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Article Review

Association Between Low Birth Weight and Stunting Incidence: Scoping Review

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ABSTRACT

Babies with low birth weight have slower growth and development compared to babies with normal birth weight as they experience digestive disorders resulting in poor nutritional intake. If this condition lasts longer without inadequate nutrition, children can be infected and experience stunting. This research aims to examine the association's evidentiary basis between low birth weight and stunting. Inclusion criteria: Indonesian or English articles published in the last 5 years; original articles focused on low birth weight on stunting incidence. This study used PRISMA-ScR Checklist with 5 stages referring to Arksey and O'Malley. The article search used 4 databases: PubMed, DOAJ, Wiley Online Library, and EBSCO. The result is a total of 16 out of 2704 articles obtained were relevant and met the inclusion criteria. This review generated two themes: the factors and impact of low birth weight. It can be concluded that babies with low birth weight significantly correlate with stunting incidence.

Keywords : Low Birth Weight, Stunting, Scoping Review

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INTRODUCTION

Stunting is defined by the World Health Organization (WHO) as a developmental problem in children caused by malnutrition, repeated infections, and inadequate psychosocial stimulation[1]. Meanwhile, UNICEF defines it as a developmental delay in which children are short for their age due to malnutrition or health interfering with prenatal and postnatal development. Stunting is children's height <-2 standard deviations in the growth chart[2].

Stunting has become a global issue and challenge. The World Health Organization (WHO) reports that the global prevalence of stunting in 2020 was 149.2 million or 22%. In 2019, the highest stunting incidence was in African countries (55%) and Asian countries (51%)[2]. According to the 2021 Indonesian Nutrition Status Survey (SGBI), the stunting prevalence in Indonesia was 24.4%[3]. This figure has not met the government's target for 2024 set out in the 2020-2024 Medium Term Development Plan and Presidential Regulation No. 72 of 2021, namely below 14% [3].

Some factors affect stunting in developing countries such as low birth weight, mother's education levels, household income, and sanitation[4]. Babies with low birth weight affect 20% of the stunting incidence[5]. LBW infants have a birth weight of less than 2500 grams, regardless of the underlying cause or gestational age[6]. LBW is a serious problem, contributing to high infant morbidity and mortality. Infants born prematurely or with a low birth weight are more likely to develop stunting, which can lead to death[7].

Babies with LBW experience slower growth and development as they have experienced intrauterine growth retardation (IUGR). Therefore, babies with LBW have slower growth and development than those with normal birth weights. Babies with LBW can experience digestive disorders because they don't function properly, resulting in malnutrition and electrolyte imbalances. The process of breastfeeding also becomes problematic as the baby is small and weak, has small digestive organs, and cannot suckle properly. Thus, if this situation last longer with inadequate or inappropriate nutrition, children are often infected and experience stunting[8].

Stunting, directly and indirectly, affects children in the short and long term. Stunting affects low birth weight, hinders cognitive development and achievement, and limits chances of living into adulthood[9]. Short-term effects can cause problems with brain development, intelligence, physical growth, and metabolic disorders. Long-term effects can cause a decrease in cognitive skills and learning success, weakening the immune system so that children are easy to get sick, obesity and disability in old age[10].

A study conducted in Seberang Ulu 1 Sub-district, Palembang in 2020 revealed that newborns with a low risk of stunting were 2.9 higher than normal newborns[8].

The Scoping Review aims to determine the association between low birth weight and stunting incidence.

METHOD

The review used a scoping review technique as the sources used varied from some articles. Scoping reviews are used to identify information gaps, make systematic assessments, and determine the impact of decisions[11]. The PRISMA-ScR Checklist was utilized for this scoping review[12]. Arkshey and O'Malley's stages covered identifying research questions, identifying relevant articles, selecting articles, mapping data, and presenting data/results, discussion, and conclusions.

Identifying research questions

This research utilized the Population, Exposure, Outcomes, Study (PEOS) framework to locate articles, establish inclusion and exclusion criteria, and identify relevant articles. The review asks, "What is the latest obstetric scientific evidence regarding the relationship between low birth weight and stunting".

