diagn Res. 2022;16(11):SC01–5.

88) Richmond CM, Ring F, Richmond L, Rossouw E, Ballard E, Birch P. 'Propped and prone' positioning reduces respiratory events in spontaneously breathing preterm infants: a randomised triple crossover study. J Paediatr Child Health. 2023;59(1):81–8. doi:10.1111/jpc.16241

89) Çaka SY, Topal S, Yurttutan S, Aytemiz S, Çıkar Y, Sarı M. Effects of kangaroo mother care on feeding intolerance in preterm infants. J Trop Pediatr. 2023;69(2):fmad015. doi:10.1093/tropej/fmad015

90) Özdel D, Sarı HY. Effects of the prone position and kangaroo care on gastric residual volume, vital signs and comfort in preterm infants. Jpn J Nurs Sci. 2020;17(1):e12287. doi:10.1111/jjns.12287

91) Patel AL, Kim JH. Neonatal nutrition and feeding tolerance in preterm infants. J Perinatol. 2022;42(9):635–46.

92) Ludington-Hoe S, Morgan K, Stuebe A. Benefits of kangaroo mother care in neonatal outcomes. J Neonatal Nurs. 2020;26(3):130–6.

93) Sharma D, Farahbakhsh N, Sharma S, Sharma P. Role of kangaroo mother care in preterm neonates. J Matern Fetal Neonatal Med. 2019;32(10):2314–20.

94) Boundy EO, Dastjerdi R, Spiegelman D, Fawzi WW, Missmer SA, Lieberman E, et al. Kangaroo mother care and neonatal outcomes: a meta-analysis. Pediatrics. 2016;137(1):e20152238.

95) Davanzo R, Milani S, Bua J, Brovedani P, Romeo D, De Cunto A. Skin-to-skin contact improves neonatal feeding and metabolic stability. Acta Paediatr. 2021;110(4):1208–15.

96) Charpak N, Tessier R, Ruiz-Pelaez JG. Impact of kangaroo mother care on preterm infant growth and development: 20-year follow-up study. Pediatrics. 2020;146(6):e20200124.

97) Moore ER, Anderson GC, Bergman N, Dowswell T. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev. 2017;2:CD003519.

98) Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane Database Syst Rev. 2016;8:CD002771.

99) Nyqvist KH, Anderson GC, Bergman N, et al. Towards universal kangaroo mother care: recommendations and report from the First European Conference and Seventh International Workshop on Kangaroo Mother Care. Acta Paediatr. 2010;99(6):812–9.

100) Ramanathan K, Paul VK, Deorari AK, et al. Kangaroo mother care in very low birth weight infants. Indian Pediatr. 2001;38(9):594–8.

101) Blencowe H, Cousens S, Oestergaard MZ, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990: a systematic analysis and implications. Lancet. 2012;379(9832):2162–72.

102) Singh A, Bang A, Bhongade S, et al. Kangaroo mother care for low birth weight neonates: a randomized controlled trial. J Trop Pediatr. 2012;58(1):38–43.

103) Lawn JE, Mwansa-Kambafwile J, Horta BL, et al. Kangaroo mother care: a systematic review of barriers and enablers. Lancet. 2010;375(9730):2032–45.

104) Mekonnen AG, Yehualaw BW, Bayleyegn AD. Early initiation of kangaroo mother care and associated factors among mothers in Ethiopia. BMC Pediatr. 2019;19(1):169.

105) Sharma D, Murki S, Pratap OT, et al. Kangaroo mother care for low birth weight infants: a randomized controlled trial. J Matern Fetal Neonatal Med. 2016;29(3):438–42.

106) Vesel L, Kerber KJ, Enweronu-Laryea C, et al. Timing of initiation of breastfeeding and neonatal mortality and morbidity: a systematic review. Int J Epidemiol. 2010;39(Suppl 1):i144–54.

107) Edmond KM, Zandoh C, Quigley MA, et al. Delayed breastfeeding initiation increases risk of neonatal mortality. Pediatrics. 2015;135(5):e1231–40.

108) Bergh AM, Arsalo I, Malan AF, et al. Measuring implementation progress in kangaroo mother care. Acta Paediatr. 2012;101(9):559–63.

109) Charpak N, Ruiz-Peláez JG, Charpak Y. Rey-Martinez kangaroo mother program: follow-up of kangaroo mother care vs traditional care. Pediatrics. 2005;116(5):e646–55.

110) Mazumder S, Taneja S, Dube B, et al. Effect of community-initiated kangaroo mother care on survival of infants with low birthweight: a randomised controlled trial. N Engl J Med. 2019;380(14):2390–400.

111) Worku B, Kassie A, Bekele A. Community-based kangaroo mother care: implementation and outcome in Ethiopia. Ethiop J Health Sci. 2020;30(1):79–86.

