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Original Article

Comparative effect of Tactile Kinetic stimulation versus Intermittent Kangaroo Mother Care on Length of Hospital Stay in Preterm Low Birth Weight Infants

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ABSTRACT

Introduction: *Preterm birth and low birth weight (LBW) contribute significantly to neonatal mortality and morbidity, particularly in resource-limited settings. Tactile Kinetic Stimulation (TKS) and Kangaroo Mother Care (KMC) are non-pharmacological interventions with potential to improve neonatal outcomes, but comparative data on their effectiveness remain limited.* ***Methods & Materials:*** *A randomized controlled trial was conducted at Dhaka Shishu (Children) Hospital from January 2019 to December 2020, involving 73 neonates (gestational age 28–33 weeks; birth weight 1200–1800 g). Data on weight, length, heart rate, temperature, and time to achieve full feeding were collected. Statistical analyses were conducted using SPSS v20.0, with p-values <0.05 considered significant.* ***Results:*** *Both groups achieved comparable outcomes across all measured parameters. Time to achieve full feeding was similar (Group A: 5.63 ± 2.63 days; Group B: 5.50 ± 2.50 days; p=0.48). Weight and length increments over 21 days did not differ significantly (final weight: Group A: 2080.94 ± 152.87 g vs. Group B: 2038.57 ± 68.43 g; p=0.21; final length: both groups: 44.35 cm; p=0.42). Clinical stability parameters, including heart rate and temperature, were comparable across both groups. Length of hospital stay was similar (Group A: 32.34 ± 2.57 days; Group B: 31.68 ± 2.66 days; p=0.28).* ***Conclusion:*** *TKS and KMC are equally effective in improving neonatal outcomes among preterm LBW infants. Both interventions are feasible, cost-effective, and suitable for implementation in resource-constrained settings. Further studies are needed to explore their long-term impacts on development and health.*

Keywords: *Preterm Infants, Low Birth Weight, Tactile Kinetic Stimulation, Kangaroo Mother Care*

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INTRODUCTION

Preterm birth remains a significant global health concern, contributing to nearly 1 million neonatal deaths annually and accounting for approximately 10% of live births worldwide, with higher prevalence in low- and middle-income countries (LMICs) such as Bangladesh. Preterm neonates often face challenges such as low birth weight (LBW), underdeveloped organ systems, and a heightened risk of hypothermia, sepsis, and feeding difficulties, which collectively contribute to prolonged hospital stays and increased healthcare costs. The World Health Organization (WHO) estimates that over 15 million preterm babies are born each year, with survival and long-term outcomes heavily dependent on the quality and accessibility of neonatal care strategies[1,2]. To address these challenges, evidence-based, cost-effective interventions tailored to resource-limited settings are critical. Kangaroo Mother Care (KMC) has emerged as a low-cost, non-pharmacological intervention widely recommended by the WHO for improving neonatal outcomes, particularly in LMICs. KMC involves sustained skin-to-skin contact between the infant and caregiver, promoting thermoregulation, breastfeeding, and emotional bonding while reducing neonatal mortality by up to 40%. Multiple meta-analyses have established KMC's efficacy in improving weight gain, reducing hospital stays, and lowering incidences of nosocomial infections and hypothermia[3,4]. Notably, a study by Conde-Agudelo et al. demonstrated that KMC reduced neonatal mortality by 36% and was associated with significantly

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improved breastfeeding rates and parental satisfaction in resource-limited contexts[5]. In Bangladesh, the integration of KMC into neonatal care practices has shown promise, with studies reporting improved survival rates and cultural acceptability among caregivers, particularly in rural and underserved areas[6]. Tactile Kinetic Stimulation (TKS) represents another non-pharmacological intervention aimed at enhancing growth and development in preterm neonates. TKS involves systematic touch and kinesthetic exercises, including moderate-pressure strokes and passive limb movements, to stimulate the neuromuscular and metabolic systems of neonates. Though less extensively studied than KMC, emerging evidence suggests that TKS may offer significant benefits in weight gain, physiological stability, and reduced hospital stays. For instance, a quasi-experimental study in Indonesia found that preterm infants receiving TKS gained an average of 148.75 grams over three days and required only 3 days of hospitalization compared to 5 days for those receiving KMC[7]. Additionally, TKS has been associated with improvements in motor control, self-regulatory behaviors, and reduced stress responses in preterm neonates, further supporting its potential as a viable neonatal care strategy[8,9]. In Bangladesh, neonatal care is hindered by high rates of preterm birth (28%) and neonatal mortality, exacerbated by limited healthcare resources and insufficient neonatal intensive care facilities. This underscores the urgent need for scalable, evidence-based interventions like KMC and TKS that address the specific challenges of resource-constrained environments. While KMC is gradually gaining acceptance within Bangladeshi healthcare practices, the implementation of TKS remains underexplored, despite its potential to complement existing care strategies and reduce the burden on overextended neonatal units[6,10]. This study aims to compare the effectiveness of TKS and intermittent KMC in reducing the length of hospital stay among preterm LBW infants in Bangladesh. By evaluating these interventions within a localized context, this research seeks to provide actionable insights for healthcare providers and policymakers, ultimately contributing to the global body of knowledge on neonatal care. Such findings have the potential to optimize resource allocation, improve neonatal outcomes, and guide the integration of innovative practices into standard care protocols in LMICs.

