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Meta-analysis: The effect of kangaroo mother care on growth (increasing length gain) in infants with low birth weight

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Abstract---This study aimed to analyze the effect of kangaroo mother care on length gain in low birth weight (LBW) infants. This study is a systematic review and meta-analysis. The articles used in this study were obtained from three database, namely PubMed, Science Direct, and Google Scholar. The articles included are full-text article with a study design of randomized controlled trial from 2013 to 2022. Articles were analyzed using the Review Manager 5.3 application. Result: A total of 11 articles from Asia continent (India, Bangladesh, Philipina, and Nepal). The data collected showed that kangaroo mother care increased growth (length gain) of LBW infants 0.21 times and was statistically significant (SMD= 0.21; CI 95%= 0.19 hingga 0.22; $p < 0.001$). Conclusion: Kangaroo mother care increases length gain in LBW babies.

Keywords---kangaroo mother care, growth, length gain, LBW.

Introduction

Birth weight is defined as the weight of a baby who is weighed within the first 1 (one) hour after birth, measurements are made at the facility (hospital, public health center, and polindes), whereas if the baby is born at home, the measurement is taken (DK et al., 2011). The causes of LBW babies are generally multi-factorial. However, the most common cause of LBW babies is premature birth. Other maternal factors are age, parity, and others. Placental factors such as vascular disease, multiple pregnancies, and fetal factors are also the causes of low birth weight (Hasegawa et al., 2011). According to WHO (2014b) there are 5 million neonatal deaths every year with a mortality rate (death in the first 28 days of life) is 34 per 1,000 live births, and 98% of these deaths come from developing countries. The incidence of low birth weight infants (LBW) in developing countries

is 16.5%, twice as large as 7% in developed countries. Statistically, 90% of the incidence of LBW is found in developing countries and the mortality rate is 35 times higher than in infants whose body weight is more than 2,500 grams.

KMC method in the management of LBW has a positive effect on the duration of breastfeeding so that it also affects the growth of the baby and the baby's temperature is within the normal range. Babies given KMC have a body temperature within normal limits and have regular heart and breathing rhythms, sleep deeper, less crying, lower incidence of infection, more weight gain, and early discharge (Rohani et al., 2017). Based on this background, a comprehensive study is needed from various primary studies on the effect of the KMC method on length gain. This study aimed to analyze the effect of kangaroo mother care on length gain in LBW infants.

Method

Data Source and Search Strategy

This study was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Mikolajewicz & Komarova, 2019). The electronic searches used were PubMed, Science Direct, and Google Scholar, conducted from inception to June 16, 2022. The inclusion criteria in this research are full-text article with Indonesian and English language using randomized controlled trial study design, the keywords to search article were as follow "kangaroo mother care" AND "length gain" OR "growth" AND "neonatal outcome" AND "low baby weight infants" OR "skin to skin contact" OR "kangaroo care" OR "kangaroo method" AND "Randomized Controlled Trial" OR "RCT". In addition, articles were manually screened from primary studies conducted previously with a randomized controlled trial design, and relevant articles were reviewed according to the PICO formulation.

Study Selection

Search for studies or articles based on eligibility criteria, namely inclusion and exclusion criteria. The inclusion criteria in this research are: a) full-text article; b) Kriteria inklusi dalam penelitian ini adalah a) artikel full text; b) the article uses Indonesian and English; c) population: low birth weight babies; d) intervention: kangaroo mother care; e) comparison: conventional method care; f) outcome: length gain; g) randomized controlled trial design; h) the size of the relationship used is Mean and SD. The exclusion criteria are articles published in languages other than English and Indonesian, articles before 2008, and articles that are not free access.

Data Extraction and Study Quality Assessment

The research is guided by the PRISMA flowchart and the assessment of the quality of research articles using critical appraisal by Centre for Evidence Based Medicine (CEBM, 2014).