Table 1. PEOS Framework

P(Population)	E(Exposure)	O(Outcome)	S(Study)
Stunting incidence	Low birth weight	Association	Any articles discussing low birth weight and stunting incidence

Identifying relevant studies

The search strategy according to the research questions and objectives, the researcher determined the inclusion and exclusion criteria as presented in the following table:

Table 2. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion criteria
a. Articles in Indonesia or English b. Original research article c. Articles related to low birth weight and stunting incidence d. Articles published in the last 5 years (2018-2022)	a. Review/Opinion Articles b. Books c. Reports d. Guideline e. Final assignment (Thesis)

Articles search used some strategies: keywords, medical subject headings (MESH), truncation, Boolean operators (OR, AND, and NOT), and keywords in British and American English. The search involved four databases (Pubmed, DOAJ, Wiley online library, and EBSCO and supporting websites) to determine the scope of this review. Meanwhile, gray used the World Health Organization (WHO), and the United Nations International Children's Emergency Fund (UNICEF). The keywords used in the search for articles were low birth weight infant* OR low birth weight* AND stunting* OR growth disorder* OR stunted* OR malnutrition* OR undernutrition* OR nutritional deficiency*. Besides, the researcher included a five-year filter (2018-2022) as well

as the kind of original research publications. Then, the search results were downloaded and saved for future reference.

After gathering the evidence, a critical appraisal was conducted using the Joanna Briggs Institute (JBI) framework. The predetermined criteria were used to choose the data.

Selecting the Outcome of the Study

The selection of articles found 2704 articles consisting of 572 articles from PubMed, 446 articles from Wiley online library, 406 articles from DOAJ, and 1280 articles from EBSCO. The next step was inserting the articles into Mendeley software and finding 30 duplicate articles. After removing duplicate articles, the researcher filtered the titles and abstracts, doing a scoping review by reading research publications in whole to determine the applicability of research articles. Eleven related articles were obtained. The articles search process can be seen in the following PRISMA Flowchart:

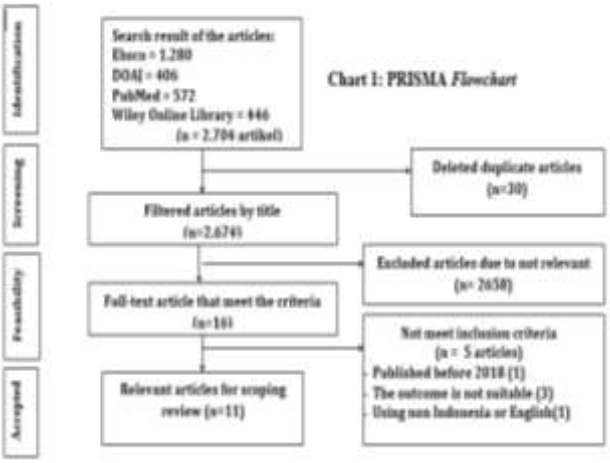


Chart 1: PRISMA *Flowchart*

Table 3. Data Charting

No.	Author, Year	Population, Sample	Data Collection	Type of Research	Results
A1	Saimin *et al.*, 2019[13]	Population: 64 children aged 6-59 months. Sample: 16 cases and 48 control	Low birth weight baby data: documentation, medical record Weight: Anthropometric measurement	case control	The results of the study obtained an odds ratio (OR) value of 5.923 (> 1) indicating that a history of LBW was significantly a risk factor for malnutrition with a lower limit of 1.724 and an upper limit of 20.346
A2	Adedokun & Yaya, 2021[14]	Population: Women aged 15 to 49, and children aged 0 to 59 months. Sample: 189, 195 children aged 0-59 months	Demographic and Health Survey Questionnaire and interview	cross-sectional	The results showed that the likelihood of experiencing stunting increased by 25% and 83%, respectively for children born with average weight and children with low birth weight <0.001. While the likelihood of stunting incidence decreased by 75% for children younger than 12 months and it increased by 12% for children aged 12-23 months.
A3	Ansuya *et al.*, 2018[15]	Population: 1485 children Sample: 570 children (190 cases and 380 control)	Demographic perform Economic status measurement scale semi-structured risk factor questionnaire and anthropometric measurement	case control study	The results showed that being underweight was significantly associated with parents' socioeconomic status, birth weight <2000 p<0.002, recurrent diarrhea, recurrent colds, and coughs, worms, and pre-lacteal feeding.