METHODS & MATERIALS

This randomized controlled trial (RCT) was conducted at Dhaka Shishu (Children) Hospital from January 2019 to December 2020 to compare the effects of tactile kinetic stimulation (TKS) and intermittent kangaroo mother care (KMC) on preterm low birth weight (LBW) infants. Neonates weighing 1200–1800 grams, with gestational ages between 28 and 33 weeks, aged ≤10 days, and meeting specific clinical stability criteria were included in the study. Neonates with unstable clinical conditions, major surgery, or congenital anomalies were excluded. A total of 73 neonates meeting the inclusion criteria were enrolled and randomly allocated into two groups using the envelope lottery method. Group A (TKS) included 38 neonates, and Group B (KMC) included 35 neonates. Baseline data, including weight, length, occipito-frontal circumference (OFC), heart rate, and temperature, were recorded prior to the intervention. Group A underwent TKS based on the Field massage therapy protocol. This involved 15-minute sessions performed four times daily. Each session included systematic tactile stimulation and passive kinesthetic stimulation, with olive oil used as a medium. All sessions were conducted under hygienic conditions and at a controlled ambient temperature to ensure neonatal comfort and safety. Group B received intermittent KMC, which involved placing neonates in skin-to-skin contact with their caregiver for 2-hour sessions, four times daily, totaling 8 hours per day. Both groups were closely monitored daily for changes in weight, length, OFC, heart rate, and temperature. Neonates were discharged based on the following criteria: consistent weight gain of 10–20 g/kg/day for at least three consecutive days, ability to maintain normal temperature independently, absence of apnea or bradycardia, successful breastfeeding without respiratory complications, and demonstrated parental confidence in neonatal care. Data collection was performed using a structured questionnaire. Statistical analyses were conducted using SPSS version 20.0. Quantitative data were analyzed with t-tests, while chi-square or Fisher's exact tests were employed for qualitative data. Statistical significance was determined at a p-value < 0.05. The study was approved by the Dhaka Shishu Hospital Ethics Committee. Informed consent was obtained from all guardians prior to the enrollment of their neonates in the study.

RESULTS

Table – I: Baseline characteristics of the studied infants (*n*=73)

Variables	Group A (n=38)	Group B (n=35)	p- value
Gestational age (mean ± SD weeks)	31.08 ± 1.55	31.28 ± 1.07	0.22ns
Birth weight (gm; mean ± SD)	1435.78± 106.55	1502.42±288.43	0.32ns
Gender			
Male	16 (42%)	17 (49%)	0.35ns
Female	22 (58%)	18 (51%)	
Mode of delivery			
NVD	16 (42%)	14 (40%)	0.48ns
LUCS	22 (58%)	21 (60%)	
Birth weight groups			
1200-1499 gm	23(61%)	21(60%)	0.63ns
1500-1800 gm	15(39%)	14(40%)	0.90ns
Age groups			
1-5 days	20 (52%)	16 (46%)	0.47ns
6-10 days	18 (48%)	19 (54%)	0.15ns

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The baseline characteristics of the studied infants were similar between Group A (TKS) and Group B (KMC), with no statistically significant differences observed across the assessed variables. The mean gestational age was 31.08 ± 1.55 weeks in Group A and 31.28 ± 1.07 weeks in Group B (p=0.22). The mean birth weight was 1435.78 ± 106.55 grams for Group A and 1502.42 ± 288.43 grams for Group B (p=0.32). Gender distribution showed 42% males and 58% females in Group A, compared to 49% males and 51% females in Group B (p=0.35). Similarly, mode of delivery showed a comparable distribution, with 42% of infants in Group A and 40% in Group B delivered via normal vaginal delivery (NVD), and 58% in Group A versus 60% in Group B delivered via lower uterine cesarean section (LUCS) (p=0.48). Birth weight and age group distributions were also comparable, with 61% of Group A and 60% of Group B in the 1200–1499 grams birth weight range, and 39% in Group A and 40% in Group B in the 1500–1800 grams range (p=0.63 and p=0.90, respectively). Age distribution showed 52% of Group A and 46% of Group B aged 1–5 days, and 48% of Group A and 54% of Group B aged 6–10 days (p=0.47 and p=0.15, respectively).

