Predictors of Stunting Among Children Under Five Year of Age in Indonesia: A Scoping Review

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Abstract

The cases of stunting in Indonesian children under five years of age is become national issues. This is due to the prevalence of stunting in Indonesian children has still remained high comparing to other southeast countries, at the national level is approximately 31 %. The consequences of child stunting may give both immediate and long term and include increased morbidity and affect to child growth and development. There is evidence of some factors are known as risk factors of stunting in children globally. The aim of this review is to identify the current literature and compile the predictors that have been associated with stunting in Indonesia and where data gaps remain. A systematic search of the literature between 2010 and 2018 was conducted using PubMed, Google Scholar, Scopus, EBSCO and Clinical Key. A search of the literature was performed by using keywords: stunting, determinants, children under five year of age, factors, Indonesia. Papers were included in this review if they identify an association between child stunting and exposure to determinant factors. The author selected 18 articles in the final analysis that met with the criteria. The included studies indicated that there are several main predictors of child stunting: child factors (low birth weight, premature birth); maternal factors (parental short stature, parental education); infection, and breast feeding. A diverse range of contributing factors are, to varying degrees, associated with stunting, demonstrating the importance of considering how those predictors interacts with nutrition. Integrated health promotion, prevention and interventions by health care providers, communities including health cadres is needed to prevent new stunting children in Indonesia

1. Introduction

A golden age period of childhood is an important period in growth due to at this time the basic growth of child that will influence and determine the next development of the child (UNICEF., 2014). One of the nutritional problems that are often faced by young children is stunting that adversely impact of the quality of life of children in achieving optimal growth according to their genetic potential (WHO., 2010). Childhood stunting is still a serious health problem globally, particularly in low income countries and developing countries (UNICEF., 2014; WHO., 2012). It is predicted around 155 million children under five years of age had stunting globally, among whom, 36% were residing in African countries and 27% in Asian countries (UNICEF., 2014). Stunting in children under five year of age denotes poor linear growth during a critical period and is diagnosed as a height for age less than −2 standard deviations from the World Health Organization (WHO) child growth standards median (WHO., 2012). In line with stunting, wasting is also identified as a public health threat in Southern Asia, including Indonesia (Black et al., 2014; the Global Nutrition Report., 2017).

Indonesia is one of the developing countries that has a high prevalence of stunting, from 88 countries in the world, and Indonesia is at the top five of stunting cases (UNICEF., 2014). Stunting remains a major public health problem in Indonesia. It is approximately 37.8% of Indonesian children were reported to be stunted in 2015, while in 2018 the prevalence of child stunting decreased to reach 31% (National Institute of Health Research and Development., 2018). Although in Indonesia has been reducing the prevalence of stunting with annual average reduction rate of 7.3% during 2013 to 2018, the progress is still quite low compared to WHO standardize (National Institute of Health Research and Development., 2018). It is alarming due to the declining childhood stunting was not satisfactory and inadequate. So that way, the issue of stunting in childhood is now become a government priority.

Stunting during childhood can result in negative health effects across the lifespan, including high morbidity and

mortality such as life-threatening complications during birthing, increased infant mortality rates, reduced cognitive performance and development, increased risk of infections, poor, delayed psychomotor development, lower school performance, poor intelligent quotients (IQ), emergence of chronic diseases, reduced production capacity in adulthood, with loses in economic growth and social developement of the country (Strewart et al., 2013; Black et al., 2014; Beal et al., 2017).

The World Health Organization has a Global Nutrition Targets for reducing the number of stunting children under five years old by 40% in 2025 and a key indicator in the second Sustainable Development Goal of Zero Hunger (WHO., 2012). The most important time to meet a child's nutritional requirement is in the first 1,000 days which is from conception to the child of 2 years of age (Black et al., 2013). During the first 1,000 days, the child needs adequate nutrition to support growth and development of the child (Black et al., 2013; WHO., 2012). After the age of two years the rate of growth slows down, and the child is considered stunted. Existing literature notices that stunting result from a complex interaction of a number of determinant factors such as house hold and family factors: poor nutrition during pre-conception, prenatal and lactation, short maternal stature, infection, intrauterine growth rate (IUGR) and preterm birth; inadequate complementary feeding, breasfeeding, water and sanitation, socio economic and cultural influences as stated in conceptual framework of stunting by the World Health Organization that cause of stunted growth (Stewart et al., 2013).