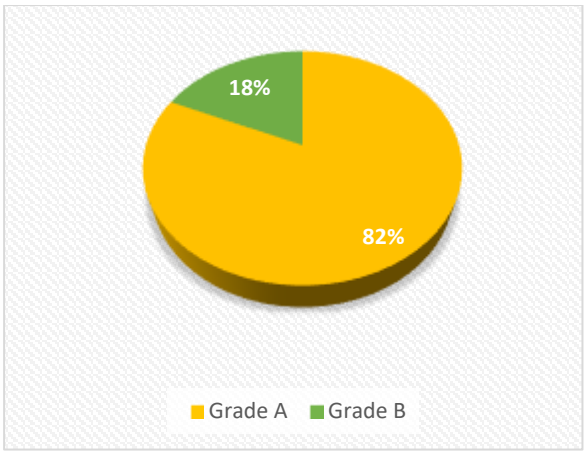
No.	Author, Year	Population, Sample	Data Collection	Type of Research	Results
A4	Ferreira *et al.*, 2020[16]	Population: 1992 (1231 children), 2005 (308000 children) and 2015 (328000 children) Sample: children aged 0-60 months 1992 (n=1231), 2005 (n=1381) and 2015 (n=988) Instrument: Survey, interviews, and anthropometric measurement		cross-sectional surveys	The results showed that in 1992, 2005 and 2015, the prevalence of stunting reached 22.6, 11.2 and 3.2% (85.8% decrease), while the prevalence of overweight reached 6.9, 7.5 and 14.9%, respectively (115.9% increase). Based on the multivariate analysis, the following positive associations with stunting were observed in 1992: age group >24 months (28.3% vs 14.5%), mothers with ≥2 children (28.8% vs 12.8%), low birth weight (28.3% vs 15.7%) p-value <0.006 and mothers with low education level (29.3% vs 7.2%).
A5	SK, B & Rana, 2021[17]	Population: 750 mothers with children aged 36-59 months Sample: 731 mothers/caregivers responded and completed the survey	Structured questionnaire and anthropometric measurement	cross sectional	The prevalence of stunting in children aged 36-59 months was 40%. The prevalence of stunting reached 40%, which is very high according to the WHO public health significance threshold (≥40%). The results of the multilevel analysis showed that low birth weight (p<0.001), birth spacing, mother's age at delivery, duration of breastfeeding, education level and mother's occupation were risk factors for stunting.
A6	Nshimyiryo *et al.*, 2019[6]	Population: 12,793 Sample: 3594 children	Anthropometric measurement and growth indicator	cross sectional	A total of 3594 children under 59 months consisting of 51% boys. The prevalence of stunting in all children reached 38%. In unadjusted analysis, the following factors were significant: boys children aged 6–23 months and children aged 24–59 months compared with those aged 0–6 months with low birth weight p<0.01, short mothers, history of deworming during pregnancy, mother's education levels, illiterate mothers and poor households
A7	Sunguya, B.F *et al.*, 2019[18]	Population: 37,409 children in 1991-2016 Sample: 1991–1992 (n=6587), 1996 (n=5437), 1999 (n=2556), 2004–2005 (n=7231), 2009–2010 (n=6597), and 2015–2016 (n=9001)	Six TDHS dataset namely demographic and health survey (DHS), Aids indicator survey (AIS), Service temporary assessment (SPA), Malaria indicator survey (MIS),	cross sectional	Results of the study showed a 30% reduction in stunting over 25 years in Tanzania. Factors related to stunting were children living in households with women as head of household (OR= 1.16, P=0.014), aged 24–35 months (OR= 1.75, P=0.019), newborn babies (OR=2.14, P<0.001) and with inconsistent or no breastfeeding (OR=3.46, P<0.001 and (OR=4.29, P=0.001). Children who live in