Table – II: Time of achieving full feeding between the study groups (*n*=73)

Times of achieving full feeding (days)	Group A (n=38)	Group B (n=35)	p- value
Mean±SD	5.63±2.63	5.50±2.50	0.48ns

The time to achieve full feeding was comparable between Group A (TKS) and Group B (KMC). The mean duration for Group A was 5.63 ± 2.63 days, while Group B required 5.50 ± 2.50 days. The difference was not statistically significant (p=0.48), indicating that both interventions had a similar impact on the time required for preterm LBW infants to achieve full feeding.

Table – III: Comparison of physical parameters between group A and group B (*n*=73)

Parameters	Group A (n=38)	Group B (n=35)	p-value
Mean±SD Weight in Grams			
Before procedure	1474 ± 50.65	1490± 57.86	0.54ns
7th day	1581.315± 39.94	1584.857± 53.33	0.24ns
14th day	1755.26±21.63	1805.571±13.02	0.84ns
21th day	2080.94±152.87	2038.57± 68.43	0.21ns
Mean±SD Length in cm			
Before procedure	41.21±0.14	41.17±0.14	0.92ns
7th day	41.44 ± 0.14	41.59±0.14	0.30ns
14th day	42.72±0.21	42.85±0.15	0.25ns
21th day	44.35±0.26	44.35±0.25	0.42ns

The comparison of physical parameters between Group A (TKS) and Group B (KMC) revealed no statistically significant differences in weight or length at any time point. For weight, both groups showed consistent increases over 21 days, with Group A starting at 1474 ± 50.65 grams and reaching 2080.94 ± 152.87 grams, while Group B started at 1490 ± 57.86 grams and reached 2038.57 ± 68.43 grams (p-values ranging from 0.21 to 0.84). Similarly, for length, both groups demonstrated gradual increases, with Group A progressing from 41.21 ± 0.14 cm to 44.35 ± 0.26 cm and Group B from 41.17 ± 0.14 cm to 44.35 ± 0.25 cm (p-values ranging from 0.25 to 0.92).

Table – IV: Comparison of clinical parameters between group A and group B (*n*=73)

Parameters	Group A (n=38)	Group B (n=35)	p-value
Mean±SD Heart Rate			
Before procedure	135.05±2.6	134±2.6	0.55ns
3rd day	132.84±3.1	132.91±3.5	0.96ns
7th day	128.65±3.5	127.86±2.6	0.63ns
10th day	126.44±2.4	125.76±2.8	0.36ns
14th day	125±2.6	124.88±3.5	0.45ns
18th day	124.63±2.4	123.42±1.6	0.85ns
21th day	123.44±2.6	122.86±3.4	0.55ns
Mean±SD temperature			
Before procedure	96.3±1.8	96.4±1.9	0.36ns
3rd day	96.8±1.6	97.3±1.2	0.12ns
7th day	97.8±1.0	97.5±0.8	0.19ns
10th day	97.4±1.8	97.0±1.6	0.44ns
14th day	98.1±1.5	98.2±1.4	0.37ns
18th day	98.4±1.3	98.5±1.3	0.13ns
21th day	98.7±1.1	98.8±1.8	0.27ns

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The comparison of clinical parameters, including heart rate and temperature, between Group A (TKS) and Group B (KMC) showed no statistically significant differences at any time point during the study period. Heart rates decreased gradually over time in both groups, with Group A starting at 135.05 ± 2.6 bpm and reaching 123.44 ± 2.6 bpm by the 21st day, while Group B started at 134 ± 2.6 bpm and reached 122.86 ± 3.4 bpm (p-values ranging from 0.36 to 0.96). Similarly, temperature measurements showed a steady increase in both groups, with Group A progressing from 96.3 ± 1.8°F before the procedure to 98.7 ± 1.1°F by the 21st day, and Group B from 96.4 ± 1.9°F to 98.8 ± 1.8°F over the same period (p-values ranging from 0.12 to 0.44).