Over the past decade in Indonesia, there has been little change in the national prevalence of child stunting as mentioned previously. There are large disparities subnational, ranging by province from 26% in Riau Islands to 52% in East Nusa Tenggara (Torlesse et al., 2016). This indicates the variation in the population's exposure to determinants of child stunting and the need to target and tailor interventions to the most vulnerable. Literature notes that there are numerous potential risk factors of child stunting in Indonesia, including proximate factors such as maternal nutritional status, breastfeeding practices, complementary feeding practices, and exposure to infection as well as related distal determinants such as education, food systems, health care, water and sanitation infrastructure and services. The purpose of this article is to review the current evidence to determine what has been studied and can be concluded as the determinants of childhood stunting in Indonesia. In this review the author uses the WHO child stunting framework (Stewart et al., 2013) to organize studies with an outcome of under five child stunting or linear growth into the appropriate determinant categories (Figure 1).
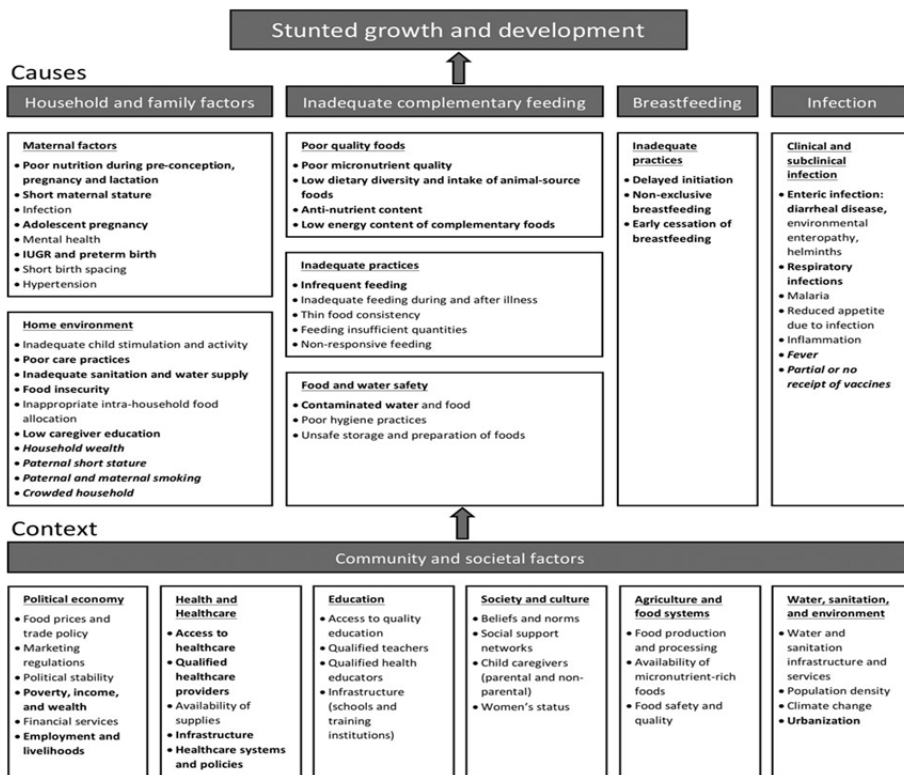

Figure 1. The World Health Organization conceptual framework on childhood stunting: Proximate causes and contextual risk factors.

2. Method

The preparation of the systematic scoping review of literature consists of several stages including:

2.1 Making Research Questions

Before starting the literature review, the author formulated the objectives of the literature review study first and formulated research questions to guide the search of literature. The research question developed is what are the predicting factors that associate to the incidence of stunting in children under five year of age?

2.2 Looking for Data Sources and Literature Search Strategy

After developing research questions, the next step is to search for journal articles published through electronic databases. The search strategy is reported below. A systematic search of the literature between 2010 and 2018 was performed using data from PubMed, PMC, Google Scholar, Proquest, Scopus, EBSCO, Web of Science and Clinical Key. In examining child stunting determinants worldwide, we used keyword searches in data based such as PubMed Central (PMC), Google Scholars, and Web of Science. For PMC, PubMed, the author used the term "malnutrition [All Fields] AND ("growth disorder" [MeSH Terms] OR ("Child stunting" [All Fields]). For Google Scholar and Web of Science, the author used the keywords "stunting, households, parenting, factors, determinants, predicting". Papers were included in this review if they identify an association between child stunting and exposure to predictor factors.