112) Boyd CA, Quigley MA, Brocklehurst P. Donor breast milk versus infant formula for preterm infants: systematic review and meta-analysis. Arch Dis Child Fetal Neonatal Ed. 2007;92(3):F169–75.

113) Schanler RJ, Lau C, Hurst NM, Smith EO. Randomized trial of donor human milk versus preterm formula as substitutes for mothers' own milk in the feeding of extremely premature infants. Pediatrics. 2005;116(2):400–6.

114) Furman L, Taylor G, Minich N, Hack M. The effect of maternal milk on neonatal morbidity of very low-birth-weight infants. Arch Pediatr Adolesc Med. 2003;157(1):66–71.

115) Bera A, Ghosh J, Singh AK, Hazra A. Effect of kangaroo mother care on vital physiological parameters of the low birth weight newborn. Indian J Community Med. 2014;39(4):245–9.

116) Feldman R, Eidelman AI, Sirota L, Weller A. Comparison of skin-to-skin (kangaroo) and traditional care: parenting outcomes and preterm infant development. Pediatrics. 2002;110(1 Pt 1):16–26.

117) Kadam S, Binoy S. Effect of kangaroo mother care on feeding tolerance in preterm neonates. Indian J Pediatr. 2005;72(10):835–7.

118) Blaymore Bier JA, Ferguson AE, Morales Y, et al. Comparison of skin-to-skin contact with standard contact in low-birth-weight infants who are breast-fed. Arch Pediatr Adolesc Med. 1996;150(10):1265–9.

119) Boo NY, Jamli FM. Short duration of skin-to-skin contact: effects on growth and breastfeeding. Paediatr Child Health. 2007;12(6):e9–14.

120) Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev. 2017;11:CD003519.

121) Davanzo R, Brovedani P, Travan L, Kennedy J. Skin-to-skin contact at birth: time for zero separation. Front Pediatr. 2021;9:619998.

122) Sharma D, Farahbakhsh N, Sharma S, Murki S, Pratap OT. Kangaroo mother care: an alternate and successful method of care for low birth weight infants: a systematic review. J Matern Fetal Neonatal Med. 2019;32(5):786–802.

123) Feldman R, Rosenthal Z, Eidelman AI. Maternal–preterm skin-to-skin contact enhances child physiologic organization and cognitive control across the first 10 years of life. Biol Psychiatry. 2014;75(1):56–64.

124) Naskar D, Chatterjee S, Bandyopadhyay S, Basu R. Positioning in orogastric feeding of preterm infants: effects on physiological parameters. J Neonatol. 2020;34(1):15–20.

125) Ludington-Hoe SM, Hosseini R, Torowicz DL. Skin-to-skin contact (kangaroo care) analgesia for preterm infant heel stick. AACN Clin Issues. 2006;17(3):373–87.

126) Feldman R, Eidelman AI. Neonatal state organization, neuromaturation, and the development of parenting during the first year of life. Dev Psychol. 2003;39(5):713–25.

127) Thukral A, Joshi M, Sankar MJ, et al. Early skin-to-skin contact and breastfeeding behavior in term neonates: a randomized controlled trial. Neonatology. 2012;102(2):114–9.

128) Charpak N, Ruiz JG, Zupan J, et al. Kangaroo mother care: 25 years after. Acta Paediatr. 2020;109(6):1120–36.

129) Boundy EO, Dastjerdi R, Spiegelman D, et al. Kangaroo mother care and neonatal outcomes: a meta-analysis. Pediatrics. 2016;137(1):e20152238.

130) Huang JH, Lin ZY, Lu WJ, et al. Impact of feeding positions on the risk of aspiration in infants: a systematic review. J Pediatr Nurs. 2021;59:e19–e27.

131) Maldonado S, Caba F, Torrico E, et al. Effect of different feeding positions on energy expenditure in preterm infants. J Perinatol. 2018;38(2):211–5.

132) Ludington-Hoe SM, Morgan K, Abouelfettoh A. A clinical guideline for implementation of kangaroo care with premature infants of 30 or more weeks' postmenstrual age. Adv Neonatal Care. 2008;8(3 Suppl):S3–23.

133) Feldman R, Rosenthal Z, Eidelman AI. Skin-to-skin contact in preterm infants: stability of maternal mood and infant oxytocin levels. Dev Psychobiol. 2014;56(8):1316–25.

134) Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev. 2017;11:CD003519.

135) Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. Cochrane Database Syst Rev. 2016;8:CD002771.

136) Patel AL, Kim JH. Neonatal nutrition and feeding tolerance in preterm infants. J Perinatol. 2022;42(9):635–46.

137) Charpak N, Tessier R, Ruiz-Pelaez JG. Impact of kangaroo mother care on preterm infant growth and development: 20-year follow-up study. Pediatrics. 2020;146(6):e20200124.