Table – V: Observation of length of hospital stay between group A and group B (*n*=73)

Hospital stay (days)	Group A (n=38)	Group B (n=35)	P-value
Mean±SD	32.34±2.57	31.68±2.66	0.28ns

The observation of the length of hospital stay showed no statistically significant difference between Group A (TKS) and Group B (KMC). The mean duration of hospital stay was 32.34 ± 2.57 days for Group A and 31.68 ± 2.66 days for Group B (p=0.28).

DISCUSSION

This study compared the effects of Tactile Kinetic Stimulation (TKS) and Kangaroo Mother Care (KMC) on the clinical outcomes of preterm low birth weight (LBW) infants, focusing on physical growth parameters, clinical stability, and the length of hospital stay. The findings revealed no statistically significant differences between the two groups across all measured parameters, indicating that both interventions are equally effective in supporting neonatal health outcomes under similar conditions. The similarity in baseline characteristics between the two groups, including gestational age, birth weight, and gender distribution, ensured that the observed outcomes were not influenced by confounding factors. Such comparability aligns with prior studies, which emphasized the importance of balancing baseline characteristics to reliably evaluate interventions in neonatal care settings[11,12]. In terms of time to achieve full feeding, this study found no significant difference between TKS (5.63 ± 2.63 days) and KMC (5.50 ± 2.50 days). These results are consistent with studies that reported similar rates of feeding progression among preterm infants receiving either intervention. For instance, Şimşek et al. demonstrated that KMC facilitates the transition to full enteral feeding by promoting physiological regulation and bonding, while Fontana et al. highlighted the role of tactile stimulation in accelerating feeding milestones[13,14]. The lack of significant differences between groups in our study suggests that both TKS and KMC effectively support feeding transitions in preterm infants. Regarding physical growth parameters, both groups exhibited comparable weight gain and length increments over the study period. Similar findings were reported in a systematic review by Narciso et al., which showed that KMC promotes weight gain without significant differences compared to other interventions when implemented for prolonged durations[15]. Furthermore, Iskandar et al. demonstrated that TKS significantly improves growth metrics, although their study highlighted slightly faster weight gains with TKS compared to KMC[7]. In this context, our findings contribute to the evidence that both interventions are viable options for promoting growth in preterm LBW infants, with negligible differences in efficacy. Clinical stability, assessed through heart rate and temperature, was achieved in both groups without significant disparities. These results align with previous studies indicating that KMC stabilizes heart rate and temperature by providing skin-to-skin contact, which reduces stress and enhances thermoregulation[16]. Similarly, TKS has been shown to improve autonomic stability and reduce stress responses, further supporting its role in maintaining clinical stability in preterm neonates[17]. The comparable outcomes in our study suggest that both interventions effectively support physiological stability in this population. The length of hospital stay was also similar between the groups, with TKS (32.34 ± 2.57 days) and KMC (31.68 ± 2.66 days) demonstrating no statistically significant difference. This finding is consistent with studies by Rangey and Sheth, who found that both interventions were equally effective in reducing hospital stays[18]. However, Iskandar et al. reported shorter hospital stays with TKS compared to KMC, potentially due to differences in implementation intensity and population characteristics[7]. Such variations underscore the need for further research to optimize intervention protocols and explore their effects in diverse healthcare settings. Overall, our study adds to the growing body of evidence supporting TKS and KMC as cost-effective and feasible interventions for preterm LBW infants in resource-limited settings. The comparable outcomes across physical growth, clinical stability, and hospital stay suggest that both interventions are viable options for neonatal care. However, additional research is warranted to explore their long-term impacts on developmental and neurocognitive outcomes, particularly in LMICs like Bangladesh, where resource constraints necessitate scalable and effective solutions.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study demonstrated that both Tactile Kinetic Stimulation (TKS) and Kangaroo Mother Care (KMC) are effective non-pharmacological interventions for preterm low birth weight (LBW) infants, with comparable outcomes across physical growth, clinical stability, and the length of hospital stay. The absence of statistically significant differences between the two groups underscores the equivalence of these interventions in

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supporting neonatal health. These findings highlight the feasibility of both TKS and KMC in resource-limited settings like Bangladesh, offering scalable and cost-effective solutions to address the challenges of preterm infant care. Further research is warranted to evaluate their long-term developmental impacts and optimize protocols for implementation in diverse healthcare environments.

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