No.	Author, Year	Population, Sample	Data Collection	Type of Research	Results
			indicator survey (KIS) and National Bureau of Statistics (NBS)		urban areas have a higher risk of stunting (OR=0.56, P<0.001) with caregiver education (OR=0.56, P=0.018), maternal obesity (OR=0.63, P<0.001), highest wealth index (OR=0.42, P<0.001), and among girls (OR= 0.77, P<0.001).
A8	Khan, Z & Safdar, 2019[19]	Population: 13944 Sample: children aged 0-59 months (n=3071) Women who ever married aged 15-49 years (n = 14,569)	Secondary analysis of 2012-2013 PDHS data	cross sectional	Results showed that 44.4% of toddlers experienced stunting, 29.4% were thin, and 10.7% were thin. Children whose mothers live in rural areas (OR=0.67, 95%CI 0.48–0.92), aged <18 years when married (OR=0.76, 95%CI 0.59–0.99) and have more than 3 times ANC visits (OR = 0.61, 95% CI 0.38-0.98) were less likely to experience stunting. Low maternal education level (OR=2.55, 95%CI 1.26–5.17), short stature (OR=2.31, 95%CI 1.34–3.98), low birth weight (OR=1.67, 95% CI 1.14–2.45) and the mother's BMI were significantly related to the child's underweight status. Children whose mothers were uneducated were more likely to experience wasting (OR=3.61, 95% CI 1.33–9.82)
A9	Sartika *et al.*, 2021[20]	Population: Mothers of caregivers and babies whose mothers participate in the previous study. Sample: 559 children aged 0-11 months	Anthropometric measurement and interview	Cross sectional	Results of the study showed that 20.8% of the 559 children experienced stunting. In the model using LBW as a predictor of stunting, children with a birth weight of <2,500 g significantly increased the likelihood of stunting. children with diarrhea in the last 2 weeks and infants aged 9–11 months who did not receive vaccination had imperfect immunity. In the non-LBW model, premature babies, short mothers, and babies aged 9-11 months who did not receive basic immunization were significantly more likely to experience stunting.
A10	Giao *et al.*, 2019[21]	Population: children aged 12-24 months receiving EPI vaccine in the community health center in Ho Chi Minh City Sample: 768 children	Questionnaire and anthropometric measurement	cross sectional	The results showed that the average age of 768 children was 16.8 ± 4.2 months, 51.7% of whom were boys. The prevalence of stunting and obesity was (8.2%) and (10.7%) respectively. Stunting was associated with older age, lower birth weight for boys and girls,

No.	Author, Year	Population, Sample	Data Collection	Type of Research	Results
					and mother's occupation (P<0.05).
A11	Binagwaho *et al.*, 2020[22]	Population: all women aged 15-49 years and children under five years Sample: National representative 9696, 10,272, 12,540, and 12,699 households with the response rate of 99.5, 99.7, 99.8, and 99.9% respectively from 2000, 2005, 2010, and 2015	Interview and anthropometric measurement	cross sectional	The prevalence of stunting in under 5 years in Rwanda declined from 2000 (47.4%) to 2015 (38.3%), although the rate remained relatively stable between 2000 and 2010. Factors associated with higher stunting rates were low birth weight, low economic status, mother's education levels, smoking and male gender

After data charting, the quality of the journal was assessed with critical judgement by assessing the potential for methodological bias or systematic error in the studies so that the reviewer can consider findings based on bias[23]. The articles were assessed using the JBI which is a critical assessment instrument freely available for investigating the methodological limitations of primary research studies[24].
Based on the assessment using Critical Appraisal, the selected items had good quality covering 9 articles with grade A and 2 articles with grade B.

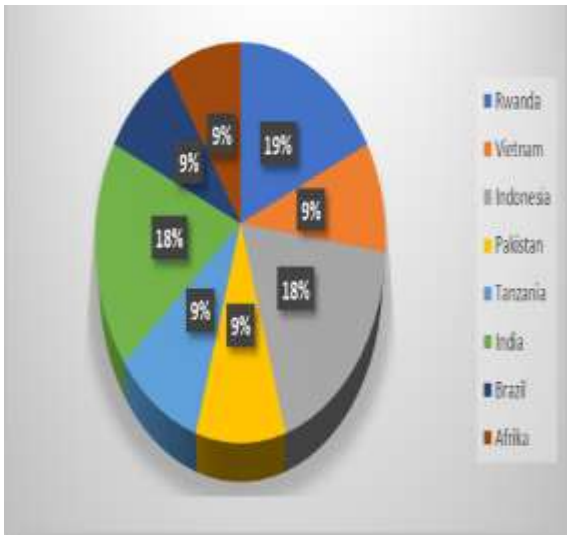
Diagram 1. Analysis by Article Grade



RESULTS

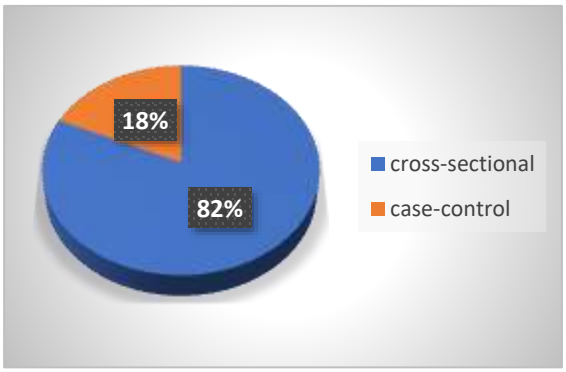
Based on the diagram above, the results of the analysis by country showed that all articles came from developing countries with 2 articles from Rwanda, 1 from Vietnam, 2 from Indonesia, 1 from Pakistan, 1 from Tanzania, 2 from India, 1 from Brazil and 1 from Africa.