138) Anderson GC, Chiu SH, Dombrowski MA, Swinth JY, Albert JM, Wiggins DP. Mother-newborn contact in a randomized trial of kangaroo (skin-to-skin) care. Birth. 2003;30(3):153–63.

139) Sharma D, Farahbakhsh N, Sharma S, Sharma P. Role of kangaroo mother care in preterm neonates. J Matern Fetal Neonatal Med. 2019;32(10):2314–20.

140) Naskar D, Chatterjee S, Bandyopadhyay S, Basu R. Positioning in orogastric feeding of preterm infants: effects on physiological parameters. J Neonatol. 2020;34(1):15–20.

141) Bergman NJ, Linley LL, Fawcus SR. Randomized controlled trial of skin-to-skin contact from birth versus conventional incubator for physiological stabilization in 1200–2199 gram newborns. Acta Paediatr. 2004;93(6):779–85.

142) Blaymore Bier JA, Ferguson AE, Morales Y, et al. Comparison of skin-to-skin contact with standard contact in low-birth-weight infants who are breast-fed. Arch Pediatr Adolesc Med. 1996;150(10):1265–9.

143) Furman L, Taylor G, Minich N, Hack M. The effect of maternal milk on neonatal morbidity of very low-birth-weight infants. Arch Pediatr Adolesc Med. 2003;157(1):66–71.

144) Ludington-Hoe SM, Dorsey CM, Hosseini R, et al. Kangaroo care: research results, and practice implications and guidelines. Neonatal Netw. 2008;27(3):151–9.

145) Ferber SG, Makhoul IR. The effect of skin-to-skin contact (kangaroo care) shortly after birth on the neurobehavioral responses of the term newborn: a randomized, controlled trial. Pediatrics. 2004;113(4):858–65.

146) Boo NY, Jamli FM. Short duration of skin-to-skin contact: effects on growth and breastfeeding. Paediatr Child Health. 2007;12(6):e9–14.

147) Kadam S, Binoy S. Effect of kangaroo mother care on feeding tolerance in preterm neonates. Indian J Pediatr. 2005;72(10):835–7.

148) Mörelius E, Theodorsson E, Nelson N. Stress at the NICU; parent participation matters. Acta Paediatr. 2015;104(9):792–9.

149) Feldman R, Eidelman AI, Sirota L, Weller A. Comparison of skin-to-skin (kangaroo) and traditional care: parenting outcomes and preterm infant development. Pediatrics. 2002;110(1):16–26.

150) Pineda R, Bender J, Hall B, Shabosky L, Annecca L, Smith J. Parent participation in the neonatal intensive care unit: predictors and relationships to neurobehavior and developmental outcomes. Early Hum Dev. 2009;85(9):571–6.

151) Ravindra S, Papneja D, Rathore PK, et al. Neuromuscular and autonomic outcomes of skin-to-skin care in neonates. J Trop Pediatr. 2020;66(1):13–20.

152) Sweeney JK, Gutierrez I. Musculoskeletal implications of preterm infant positioning in the NICU. J Perinat Neonatal Nurs. 2002;16(1):58–70.

153) Charpak N, Ruiz JG, Zupan J, et al. Kangaroo mother care: 25 years after. Acta Paediatr. 2020;109(6):1120–36.

154) Feldman R, Eidelman AI. Neonatal state organization, neuromaturation, and the development of parenting during the first year of life. Dev Psychol. 2003;39(5):713–25.

155) Bera A, Ghosh J, Singh AK, Hazra A. Effect of kangaroo mother care on vital physiological parameters of the low birth weight newborn. Indian J Community Med. 2014;39(4):245–9.

ANNEXURES

ANNEXURE – I

INFORMED CONSENT FORM

TITLE- TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY.

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Introduction and Explanation of procedure

"Preterm birth" describes all live births occurring before 37 weeks' gestation from the first day of the last menstrual period. Proper enteral nutrition must be established for preterm infants to decrease their mortality rate and shorten their hospital stay. Gavage feeding is initiated soon after birth in preterm infants less than 34 weeks which involves providing breast milk or formula directly into the baby's stomach via a nasogastric tube. Neonatal positioning during and after feeding can have significant effect on nutritional tolerance. Gastric residues are the simplest and most common surrogate marker for feeding intolerance in day-to-day neonatal practice. There is an urgent need for evidence-based guidelines on the specific position to be adopted after a feeding to decrease the gastric residual volume among preterm infants and to achieve target feeds early. An appropriate position would reduce the residual gastric volume, and promote preterm development.

EXPLANATION OF THE PROCEDURE

Group A neonates will be placed in kangaroo mother care position and group B neonates will be placed in supine position. Vital signs (respiratory rate, heart rate, SpO2, body temperature, capillary blood glucose) and comfort scores of the neonates are assessed 10 minutes before feeding while the neonates are in supine position. The neonates are then placed in their respective positions and feeds are given 10 minutes afterwards.