- Does this study address a clear research focus?
- Is the Randomized Controlled Trial research method appropriate to answer the research question?
- Are there enough subjects in the study to establish that the findings were not coincidental?
- Were the subjects randomly divided into the experimental and control groups? If not, can this be biased?
- Does the study use inclusion/exclusion criteria?
- Were the two groups comparable at the start of the study?
- Were objective and unbiased outcome criteria used?
- Is the measurement method used objective and valid to measure the results? If not, is there any blinding in the study?
- Is effect size practically relevant?
- Is the estimated effect correct? Is there a confidence level interval?
- Are there any confounding factors that have not been taken into account?
- Can the results be applied to your research?

Tabel 1

Assessment of study quality using critical appraisal by Center for Evidence Based Medicine (CEBM, 2014)

Primary Study	Criteria												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Suman et al. (2008)	1	1	1	1	1	1	1	1	1	1	1	1	12
Gathwala et al. (2010)	1	1	1	1	1	0	1	1	1	1	1	1	11
Ghavane et al. (2012)	1	1	1	1	1	1	1	1	1	1	1	1	12
Dandeker and Shafee (2013)	1	1	1	1	1	1	1	1	0	1	1	1	11
Acharya et al. (2014)	1	1	1	1	1	1	1	1	0	1	1	1	11
Sharma et al. (2016)	1	1	1	1	1	1	1	1	1	1	1	1	12
Vohra (2017)	1	1	1	1	1	1	1	1	1	1	1	1	12
Chowdury et al. (2018)	1	1	1	1	1	1	1	1	1	1	1	1	12
Ahmed et al. (2019)	1	1	1	1	1	1	1	1	1	1	1	1	12
Jahan et al. (2020)	1	1	1	1	1	1	1	0	1	1	1	1	11
Ocampo et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	1	12

Note: Answer: Yes=1, No =0

Statistical Analysis

Review Manager (RevMan) is software used to analyze data. RevMan is issued by The Cochrane Collaboration created to prepare and maintain Cochrane affairs. RevMan facilitates the preparation of a full protocol and review, including text, study characteristics, comparison tables, and study data. RevMan can perform meta-analysis of the entered data, and present the results graphically (Cohrane, 2014). This software has been used since 2014, RevMan helped authors make a systematic review or meta-analysis that is used to present the results of the overall mean difference, describing the 95% Confidence Interval (CI) using the effect model and data heterogeneity (I^2).

Results

An initial search of the database returned 1,297 articles. After screening the articles by removing articles based on the eligibility criteria, 11 articles were found that were included in the meta-analysis synthesis (figure 1).