Diagram 2. Analysis by types of country



Based on the diagram below, eleven articles were selected quantitatively consisting of 9 articles with the cross-sectional method and 2 articles with case-control method.

Diagram 3. Analysis by types of study



Mapping/Scoping

1. Geographical Characteristics

The systematic search results obtained 11 articles published between 2018-2022. The articles come from some developing countries, namely Rwanda, Vietnam, Indonesia, Pakistan, Tanzania, India, Brazil, and Africa.

2. Thematic

The results of the review identified some topics that are in accordance with the focus of the review, namely:

Table 4. Mapping/Theme Grouping

THEME	SUB-THEME
Factors influencing stunting	1. Age [1,4,6,7,8,10]
	2. Number of children [4]
	3. Birth weight [3,4]
	4. Economic status [2,5,6]
Impacts of low birth weight	1. Infection [3,9]
	2. Increasing infant Mortality [9]
	3. Stunting [1,2,3,5,7,8,9,10]

DISCUSSION

According to the review results involving 11 relevant articles, some articles discussed themes that could affect LBW on the stunting incidence.

Factors Affecting Stunting

Low birth weight is birth weight <2500 grams[6]. Low birth weight babies risk developing conditions that hinder their growth[16]. Nutrition is important at every stage of a person's life, from before birth to older people. Infants and toddlers are vulnerable to malnutrition[6].

Malnutrition causes disorders in children's growth and development, which can continue into adulthood if not treated soon. This study shows that most children with stunting in the coastal areas of Southeast Sulawesi are aged 25-48 months[13]. The research results are almost the same in Rwanda, Vietnam, Pakistan, Tanzania, India, Brazil, and Africa, where the prevalence of stunting in toddlers is high. When children grow, the prevalence of stunting typically rises to its peak between 24 and 35 months and then declines[19].

Economic status influences stunting incidence. Children from low economic status have a higher chance of being short and thin than those from high economic status[14]. Child nutrition suffers due to poverty because poor households do not have the financial ability to buy and eat foods high in vitamins and minerals that can enhance children's health. However, rich households can access these foods, greatly supporting growth and development[6]. Thus, better socioeconomic conditions and promoting global access to health and education are the basic strategies for reducing stunting incidence[17].

The number of children also influences stunting incidence, as "mothers with three or more children" contributed to malnutrition. Referring to the 1992 and 2015 surveys, more education expenditure is required to improve population health standards. It is predicted that moms will have less time to care for their children and have poorer per capita availability regarding the higher frequency of stunting in children whose mothers have three or more children[16].

Impacts of Low Birth Weight

Low birth weight infants are more vulnerable to illness, stunting, and possibly neonatal death. Babies with low birth weight are more susceptible to infections such as diarrhea and lower respiratory tract infections and have a higher risk of complications such as sleep apnea, jaundice, anemia, chronic lung disease, fatigue, and loss of appetite than those with normal birth weight. Low birth weight can also cause infant death[21]. Besides, the infection can also cause malnutrition, which makes children more susceptible to infectious diseases and increases the risk of growth delays[15].

Babies with low birth weights grow

slower than babies with normal birth weights. Babies born with LBW can experience digestive disorders as they don't function properly, resulting in poor food intake and electrolyte imbalances that hinder growth and development, resulting in stunting[18]. Children whose birth weight is low are 5 times more likely to be stunted than those whose birth weight is normal[14]. Meanwhile, a study by Binagwaho et al. (2020) reveals that the likelihood of stunting is more than double compared to children with normal weight. Another study[25] shows that A low birth weight increases the risk of stunting by 1.58 times compared to-a normal birth weight. The study found that children with low birth weights are more likely to experience stunting[15]. It is supported by the article findings [1,2,3,5,7,8,9,10] that LBW infants significantly correlate with stunting[19.]

The limitations in this scoping review are using articles from developing countries due to limited international scopes that discuss the relationship between LBW and stunting incidence in developed countries. In terms of the type of study, most articles used the quantitative method so the information obtained tends to be short and not in-depth.

CONCLUSION

Children with a low birth weight of <2500 and children of mothers with children ≥3 with a low economic status have a low health awareness and nutritional status resulting in high stunting rates. Babies with low birth weight are at risk of infection, which causes malnutrition, stunting, and even neonatal death. And most births with low birth weight occur in low- and middle-income households in developing countries. Low birth weight has a significant relationship with the prevalence of stunting.

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