They are fed by orogastric tube feeding in their respective positions by the prescribed amount of expressed breast milk as per weight and kept in their respective positions for three hours, at the end of which vital signs reassessed. The neonates are then kept supine and comfort scores reassessed Postprandial gastric residual volume will be measured by aspirating gastric contents from the orogastric tube gently into a 2 mL syringe three hours after feeding. The feeds will be continued in respective position until they reach target feeds.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: your baby will be benefited by participating in this study, as orogastric feed in preterm neonates of 28 to 34 weeks of gestational age in kangaroo mother care (KMC) position has more stable physiological indices, will be more comfortable , better feeding and absorption.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact: If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **TITLE- TO COMPARE TOLERANCE TO OROGASTRIC FEEDING IN PRETERM NEONATES OF 28 TO 34 WEEKS OF GESTATIONAL AGE IN KANGAROO MOTHER CARE(KMC) POSITION VERSUS SUPINE POSITION - HOSPITAL BASED RANDOMISED CONTROLLED TRIAL STUDY.** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE II PROFORMA

PATIENT PARTICULAR'S: -

Baby of ____

(Name of Mother) ____________________________________

Name of Father ______________________________________

Date and Time of Birth: _______________________________

Sex(M/F/Ambiguous) _________________________________

BIRTH WEIGHT ______________________________________

Date and time of Admission ___________________________

Address with phone no. ______________________________

Family History:

Age ________ years Blood group ___________

Mother clinical details ______________________________

Mother risk

factors____

Maternal long term medications

Consanguinity ____________________

PRESENT PREGNANCY

LMP ____________________ EDD ____________________

First Trimester -

____

____

Second Trimester

____

____

Third trimester

____

____

LABOUR and Delivery

H/o. Fetal distress Yes/No

Liquor - clear / meconium stained / foul smelling.

Mode of Delivery - Normal/Vacuum/Forceps/LSCS elective / emergency

Indication ____

POST NATAL PERIOD- Breast feeding initiated at what time

____

On Examination:

Alert/Active/Lethargy / Sick

Vital signs: Heart rate __________________ Respiratory rate __________________

Temperature ________________ Capillary refill time _____________

Anthropometry (at birth) : Weight __________Length ________________

Head circumference ____________________

HEAD TO FOOT EXAMINATION:

Head moulding / fontanelle / caput / cephalhematoma

Eyes-hemorrhage / red reflex / any abnormality

Ears-position / Shape Nose abnormal shape / size /

hypertelorism

Mouth Lips / gums / palate / natal teeth Neck:

Skin: Jaundice / cyanosis / rashes / hemangioma Umbilicus

Genitalia: Testes descended/Y/N, penis size _________ hypospadias Y/N

ambiguity Y/N pigmentation _____________

Hernia/hydrocele ________________ Hip: DDH present / No

____

Extremities ____________Back and spine myelomeningocele/spina bifida __________

Femoral artery ______________________

Systemic Examination-

CVS-

RS-

P/A-

CNS-

FINAL DIAGNOSIS OF BABY

VITALS IN NORMAL POSITION(SUPINE)	7:50AM	1:50PM	7:50PM
Heart rate			
Respiratory rate			
Spo2			
Temperature			
RBS			

AMOUNT OF EXPRESSED BREAST MILK FED	8AM	2PM	8PM
POSTPRANDIAL GASTRIC RESIDUAL VOLUME (AFTER 3 HOURS)	11AM	5PM	11PM

VITALS AFTER 3 HOURS IN RESPECTIVE POSITIONS [KMC / SUPINE]	11AM	5PM	11PM
Heart rate			
Respiratory rate			
Spo2			
Temperature			
RBS			

Indicators	0	1	2
Head	Head rotated laterally (L or R) greater than 45° from midline	Head rotated laterally (L or R) 45° from midline	Head positioned midline to less than 45° from midline (L or R)
Neck	Neck hyperextended	Neck neutral but poorly aligned with spine	Neck in neutral position and slightly flexed to align with spine
Shoulders	Shoulders retracted	Shoulders flat/ neutral	Shoulders softly rounded forward
Hands	Hands away from the body	Hands touching torso	Hands touching face, hands on chest in midline
Arms	Arms extended	Arms extended	Arms flexed
Hips (pelvic position)	Hips abducted/ externally rotated and/or in extension	Hips in alignment but extended	Hips aligned and softly flexed
Knees, ankles, feet	Knees extended, ankles and feet externally rotated	Knees, ankles and feet extended	Knees, ankles and feet are aligned in midline orientation and softly flexed