2.3 Inclusion/Exclusion Criteria

Studies were eligible if they met the following criteria:

1. Study site: Studies conducted in Indonesia.
2. Design: Randomized and non-randomized controlled trial (RCTs), Cross sectional, Survey and observational studies
3. Outcome: Stunting in children under five years of age.
4. Relevance: Studies published in English and Bahasa Indonesia that addressed any causal or contextual factors of stunting as identified in the WHO framework.

2.4 Studies Selection

The total titles/abstracts identified in the database werre17.727, and no additional titles/abstracts through additional searching outside of the databases. After excluding duplicated titles/abstract, remained 606 and after a further removal of 505 (83.3%) duplicated titles/abstract, obtained 101 titles/abstract. In the next stage, the full text articles were examined in more depth. For the remaining 101 articles screened, 59 were excluded because were not studies conducted in Indonesia, 24 outcomes did not meet the inclusion criteria, it was only 18 studies which met the criteria. This review focused on risk factors that can contributed to stunting in children under five years of age in Indonesia. All studies included were appraised for minimizing risk of bias. The selection process is illustrated in Figure 2 below.
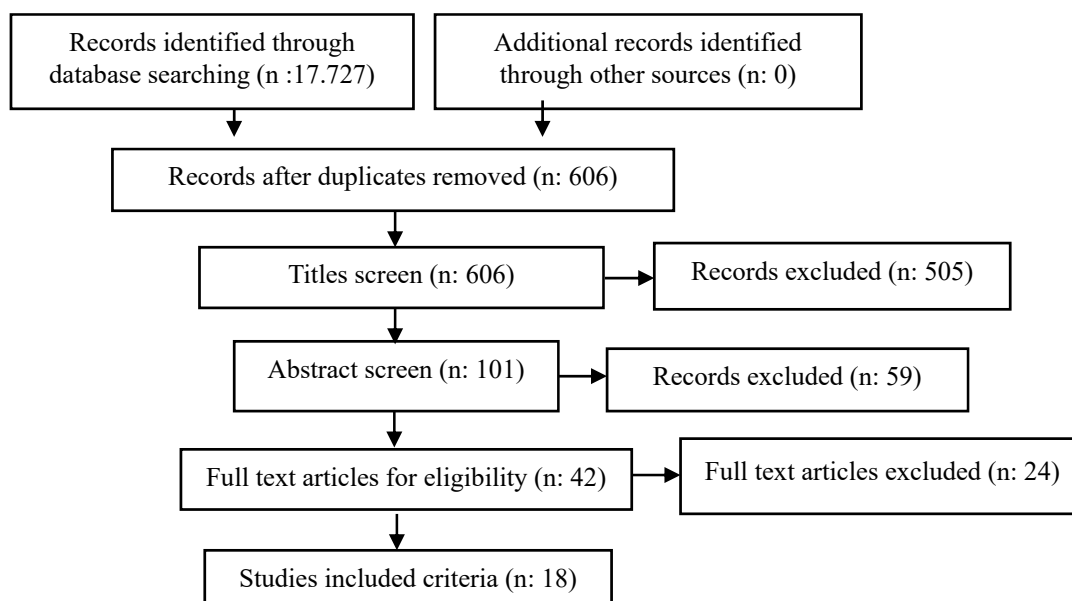
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Figure 2. Flow of studies through the selection process

3. Results

Based on the results of the screening of 18 articles selected from 2010-2018, all articles were analyzed using quantitative methods, with a cross sectional and case control research design. Table 3 present summary of review literature. In the research results, there are 3 main risk factors or predictors that associated to child stunting in Indonesia follow the WHO framework of stunting: 1) household and family factors, 2) infection and 3) breastfeeding.