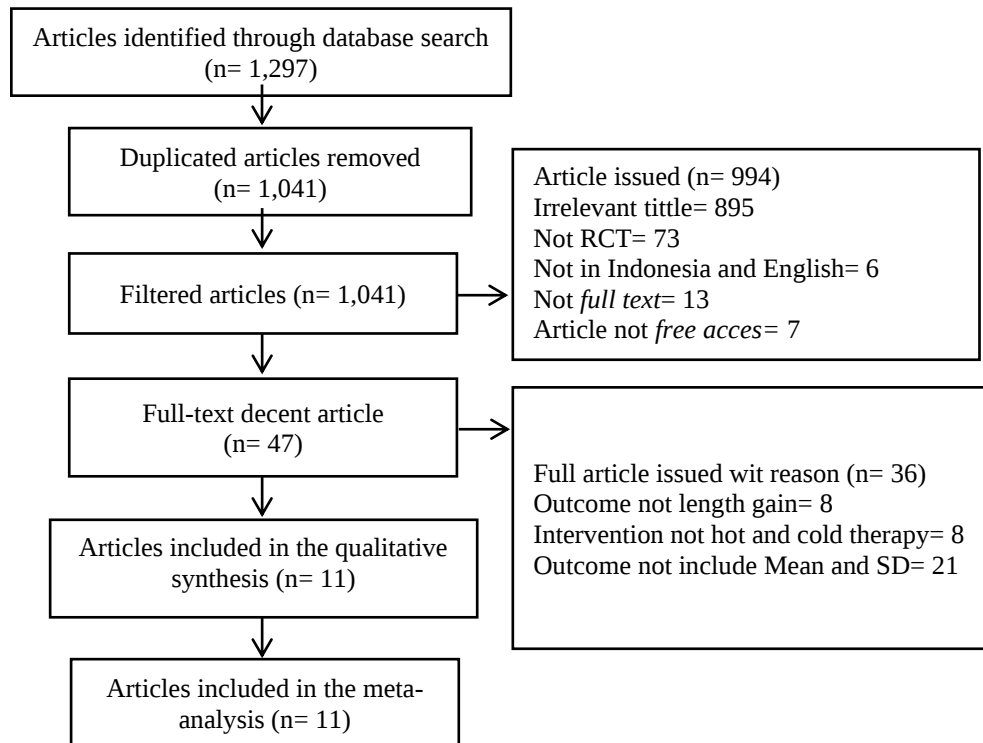


Figure 1. Result of Prisma Flow Diagrams

Study Characteristics

Figure 1 provides information on the baseline characteristics of the studies included in the meta-analysis. There are 11 primary study articles originating from the Asian continent (India, Bangladesh, Philippines, and Nepal) with a randomized controlled trial study design that were included in this study.

Tabel 2
Description of Primary Studies

Author (Year)	Coun try	Stud y Desig n	Sam pel	P	I	C	O	Mean	SD			
			IC	CG					IC	CG	IC	CG
Suman et al. (2008)	India	RCT	103	103	Bayi <250 0 g.	<i>Kangaroo Mother Care</i>	<i>Conve ntional Metho d Care</i>	Body weigh t, body lengt	0.99	0.70	0.75	0.45

Author (Year)	Country	Study Design	Sam pel	P	I	C	O	Mean	SD			
			IC	CG					IC	CG	IC	CG
								h, head circu m feren ce, chest circu mfere nce, armp it circu mfere nce, leg lengt h.				
Gathw ala et al. (2010)	India	RCT	50	50	Bayi <180 0 g.	Kangaroo Mother Care	Conve ntional Metho d Care	Weig ht gain, lengt h gain, oksip ito circu mfere nce	1.03	0.74	0.05	0.05
Ghava ne et al. (2012)	India	RCT	68	68	Bayi <150 0 g.	Kangaroo Mother Care	Conve ntional Metho d Care	Weig ht gain, lengt h gain, oksip ito circu mfere nce and breas tfeedi ng rate.	47.4	46.5	2.6	3.1
Dande ker and Shafee (2013)	India	RCT	60	60	Bayi <200 0 g.	Kangaroo Mother Care	Conve ntional Metho d Care	Weig ht gain, lengt h gain,	0.99	0.70	0.19	0.19

Author (Year)	Country	Study Design	Sample IC	P CG	I	C	O	Mean	SD			
									IC	CG	IC	CG
Acharya et al. (2014)	Nepal	RCT	63	63	Bayi <200 0 g.	<i>Kangaroo Mother Care</i>	<i>Conventional Method Care</i>	head circu m feren ce, hypot herm ia, sepsi s, apne a dan ASI. Weig ht gain, hypot herm ia, apne a, lengt h gain. Weig ht gain, lengt h gain, head circu mferen ce, lengt h of stay, exclu sive breas tfeedi ng. Weig ht gain, lengt h gain, head circu m	0.38	0.34	0.34	0.29
Sharma et al. (2016)	India	RCT	63	63	Bayi <150 0 g.	<i>Kangaroo Mother Care</i>	<i>Conventional Method Care</i>	gain. Weig ht gain, lengt h gain, head circu mferen ce, lengt h of stay, exclu sive breas tfeedi ng. Weig ht gain, lengt h gain, head circu m	1.00	0.98	0.6	0.7
Vohra (2017)	India	RCT	60	60	Bayi <250 0 g.	<i>Kangaroo Mother Care</i>	<i>Conventional Method Care</i>	gain, lengt h gain, head circu m	0.92	0.89	0.11	0.07