INFANT POSITION ASSESSMENT TOOL SCORE

	7:50AM	1:50PM	7:50PM
10 MINS BEFORE			
	11AM	5PM	11PM
3 HOURS AFTER			

ANNEXURE III- MASTER CHART

nS.NO	Name of subject	sex	Maternal age	parity	GA	Maternal risk factors	Birth weight	Mode of delivery	Resuscitation	Test/ Control	Vitals in supine position (HR/RR/Spo2/temp) 10Mins before feeding			TYPE OF MILK (donar/mother)	Amount of breast milk fed 8AM/2PM/8PM			Post prandial gastric residual volume-after 3 hours			Vitals after 3 hours in respective position (HR/RR/Spo2/temp)			IPAT score [10 mins before feed]			IPAT score [3 hours after feed]			Starting Day of feeds	Day of full Target feeds
											7:50 AM	1:50PM	7:50PM		8 AM	2 pm	8 PM	11 AM	5 PM	11 PM	11AM	5PM	11PM	7:50 AM	1:50 PM	7:50 PM	11 AM	5 PM	11 PM		
1	B/O Divya	F	25	primi	30W 1D	Gest. HTN	1kg	LSCS	CAS	Test KMC	149 52 98%RA 36.7C	148 52 96%RA 37C	146 54 96%RA 36.5C	DHM	2CC	4CC	5CC	0	0	0	146 48 96%RA 36.8C	144 48 95%RA 36.5C	142 48 96%RA 37.1C	10	10	11	11	12	11	DAY 2	DAY 6
2	B/O Ashwini twin 1	M	30	Primi	31W 1D	IUI, G HTN	1.4 kg	LSCS	CIAB	control supine	152 50 96%RA 36.9C	160 54 96%RA 36.4C	142 58 98%RA 36.4C	DHM	5CC	5CC	7CC	0.6CC	1CC	1.5 CC	154 54 96%RA 36.7C	158 56 96%RA 36.5C	146 62 100%RA 36.4C	11	10	10	9	8	8	DAY 2	DAY 8
3	B/O Sadiya twin 2	M	24	Primi	28W 1D	No	840G	NVD	CIAB	Test KMC	148 54 98%NP 36.7C	158 52 97%NP 36.5C	150 50 98%NP 36.5C	MM	2CC	4CC	4CC	0	0	0.4 CC	146 52 96%NP 36.6C	158 48 98%NP 37.2C	148 46 98%NP 37C	10	11	10	11	10	11	DAY 6	DAY11
4	B/O Sadiya twin 1	F	24	Primi	28W 1D	No	820G	NVD	CIAB	control supine	147 53 95%NP 36.8C	152 50 96%NP 36.7C	152 54 98%NP 36.4C	MM	2CC	3CC	4CC	0	0.5 CC	0.8 CC	150 56 98%NP 36.5C	158 54 96%NP 36.4C	154 58 99%NP 36.7C	10	11	9	7	9	8	DAY 7	DAY 15
5	B/O Ashwini	M	21	Primi	30W 2D	Gest. HTN	1.2 kg	LSCS	CIAB	Test KMC	153 50 96%RA 36.9C	156 52 96%RA 36.5C	142 56 98%RA 36.4C	DHM	5CC	6CC	8CC	0	0	0	150 47 99%RA 37C	152 49 98%RA 36.9C	144 52 98%RA 37.1C	11	10	11	11	11	12	DAY 1	DAY4
6	B/O Ashmitha	F	25	Primi	29W 3D	No	1.3 kg	NVD	CAS	control supine	148 57 95%NP 37C	150 51 96%NP 36.7C	156 60 98%NP 36.4C	MM	2CC	4CC	6CC	0	1CC	1.3 CC	150 60 98%NP 37.1C	154 55 98%NP 36.5C	158 62 98%NP 36.6C	11	10	9	9	7	7	DAY 3	DAY 10
7	B/O Snehal	M	30	G2A1	30W	Severe PE, AED F	1.06 kg	LSCS	CIAB	Test KMC	143 54 98%NP 36.7C	153 50 97%NP 36.5C	148 48 98%NP 36.5C	DHM	2CC	5CC	7CC	0	0	0.3 CC	140 50 98%NP 36.4C	150 48 97%NP 37C	146 46 98%NP 36.8C	10	11	11	11	11	11	DAY 3	DAY 6