Table 3. summary of review literature

Authors	Objective study	Subject	Design	Place	Findings
Inochi Lara Palino, Ruslan Majid, & Ainurafiq (2017)	To know Risk factors of stunting in children under five years of age	65 cases and 65 controls (children under five years of age)	Case control with matching procedure	Puuwatu Health Center, Kendari City Indonesia	LBW (OR = 5.5; 95% CI = 1,200-51,065); Maternal height (OR=2.5; 95% CI=1.159-5.832) and parity (OR=3.25; 95% CI=1.428-8.305) are determinant of child stunting
Murtini & Jamaluddin (2018)	To identify the factors associated with the incidence of stunting in children aged 0-36 months	25 stunting children under three year of age	cross sectional study	Lawawoi Public Health Center, Sidenreng Rappang Regency Indonesia	There is a relationship between LBW with stunting with a value of p = 0.008 (p <α = 0.05
Ninna Romawati & Ruli Bahyu Antika (2014)	To know risk factors associated with the incidence of	120 stunting children under three year of age	cross-sectional design	District of Jember East Java Indonesia	Low parent education, low parent income, parenting, lower education and income family, parenting and

	stunting among children aged 6-36 months				poor diet, and not given exclusive breast milk, never suffered an infection,
Eni Rukmana., Dodik Briawan, & Ikeu Ekayanti (2016)	To analyze risk factors of stunting in children aged 6-24 months	360 children	cross sectional study	Bogor West jva Province Indonesia	Low birth weight <2500 g (p = 0,000; OR = 4,192; 95% CI = 1,900-9,247) and low paternal education at <12 years (p=0,035; OR=1,807; 95%CI=1,042-3,133). is a risk factor for stunting in children of 6-24 months
Cut Novianti Rachmi, Kingsley E. Agho, Louise Alison Bau & Yanqiao Zhang, Edito (2016)	To: a) determine temporal trends in the prevalence of underweight, stunting, and at risk of overweight/ overweight or obesity in Indonesian children aged 2.0–4.9 years; and b) examine associated risk factors.	22,000 children stunting	Survey	Sumatra, Java, Kalimantan and Sulawesi Island Indonesia	There is strong associations between stunting and a lower birth weight; underweight children, and mothers' and fathers' education levels.
Erna Kusumawati, Setiyowati Rahardjo, and Hesti Permata Sari (2015)	To analyze risk factors related to child, mother, and environment factors for stunting under three years in order to develop a control model	Case sample is 50 stunting toddlers, the control sample is 50 normal status toddlers	Observational with case control	The working area of the Kedungbanteng Health Center, Banyumas Regency Indonesia	The risk factor for stunting and being the most dominant factor is infectious disease
Dicka Indo Putri Priyono, Sulistiyani,and Leersia Yusi Ratnawati (2015)	To analyze the determinant of stunting in children aged 12-36 months	86 children under five were taken by simple random sampling technique	Cross sectional	Randuagung Public Health Center, Lumajang Regency Indonesia	There is a relationship between infectious diseases, and genetics with the incidence of stunting. Genetic is the most influential risk factor for stunting

Sari et al. (2010)	To identify the relationship between stunting and nongrain food expenditure at the household level among children 0–59 mo old in Indonesia's rural and urban poor population.	Forty thousand households were selected	The Nutrition and Health Surveillance System (NSS)	5 urban poor populations from slum areas in the cities of Padang, Jakarta, Semarang, Surabaya, and Makassar and the rural population from the provinces of West Sumatra, Lampung, Banten, West Java, Central Java, East Java, the island of Lombok (West Nusatenggara), and South Sulawesi.	There is correlation between households with a lower proportion of total expenditure on nongrain, including animal and plant sources, and higher proportional expenditure on grain were at a higher risk of child stunting.
Friska Meilyasari et al. (2014)	To Identify risk factors of children stunting under 3 year of age	24 toddlers for cases group and 24 toddlers for control group	Case control	Kendal Indonesia	The risk factors of stunting in toddlers are prematuritas,
Aryastami et al. (2017)	To analyze the relationship between low birth weight (LBW), child feeding practices and neonatal illness with stunting among Indonesian toddlers.	3,368 infants	Cross sectional study	33 provinces and 441 districts in Indonesia	LBW is the major determinant of stunting in children
Anna Vipta Resti Mauludyani, Umi Fahmida & Otte Santika (2012)	To know risk factors associated with the incidence of stunting among children aged 6-36 months	31569 children under five year of age	The ecological study (survey)	437 districts in 33 provinces in Indonesia	Prevalence of high stunting was associated with income, proportion of low education of mother and proportion of food expenditure.
Isnninda Priska Syabandini, Siti Fatimah Pradigdo, Suyatno, Dina Rahayuning	To analyze risk factors for stunting in children aged 6- 24 months in fishing areas	60 respondents consisting of 30 cases and 30 controls	Observational research using quantitative research methods, descriptive analytic types and	Tambak Lorok Village, Tanjung Mas Village, North Semarang Indonesia	Children who have Low Birth Weight (LBW) are a 19-fold greater risk factor for stunting compared to children who have normal birth