Author (Year)	Country	Study Design	Sample IC	P CG	I	C	O	Mean	SD			
									IC	CG	IC	CG
Chowdury et al. (2018)	Bangladesh	RCT	25	25	Bayi <1800 g.	Kangaroo Mother Care	Conventional Method Care	Weight gain, length gain, head circumference	0.99	0.92	0.16	0.10
Ahmed et al. (2019)	Bangladesh	RCT	25	25	Bayi <1800 g.	Kangaroo Mother Care	Conventional Method Care	Weight gain, length gain, head circumference	0.99	0.92	0.16	0.10
Jahan et al. (2020)	India	RCT	40	40	Bayi <1800 g.	Kangaroo Mother Care	Conventional Method Care	Weight gain, length gain, head circumference	0.99	0.71	0.70	0.44
Ocampo et al. (2021)	Philippines	RCT	26	26	Bayi <1500 g.	Kangaroo Mother Care	Conventional Method Care	Weight gain, length gain, head circumference, chest circumference	1.00	0.80	0.44	0.52

Result of Meta-Analysis

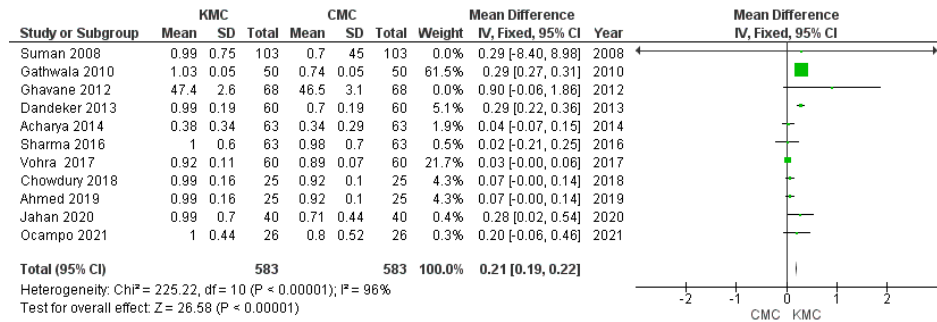


Figure 2. Forest plot of the effect of kangaroo mother care on length gain in infants with LBW

Based on figure 2, the forest plot showed menunjukkan bahwa there is high heterogeneity between experiments ($I^2 = 96\%$; $p < 0.001$) so the analysis using Random Effect Model (REM). The kangaroo mother care intervention can increase growth (length gain) in LBW babies by 0.21 times (SMD= 0.21; CI 95%= 0.19 to 0.22; $p < 0.001$).

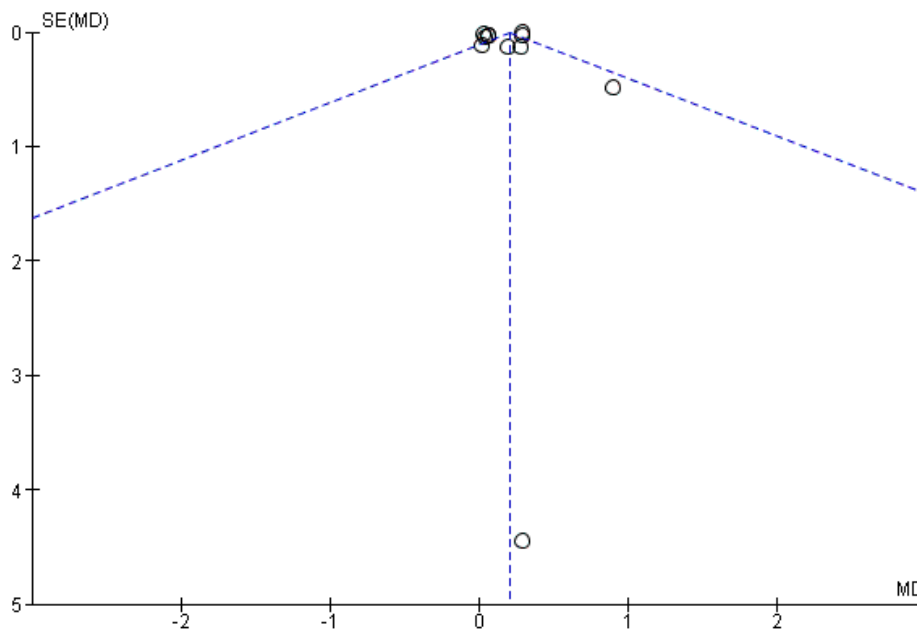


Figure 3. Funnel plot of the effect of kangaroo mother care on length gain in infants with LBW

Based on Figure 3, the funnel plot graph looks symmetrical between the right and left plots, this shows that there is no publication bias.