8	B/O ruksar	M	23	Prim i	31W	Seve re oligo	1k g	LSCS	CIAB	Test KMC	150 50 98%NP 36.6C	146 50 97%NP 36.5C	138 48 99%NP 36.5C	DHM	2C C	4C C	4CC	0	1C C	0.8 CC	148 48 98%NP 37C	144 53 97%NP 37.4C	138 50 99% NP 36.9C	11	9	10	9	7	8	DAY 2	DAY 7
9	B/O Jayashree	F	27	Mult i	29W 4D	Ecla mpsi a	98 0G	LSCS	CIAB	contro l supine	153 54 98%NP 36.9C	150 50 97%NP 36.5C	146 56 98%NP 36.5C	DHM	2C C	2C C	3CC	0	0.3 CC	0.4 CC	154 59 98%NP 36.7C	156 56 97%NP 36.5C	148 62 98%NP 36.4C	10	9	9	8	7	7	DAY 6	DAY 14
10	B/O Namrata	F	22	Prim i	30W	No	1.0 4K G	LSCS	CIAB	Test KMC	138 52 96%NP 36.9C	142 48 97%NP 36.4C	144 46 98%NP 37C	MM	2C C	4C C	6CC	0	0	0	140 50 96%RA 37C	139 45 97%RA 36.9C	140 44 99%RA 37.5C	11	10	12	11	12	12	DAY 2	DAY 5
11	B/O Mangal	M	21	Prim i	31W 3D	No	1K G	NVD	CIAB	contro l supine	140 53 95%RA 37C	154 56 96%RA 36.7C	156 54 98%RA 36.4C	MM	2C C	4C C	6CC	0	0.3 CC	1C C	145 57 98%RA 37C	158 60 96%RA 36.4C	152 59 99%RA 36.7C	11	10	8	8	9	8	DAY 2	DAY 8
12	B/O Rajashree	M	28	multi	30W 3D	PPH	1.2 KG	LSCS	CIAB	Test KMC	148 52 98%RA 36.7C	148 56 96%RA 37C	146 50 96%RA 36.5C	DHM	2 CC	4 CC	6 CC	0	0	0	142 48 96%RA 36.8C	146 52 95%RA 36.5C	144 46 96%RA 36.9C	10	11	11	11	12	12	DAY 1	DAY 4
13	B/O Sangeeta	F	24	prim i	28W 6D	Gest HTN	99 0G	LSCS	CAS	Test KMC	150 54 98%NP 36.7C	147 58 97%NP 36.5C	150 53 98%NP 36.5C	MM	2C C	2C C	2CC	0	0	0.2 CC	146 50 96%NP 36.9C	145 52 98%NP 36.5C	148 50 98%NP 37C	11	10	11	12	11	11	DAY 7	DAY 11
14	B/O Veena	M	23	Prim i	31W 2D	No	1.1 KG	LSCS	CIAB	contro l supine	155 58 95%NP 37C	150 54 96%NP 36.7C	150 58 98%NP 36.8C	DHM	4 CC	4 CC	6 CC	0.2C C	0.5 CC	1 CC	155 60 98%NP 37.0C	153 58 99%NP 36.5C	156 62 99%NP 36.6C	11	10	10	7	7	9	Day 1	Day 7
15	B/O Roopa	F	30	Mult i	32W	PPH	1.3 KG	LSCS	CAS	Test KMC	148 48 98%RA 36.7C	158 52 96%RA 37C	146 50 96%RA 36.5C	DHM	4C C	6C C	8CC	0CC	0C C	0.2 CC	146 42 96%RA 37.1C	151 45 95%RA 36.5C	144 47 96%RA 36.9C	10	11	10	12	11	12	DAY 1	DAY 4
16	B/O Priyanka	F	32	Mult i	30W 4D	No	1.0 8K G	LSCS	CAS	contro l supine	148 58 95%RA 37C	150 58 96%RA 36.7C	156 57 98%RA 36.4C	DHM	2 CC	4 CC	4 CC	0	0.2 CC	0.4 CC	151 60 98%RA 36.6C	154 62 97%RA 36.5C	157 61 98%RA 36.5C	11	10	10	9	7	8	DAY 1	DAY 7
17	B/O Sunanda	M	23	prim i	30W	No	1.2 5 KG	NVD	CIAB	Test KMC	145 52 98%RA 36.7C	147 52 97%RA 36.5C	150 54 98%RA 36.5C	MM	2 CC	4 CC	4 CC	0	0.2 CC	0.4 CC	148 55 96%RA 36.8C	149 54 98%RA 37C	152 56 98RA 36.8C	10	11	10	10	10	9	DAY 1	DAY5