Pangestuti (2018)		case control design		weight with p = 0.01. Children who have a history of infection are a 9-fold greater risk factor for stunting compared to children who have no history of infection with p = 0.001.
Endi Prawirohartono, Detti Nurdiati, & Moammad Hakimi (2016)	To estimate the inluence of prognostic factors detected at birth for stunting at 24 months of age and the occurennce of reversal of stunting at 24 months of age among children in a rural area of Indonesia.	343 infants	A randomized controlled, double-blind, community-based study	a rural area of Indonesia.	Boys who were born prematurely with low birth weight and small-for-gestational age have significantly higher risk to become stunted at 24 months of age.
Khoirun Ni'mah, & Siti Rahayu Nadhiroh (2015)	To determine factors associated to stunting among children under five	35 children under five year of age for cases and 35 children under five year of age for control	Case control	Distric Surabaya Indonesia	There was a relationship between birth length, exclusive breastfeeding, family income, mother's education and mother's nutrition knowledge of stunting among children under five year of age
Manggala et al. (2018)	To investigate the risk factors of stunting in children aged 24-59 month	166 children	Cross sectional	Gianyar Bali, Indonesia	Risk factors for stunting in children are low paternal education, maternal height less than 150 cm, high risk maternal age, low birth weight, low birth length and unexlusive breastfeeding.
Zilda Oktarina & Trini Sudiarti (2014)	To analyze risk factors of stunting in underfive children aged 24-59 months in Sumatera.	1,238 children	Cross sectional	Aceh, North Sumatera, South Sumatera, and Lampung Provinces	The significant risk factors of stunting among subjects (p<0.05) were mother's height (OR=1.36), fat intake (OR=1.30), family size (OR=1.38), and drinking water resources (OR=1.36).

					The dominant factor that associated with stunting in children was family size (OR=1.38).
Indriani et al. (2018)	To analyze prenatal factors associated with the risk of stunting in Nganjuk	225 children under five year of age	an analytic observational study with a case control design	Nganjuk, east Java Indonesia	The risk of stunting increases with maternal height <150 cm, birth length <48 cm, and large family size.
Titaley et al. (2019)	To examine the determinants of stunting in children aged 0-2 years In Indonesia using adata derived	24,657	Basic health survey	33 provinces in Indonesia	There are 20 potensial predictors of stunting that categorized into four main gropus ie., household and housing (maternal and paternal characteristics, antenatal care serices and child characteristic

4. Discussion

Childhood stunting is a kind of malnutrition in children that potentially give negative impact to children's growth and development, quality of life and future life of the stunting children. Stunting is considered to be a major public health problem in Indonesia as in other developing countries. Despite having several interventions such as specific and sensitive intervention approaches, the prevalence of stunting in Indonesia among children under five year of age is 31% still is higher than normal standardized WHO of 20%. It shows that progress in reducing and managing childhood stunting has been slow over the past decade.