Discussion

This meta-analysis raised the topic related to the effect of kangaroo mother care on growth (body length) in LBW infants. This study discusses the KMC method which is considered important because it can be one of the treatments that can be carried out on LBW infants for temperature stabilization, weight gain, and baby length. Kangaroo Mother Care can increase weight in LBW babies. This is in line with research (Agudelo & Rosella, 2016), Kangaroo Mother Care (KMC) is a LBW baby care by positioning the baby to make direct skin-to-skin contact with the mother or caregiver, this method is one method that can be done easily to improve the health and well-being of LBW babies in the long term. The ideal implementation of KMC can be carried out continuously, by means of continuous skin to skin contact (SSC) techniques between the baby and the mother or caregiver. Research shows that KMC has a positive effect on babies and can be done easily by mothers or caregivers when compared to conventional care (Lawn et al., 2010). The implementation of KMC can be carried out twenty-four (24) hours continuously if the circumstances allow (Punia, 2020).

Another study that discussed KMC and its effect on weight gain, length gain, and greater head circumference gain compared to those in the control group. Similar studies have been made by (Cattaneo et al., 1998) conducted a randomized trial at the tertiary level and teaching hospitals in which 149 neonates were randomly assigned to the intervention group (KMC) and 136 to the control group (CMC) (conventional treatment methods such as warm rooms or incubators). Separate care for mother and baby using technology in the neonatal unit makes bonding difficult and creates barriers to breastfeeding. The KMC method is used to stimulate production (Anggraini & Septira, 2016). Several studies on the effect of KMC in breastfeeding show that breastfeeding takes longer, milk production is more stable, the number of breastfeeding per day increases, mother's confidence in breastfeeding increases.

According to research (Samra et al., 2013) said KMC can increase the weight of LBW babies because this intervention can make the baby stay longer with the mother so that breastfeeding becomes longer, milk production becomes more stable, the number of breastfeeding per day will increase so that it can indirectly increase nutritional intake in infants. and will affect the baby's weight gain and length. Ramanathan et al. (2001) showed that weight gain in LBW infants can also be influenced by a balance between food intake and energy expenditure, because during the KMC method the baby will expend less energy. In addition, the success of the KMC method is also influenced by knowledge, education, mother's attitude, and family support as well as health facilities and services provided (Agussafutri et al., 2021).

Limitation

This study has a search bias because the researcher only uses 4 databases, namely PubMed, Springerlink, Sciencedirect, and Google Scholar so that it ignores other database sources, besides that there is also a language bias, due to limitations in translating the language of the researcher so that only published

articles using Indonesian and English and ignore articles published in other languages.

Conclusion

This meta-analysis is a study that discusses the effect of kangaroo mother care on growth (body length) in LBW infants, and the results show that kangaroo mother care is statistically significant for increasing growth (body length) in infants. The studies that were included in the meta-analysis have been critically appraised by the researchers, then this study highlights the non-pharmacological therapies that can be carried out in the management of infants with low birth weight (LBW), especially infant growth. Health promotion, literacy and counseling activities for both health workers and patients need to be carried out to increase knowledge of the management of LBW infants using non-pharmacological therapy in order to minimize complications due to growth retardation.

Conflict of interest

There is no conflict of interest.

Funding and sponsorship

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Research ETHIC

There was no ethical agreement, as the study design used a meta-analysis.

Author Contribution

All authors contributed equally in the search, screening, and rating of articles as well as writing and compiling articles with a meta-analytical study design.

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