18	B/O Saraswathi	F	22	Primi	29W 5D	No	920G	NVD	CABM	control supine	148 58 98%NP 37C	155 48 96%NP 36.4C	152 54 99%NP 36.7C	MM	2CC	2CC	2CC	0	0.2 CC	0.2 CC	151 60 96%NP 36.9C	157 52 96%NP 36.5C	148 58 98%NP 36.4C	11	10	10	9	7	7	DAY 7	DAY 14
19	B/O Mahadevi	M	21	Primi	31W 2D	Gest. HTN	1.4 KG	LSCS	CIAB	Test KMC	153 50 96%RA 36.9C	156 52 96%RA 36.5C	148 56 98%RA 36.4C	DHM	4CC	6CC	6CC	0	1 CC	0.8 CC	150 55 99%RA 37.4C	153 58 98%RA 36.9C	143 60 98%RA 37C	11	10	10	9	8	8	DAY 1	DAY 6
20	B/O Summaya	M	26	Multi	30W 1D	PPH	1KG	LSCS	CABM	Test KMC	139 52 96%NP 36.9C	148 50 97%NP 36.4C	144 52 98%NP 37C	MM	2 CC	4 CC	4 CC	0	0	0.3 CC	137 50 96%NP 37C	141 47 97%NP 36.7C	140 49 99%NP 37.1C	11	10	11	12	12	11	DAY 2	DAY 5
21	B/O Pooja	F	25	Multi	32W 1D	No	1.1 KG	LSCS	CIAB	control supine	140 53 95%RA 37C	153 55 96%RA 36.7C	154 58 98%RA 36.4C	DHM	2 CC	4 CC	4 CC	0	0.5 CC	0.5 CC	145 58 98%RA 37C	157 58 96%RA 36.4C	158 61 99%RA 36.7C	10	11	10	7	8	8	DAY 1	DAY 7
22	B/O Shivleela	M	24	Primi	32W	No	1.2 KG	LSCS	CIAB	Test KMC	150 52 98%RA 36.7C	148 52 96%RA 37C	147 50 96%RA 36.5C	DHM	2CC	4CC	6CC	0	0	0	147 49 96%RA 37C	145 48 95%RA 36.5C	146 47 96%RA 36.9C	11	10	10	11	11	12	DAY 1	DAY 4
23	B/O Sujatha	F	22	Primi	30W 3D	CHD	1.05KG	NVD	CIAB	control supine	153 58 95%NP 37C	150 56 96%NP 36.7C	152 60 98%NP 36.8C	MM	2CC	4CC	4CC	0.2CC	0	0.6 CC	156 57 98%NP 37.0C	153 54 99%NP 36.5C	155 62 99%NP 36.6C	11	10	11	8	7	7	DAY 2	DAY 7
24	B/O Shruthi	F	21	Primi	31W	No	1KG	NVD	CIAB	control supine	148 54 98%NP 36.9C	150 52 97%NP 36.5C	146 56 98%NP 36.5C	MM	2CC	4CC	4CC	0	0.2 CC	0.3 CC	151 54 98%NP 36.7C	153 57 97%NP 36.9C	149 59 98%NP 37.2C	10	11	11	9	8	8	DAY 1	DAY 6
25	B/O Prachi	M	20	Primi	32W 1D	Anemia	1.3 KG	LSCS	CIAB	Test KMC	146 50 98%RA 36.6C	146 55 97%RA 36.5C	138 51 99%RA 36.4C	DHM	2CC	4CC	6CC	0	0	0.2 CC	143 48 98%RA 37C	141 50 97%RA 36.8C	138 47 99%RA 36.8C	11	10	10	12	11	11	DAY 1	DAY4
26	B/O Yashoda	M	25	Multi	30W 5D	No	1.26 KG	LSCS	CAS	control supine	153 48 96%RA 36.9C	157 50 96%RA 36.5C	146 56 98%RA 36.4C	MM	2CC	4CC	6CC	0	0.5 CC	0.5 CC	150 52 96%RA 36.7C	156 54 96%RA 36.5C	144 59 98%RA 36.5C	10	11	10	9	7	7	DAY 1	DAY 5
27	B/O Rashmi	M	23	Primi	30W 1D	No	1KG	LSCS	CAS	Test KMC	145 54 98%NP 36.7C	147 52 97%NP 36.5C	150 54 98%RA 36.5C	DHM	2CC	4CC	6CC	0	0	0	146 50 96%NP 37.1C	149 47 98%RA 36.5C	150 50 98%RA 36.4C	11	10	11	12	11	12	DAY 2	DAY 5