The author used the WHO conceptual framework in this review of the literature on predictors child stunting in Indonesia. This review identified a number of factors that have beed studied for the association with stunting in children under five year of age, namely as followed:

4.1 Household and Family Factors

Child Factors (Low birth weight, premature birth)

Low birth weight

Low birth weight (LBW) babies have a risk of morbidity such as delayed of growth and development of child. In this review the author found there are four studies indicated that low birth weight is a determinant of childhood stunting in Indonesia. Palino, Majid and Ainurafiq (2017) conducted study in Kendari found that low birth weight is a determinant of stunting with OR=5.5, which means it has a 5.5 times greater risk of experiencing stunting compared to toddlers who have a history of LBW. This is supported by research by Murtini and Jamaludin (2018) in Rappang who found that there was a relationship of LBW with stunting with a value of p=0.008. In line research also conducted by Rukmana, Briawan and Ekayanti (2016) indicated that low birth weight <2500 grams is a risk factor for stunting with an OR value of 4.1 which means that children with LBW have a risk 4.1 times more likely to experience stunting. Similarly, Rahayuh et al. (2016) showed that there is a relationship between LBW and stunting with a value of p=0.029. The impact of babies who have low birth weight will continue from generation to generation, children with LBW will have less anthropometric size on their development. Similar research conducted in Etiophia by Berhe et al. (2019), showed that LBW is predictor of stunting with an OR value of 5.3 which means that LBW has a 5.3 times greater risk of experiencing stunting. Other study in Madagascar found that LBW was more likely to experience stunting with an OR value of 1.6 (Rabaoarisoa et al., 2017). A study in Ghana carried out by Boah et al. (2019) indicated that LBW is a stunting determinant and 3 times more likely to have a risk of stunted growth. Prevention of LBW can be done by monitoring maternal health during pregnancy.

Result of this review identified that prematurity have been strongly associated with child stunting in Indonesia. As Prawirohartono, Nurdiati and Hakimi (2016) conducted a secondary analysis of data collected between 1995 to

1999 and found that premature birth was associated with an RR of 7.11 (95% CI [2.07, 24.48]). Low birth weight is a predicting factor to growth completion after birth. LBW is correlated to IUGR and or preterm delivery (Wu et al., 2004). Other earlier study (Karima et al., 2012) indicated that there is significant relationship between nutritional status of mother, weights gained during pregnancy, iron intake and the age of gestation with the incidence of LBW. A study in Zimbabwe showed that growth of the LBW babies are well behind the growth of normal weight babies and signifivant length differences were behind the growth of normal weight babies and significant length differences were seeming at 12 months of age (Mbuya et al., 2010). Babies with LBW under 2,500 grams have a higher risk of infection, malnutrition and other illness (WHO, 2010). Birth weight is an important and reliable indicator to determine the health, nutrition and socio- economic status of people in developed and developing countries (WHO, 2017; Aryastami et al., 2017).

Maternal factor

Maternal or paternal short stature

Short paternal stature was also a determinant factor for prevalence of child stunting (WHO., 2015). This review identified there are two studies found that there is association between paternal short stature with child stunting under five year of age. Oktarina and Sudiarti (2015) identified there is significant determinant factors of stunting among subjects (p<0.05) was mother's height (OR=1.36). Similarly, recent study by Manggala et al. (2018) found maternal height has correlated with growth failure in children and short parents seemed to have stunted children (Sinha et al., 2018). Other study by Indiani et al. (2018) indicated that short mother <150 cm were more likely to have stunting than mother with normal height (≥150 cm) (b=2.59; 95% CI= -0.75 to 4.42; p= 0.006). The result of this study supported a study of Aguayo et al. (2016), which stated that mothers who were <145 cm tall would increase the incidence of stunting in infants by 2.04 times than mothers who were ≥145 cm (b= 2.04; 95% CI=1.46 to 2.81). The association between maternal or parental stature and liner growth of children is might because of genetic factors, adequate nutritional intake and reproductive health of mothers (Sinha et al., 2018; Stewart et al., 2013).

Maternal or paternal education

Result of this review noticed there is association of low paternal education to child stunting. Six studies reported that parental education was a determinant factor of inadequate nutritional status of children which leading to stunted child (Manggala et al., 2018; Rachmi, Agho, Li & Baur., 2016; Rukmana, Briawan & Ekayanti., 2016; Ni'mah &Nadhiroh., 2015; Rohmawati & Antika., 2014; Mauludyani, Fahmida & Santika, 2012). Other study conducted by Astari, Nasoetion and Dwiriani (2005) found that parent with having higher educational background may have better understanding of the need of adequate nutritional status, growth and development of a child, which may able to provide optimal care to their children. It is concurrent with WHO Conceptual Framework on Childhood Stunting that stated inadequate maternal care practice and poor maternal education as determinants of childhood stunting (Beal et al., 2017; Stewart et al., 2013).

