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Department of Neurology, The Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430014, China. The Effects of Continuous, Intermittent Kangaroo Mother Care and Conventional Care on Improving Weight Gain in Low Birth Weight Infants: A Systematic Review and Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - No.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 9 May 2025 and was last updated on 9 May 2025.

INTRODUCTION

Review question / Objective The PICOS (Population, Intervention, Comparison, Outcomes, Study Design) framework was applied for inclusion criteria:

Population (P): LBW infants (<2500 g).

Intervention (I): KMC, including continuous skin-toskin contact, exclusive breastfeeding, and support from community health workers.

Comparison (C): Conventional care or no KMC intervention.

Outcomes (O): Infant nutritional indicators (e.g., weight gain, length, head circumference growth rate), exclusive breastfeeding rates, etc.

Study Design (S): RCTs.

Studies were excluded if KMC was not explicitly defined, lacked community-based implementation, or had incomplete or inaccessible data.

Condition being studied Low birth weight (LBW) infants account for 14.7% of global newborns and

exhibit significantly higher mortality and morbidity rates compared to normal-weight infants. Kangaroo Mother Care (KMC) has been widely studied as an effective care strategy, but the optimal implementation mode (continuous vs. intermittent) remains unclear. This study aims to compare the effects of continuous KMC, intermittent KMC, and conventional care on improving weight gain, length, head circumference, and exclusive breastfeeding rates in LBW infants through a systematic review and meta-analysis, thereby clarifying the advantages of different modes.

Databases including PubMed, Web of Science, Scopus, and EMBASE were searched to identify community-based prospective randomized controlled trials. The PRISMA guidelines were followed for systematic review and meta-analysis. Direct meta-analysis and network meta-analysis were conducted to evaluate the effects of different interventions on neonatal weight gain, length, head circumference growth velocity, and exclusive breastfeeding rates.

METHODS

Search strategy ("Kangaroo Care" OR "Kangaroo Mother Care" OR "Skin-to-Skin Care") AND ("Low Birth Weight" OR "Preterm Infants").

Participant or population ("Kangaroo Care" OR "Kangaroo Mother Care" OR "Skin-to-Skin Care") AND ("Low Birth Weight" OR "Preterm Infants").

Intervention ("Kangaroo Care" OR "Kangaroo Mother Care" OR "Skin-to-Skin Care") AND ("Low Birth Weight" OR "Preterm Infants").

Comparator ("Kangaroo Care" OR "Kangaroo Mother Care" OR "Skin-to-Skin Care") AND ("Low Birth Weight" OR "Preterm Infants").

Study designs to be included Randomization procedures Allocation concealment Blinding of participants and assessors Handling of missing outcome data Risk of selective reporting Other sources of bias.

Eligibility criteria To ensure rigorous study selection, two researchers independently evaluated titles and abstracts before conducting full-text assessments of potentially relevant articles. A standardized data extraction template was developed in Excel to systematically record key details such as lead author, year of publication, participant characteristics, sample size, intervention protocols, follow-up period, measured outcomes, and quality appraisal criteria. Any disagreements between reviewers were resolved through consensus or by involving a senior investigator.

Information sources This systematic review and meta-analysis synthesizes prospective randomized controlled trials (RCTs) evaluating the health effects of KMC on LBW infants. The study adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

2.2 Data Sources and Search Strategy

Electronic databases, including PubMed, Web of Science, Scopus, and EMBASE, were systematically searched for studies investigating community-based KMC interventions for LBW infants. The search strategy incorporated keywords such as "kangaroo mother care," "skinto-skin contact," "low birth weight," and "preterm," combined with MeSH terms and free-text terms. The search was conducted up to April 1, 2025, with no language or date restrictions. For nonEnglish publications, online translation tools were used to extract English abstracts or full texts.

Main outcome(s) A total of 10 randomized controlled trials (1,153 neonates) were included, with three studies evaluating continuous KMC and seven assessing intermittent KMC. Direct metaanalysis demonstrated that intermittent KMC was associated with significantly greater weight gain (MD = 3.72, 95% CI: 1.51-5.93) and length increase (MD = 0.17, 95% CI: 0.05-0.28) compared to conventional care, whereas continuous KMC showed a more pronounced, though non-significant, effect on head circumference growth (MD = 0.10, 95% CI: -0.03-0.23). Additionally, intermittent KMC substantially improved exclusive breastfeeding rates (OR = 2.13, 95% CI: 1.15–3.91). Network meta-analysis further supported these findings, with SUCRA rankings indicating that intermittent KMC was the most effective intervention for enhancing weight and linear growth, while continuous KMC yielded the best outcomes for head circumference expansion. These results suggest differential benefits of KMC modalities, with intermittent KMC favoring somatic growth and continuous KMC potentially offering neurodevelopmental advantages through improved head growth.

Quality assessment / Risk of bias analysis The analysis comprised two components: direct metaanalysis and NMA. Direct meta-analysis was performed using R software. For continuous variables, mean differences (MD) with 95% confidence intervals (CI) were calculated; for dichotomous variables, odds ratios (OR) with 95% CI were used. Heterogeneity was assessed via χ^2 tests and I² statistics. A fixed-effects model was applied if P \ge 0.1 and I² \le 50%, indicating low heterogeneity; otherwise, a random-effects model was used. Publication bias was evaluated using funnel plots and Egger's test. Asymmetrical funnel plots or Egger's test results (P < 0.05) suggested potential bias, prompting sensitivity analyses.

Strategy of data synthesis Network metaa n a l y s i s w a s c o n d u c t e d u s i n g STATA's network package. A network plot was generated to visualize intervention comparisons. Both direct and indirect evidence were integrated under the assumption of consistency and transitivity. Node-splitting analysis tested consistency between direct and indirect evidence; if inconsistency was detected (P < 0.05), an inconsistency model was applied. Bayesian frameworks estimated pooled effect sizes (OR/MD with 95% CI). Surface Under the Cumulative Ranking Curve (SUCRA) probabilities ranked intervention efficacy.

Subgroup analysis Publication bias was assessed using Egger's test and funnel plots. While Egger's test did not indicate significant bias for any outcome, its reliability was limited due to the small number of included studies. Funnel plots exhibited asymmetry, suggesting potential publication bias (Figure 7).

Sensitivity analysis was conducted by sequentially excluding individual studies. For daily weight gain, the MD ranged from 2.62 to 4.15; for weekly length gain, from 0.14 to 0.20; for weekly head circumference gain, from 0.06 to 0.15; and for exclusive breastfeeding rates, the OR ranged from 1.72 to 2.45. Sensitivity analysis results are presented in Figure 8.

Sensitivity analysis Network meta-analysis was conducted using STATA's network package. A network plot was generated to visualize intervention comparisons. Both direct and indirect evidence were integrated under the assumption of consistency and transitivity. Node-splitting analysis tested consistency between direct and indirect evidence; if inconsistency was detected (P < 0.05), an inconsistency model was applied. Bayesian frameworks estimated pooled effect sizes (OR/MD with 95% CI). Surface Under the Cumulative Ranking Curve (SUCRA) probabilities ranked intervention efficacy.

Country(ies) involved China.

Keywords Low birth weight infants; Kangaroo Mother Care; Growth parameters; Exclusive breastfeeding rate;Meta-analysis.

Contributions of each author

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