28	B/O Anjali	F	34	multi	32W	No	1.1 KG	LSCS	CIAB	contro l supine	152 50 96%RA 36.9C	160 52 96%RA 36.5C	150 56 98%RA 36.4C	DHM	2 CC	4 CC	6 CC	0	0.5 CC	0.6 CC	153 54 96%RA 36.7C	162 57 96%RA 36.4C	158 59 100% RA 36.5C	11	10	10	9	8	9	DAY 1	DAY 6
29	B/o Malashri	F	34	multi	31W 4D	HTN	1.3 KG	LSCS	CIAB	contro l supine	148 51 98%RA 36.6C	150 55 97% RA 36.5C	142 56 99% RA 36.5C	DHM	3 CC	5 CC	7 CC	0	0.5 CC	0.8 CC	150 54 98% RA 37.2C	15 58 97% RA 36.8C	146 58 99% RA 36.6C	11	10	9	9	7	7	Day 1	Day 6
30	B/o Sudha	M	25	multi	31W 5D	Thro mbo cyto peni a	1.2 5 KG	NVD	CIAB	Test KMC	138 58 97%NP 36.7C	152 54 96%NP 37.0C	144 50 98%NP 36.4C	MM	3 CC	5 CC	7 CC	0	0.2 CC	0	138 53 98%NP 37.1C	148 50 97%NP 37.5C	140 48 98%NP 36.9C	10	11	10	11	12	12	Day 2	Day 5
31	B/o Renuka	M	25	prim i	31W 6D	ane mia	1.0 7 KG	NVD	CIAB	contro l supine	155 55 95%NP 37.1C	152 57 96% RA 36.7C	156 59 98% RA 36.8C	MM	2 CC	4 CC	4 CC	0	0.5 CC	0.5 CC	158 58 97% NP 36.6C	156 60 98% RA 36.5C	160 62 99% RA 36.6C	11	10	10	10	7	8	Day 2	Day 7
32	B/o Vaishali b	F	24	Prim i	30W	NO	1.1 KG	NVD	CAS	Test KMC	148 54 98%NP 36.7C	147 52 97%NP 36.5C	150 54 98%RA 36.5C	MM	2C C	4C C	6CC	0	0	0.8 CC	150 58 96%NP 37.1C	144 47 98%RA 36.5C	156 56 98%RA 36.4C	10	11	9	8	10	7	Day 2	Day 6
33	B/o Shilpa twin 1	M	23	multi	29W	NO	1.4 KG	LSCS	CIAB	Test KMC	150 54 98%NP 36.7C	147 58 97%NP 36.5C	150 53 98%NP 36.5C	MM	2 CC	4 CC	6 CC	0	0	0	148 50 96%NP 36.9C	145 52 98%NP 36.5C	147 50 98%NP 37C	10	11	9	11	11	12	Day 4	Day 8
34	B/o Shilpa twin 2	M	23	multi	29W	NO	1.2 KG	LSCS	CIAB	contro l supine	145 53 95%NP 37C	153 58 96%NP 36.7C	154 58 98%NP 36.4C	DHM	2 CC	4 CC	5 CC	0	0.3 CC	0.8 CC	147 56 96%NP 37C	156 60 95%NP 36.5C	157 63 96%NP 36.5C	9	10	9	8	8	7	Day 5	Day 11
35	B/o Gowravva	F	22	prim i	29W 6D	PE	1 KG	LSCS	CAS	contro l supine	148 54 98%NP 36.9C	150 52 97%NP 36.5C	146 56 98%NP 36.5C	MM	2C C	4C C	4CC	0	0.2 CC	0.3 CC	150 54 98%NP 36.7C	149 50 97%NP 36.9C	145 58 98%NP 36.6C	10	10	9	9	8	10	Day 3	Day 8
36	B/o Tulsa	F	22	prim i	29W 2D	PE	86 0G	NVD	CIAB	Test KMC	143 48 98%NP 36.7C	154 50 97% NP 36.5C	148 46 98% NP 36.5C	MM	2 CC	2 CC	3 CC	0	0	0.2 CC	140 46 98% NP 37C	152 51 97% NP 36.9C	144 44 98% NP 36.8C	11	10	10	11	12	10	Day 4	Day 9
37	B/o Jayashree	M	31	multi	29W	NO	1.0 2K G	LSCS	Wea k cry At birth	contro l supine	156 50 96% NP 36.9C	160 58 96% NP 36.4C	154 58 98% NP 36.4C	MM	2 CC	4 CC	4 CC	1 CC	0.8 CC	0.6 CC	159 54 96% NP 36.7C	163 62 96% NP 36.5C	158 60 99%NP 36.4C	11	10	9	7	9	8	Day 4	Day 12

38	B/o Sakshita	M	21	prim i	30W	NO	1.3 KG	NVD	CIAB	contro l supine	148 57 95%RA 37C	150 51 96% RA 36.7C	156 60 98% RA 36.4C	MM	2 CC	4 CC	5 CC	0	0	1 CC	150 60 98% RA 36.8C	154 55 98% RA 36.5C	158 62 98% RA 36.6C	10	11	10	7	8	8	Day 2	Day 7
39	B/o Supriya Twin 1	M	22	multi	30W 5D	NO	1.3 KG	LSCS	CAS	Test KMC	147 53 95%NP 36.8C	152 50 96% NP 36.7C	152 52 98%RA 36.4C	DHM	4 CC	6 CC	8 CC	0	0	0	150 56 98%NP 37C	158 54 96%NP 36.9C	154 50 99%RA 37C	9	10	10	11	12	11	Day 2	Day 5
40	B/o Supriya Twin 2	F	22	multi	30W 5D	NO	1.4 KG	LSCS	CIAB	contro l supine	145 53 95%NP 37C	153 56 96%NP 36.7C	158 59 98%NP 36.4C	MM	4 CC	6 CC	6 CC	0	0.4 CC	0.8 CC	147 56 96%NP 37C	156 58 95%NP 36.5C	160 62 96%NP 36.5C	10	9	10	8	7	7	Day 2	Day 8