Family size

Other significant factors of the household and family factor identified in this review was family size. Result of the review evidence found that there was an association between family size and child stunting. Two studies showed that there was an association between family size and stunting, and it was statistically significant (Oktarina & Sudiarti, 2014) and Indriani et al. (2018). For instance, Indriani et al. (2018) indicated that there was a correlation between family size and stunting that there was an association between family size and stunting. This study showed it was significant statistically. Family size ≥5 have possibility of stunting (b= 2.31; 95% CI=0.34 to 4.29; p=0.022). Similarly, a study conducted in Ethiopia by Wolde, Berhan and Chala (2015) found thathaving large family size (AOR=3.3; 95% CI, 1.4-7.9) would increase the incidence of child stunting. Children from big family size may less get nutrition intake, lack of parent attention and care (Proverawati &Wati., 2011). Parents of large family size should spend more monet to fulfill their family needs.

4.2 Infection

Based on the WHO framework infection includes enteric infection (diarrheal disease, environmental enteropathy, and helminths), respiratory infections, malaria, and inflammation. Literature notes that respiratory and enteric infection is predictor of child stunting (Beal et al., 2017). In our review infection is one of predictor of stunting in children under of five years of age. Two studies found that there is a relationship between infectious diseases and the incidence of stunting (Kusumawati, Rahardjo & Sari., 2015; Priyono, Sulistiyani & Ratnawati., 2015). This is supported by Syabandini et al. (2018) which found that children who have a history of infection are 9 times greater risk of stunting compared to children without a history of infection with p = 0.001. A similar study was also

conducted by Maywita (2018) in Lubuk Begalung who found that there was a significant relationship between the history of infectious disease and the incidence of stunting with an OR value of 3,868. It means that it has a risk of 3.868 times greater for stunting than children without a history of infectious disease.

Exposure to infectious diseases has a more severe effect of growth faltering in normal children. Another study supporting by Aridiyah et al. (2015) in Lumajang's rural and urban areas which found factors that influence stunting in children under five year of age in rural areas and urban is a history of infectious diseases. Kusumawati, Rahardjo and Sari et al. (2015) showed that risk factors and became the most dominant factor is infectious disease. The recent study conducted by Berhe (2019) in Etiophia and Rabaoarisoa et al. (2017) in Madagascar also found diarrhea is a risk factor for stunting (OR=5.3), which means it has a 5.3 times greater risk of experiencing stunting and trichuristrichiura infection (2,4; 95%) is the main stunting factor. Prevention of infection can be done by avoiding the originator of the infection and handling appropriately and immediately if an infection has occurred.

4.3 Breasfeeding

According the WHO framework under unoptimal breastfeeding practices, includes delayed initiation of breastfeeding, unexlusive breastfeeding, and early termination of breastfeeding. Breast milk is known as essential feeding for infants during the first six months of life. The World Health Organization and Indonesian Ministry of Health recommend all babies must be given full exclusive breastfeeding. It is needed for babbies to enhancing growth and development of infants (Martin et al., 2011). Results of this review found that there are three studies identified unexclusive breastfeeding had an association of child stunting (Manggala et al., 2018; Ni'mah & Nadhiroh., 2015; Romawati & Antika., 2014). The WHO framework states that unexlusive breastfeeding practices, delayed initiation of breastfeeding, and early termination of breastfeeding are significantly associated with childhood stunting

5. Conclusions and Reccomendations

The results of this review show that there is a diverse range of predictors of stunting in children under five years of age in Indonesia. The current evidence in Indonesia mainly align with the common of proximate factors that found in a broad of literature such low birth weight, premature birth, parental short stature, parental education, family size, infection, and breastfeeding that significantly associated with childhood stunting. Not all of proximate risk factors identified in the WHO framework has been examined for the prevalence of stunting in Indonesia. It is therefore needed future studies to addressing these knowledge gaps in Indonesia. The findings indicate that the need for developing integrated health promotion, prevention and interventions to reduce stunting in Indonesia. Intergative stunting prevention and interventions should use multi sectoral approaches that involve health care professionals, families, government and communities.

Competing Interests Statement

The author declares that she has no competing interests.

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