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Scoping Review
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Child Stunting Against Acute Respiratory Infections in Developing Countries: A Scoping Review

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ABSTRACT

Background: Acute Respiratory Infections (ARIs) are a leading cause of morbidity and mortality among young children, particularly those who experience stunting. This study aims to map the factors associated with ARIs in stunted toddlers using a scoping review methodology.
Subjects and Method: This scoping review was conducted using data obtained from PubMed Central. The target population included toddlers with stunting and ARIs. A search was performed using the keywords "stunting AND acute respiratory infections AND toddler," yielding 712 articles, which were narrowed down to 8 relevant articles after applying a 10-year time frame. The factors influencing ARIs in stunted toddlers were categorized into five groups: (1) environmental and sanitation factors, (2) nutritional factors, (3) socio-economic factors, (4) co-infections, and (5) genetic and biological factors.
Results: The factors influencing ARIs in stunted toddlers were categorized into five groups: (1) environmental and sanitation factors, (2) nutritional factors, (3) socio- economic factors, (4) co-infections, and (5) genetic and biological factors. ARIs and stunting are interrelated through various complex factors.
Conclusion: A multidisciplinary approach is essential to enhance access to healthcare services, improve nutritional education, and address sanitation conditions, with the goal of reducing the prevalence of ARIs and stunting in toddlers, thereby supporting optimal growth.

Keywords: acute respiratory infections, stunting, toddlers.

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BACKGROUND

Acute Respiratory Infections (ARIs) are infections that occur in the respiratory tract, encompassing both the upper and lower respiratory parts, and are caused by various pathogens, including bacteria, viruses, fungi, and parasites. The majority of children diagnosed with ARIs, except those with nasal obstruction, typically exhibit one or more symptoms such as cough, difficulty breathing or dyspnea, and rapid breathing (tachypnea) (Jamison et al., 2006; Roth et al., 2015; WHO, 1994).

ARIs are among the leading causes of illness and death in children under five years of age globally (Accinelli, Leon-Abarca and Gozal, 2016). The mortality rate attributed to ARIs shows significant regional variation (Wang et al., 2016). According to data from the World Health Organization (WHO), it is estimated that ARIs account for approximately 3.5% of the total global disease burden and contribute to 30% to 50% of all outpatient pediatric visits, as well as over 30% of hospital admissions for children in low- and middle- income countries (WHO, 2022).

Stunting in children under five years refers to a linear growth impairment that occurs during a critical period, characterized by height-for-age below -2 standard deviations from the median growth standards established by the WHO (Sanità, 2006). The impact of stunting on children can be both short-term and long-term, including increased rates of illness and mortality, impaired child development and learning capacity, a higher risk of infections and non-communicable diseases in adulthood, and reduced productivity and economic capacity (Stewart et al., 2013).

Acute Respiratory Infections (ARIs) have a significant relationship with the occurrence of stunting in toddlers. Children often experience recurrent infections, including ARIs, which can disrupt their growth and development. Repeated infections contribute to decreased immune system function, thereby increasing a child's susceptibility to other infectious diseases. Toddlers exhibiting ARI symptoms such as cough, runny nose, fever, and vomiting for more than 14 days are at high risk for stunting, especially if these symptoms persist for over two weeks (Arini et al., 2020). Analysis models indicate that children with stunting have a higher risk of ARIs, with the prevalence rate of ARIs in stunted children reaching 30%, compared to 15% in non-stunted children (Orunmoluyi et al., 2022). Stunted toddlers are highly susceptible to ARIs, as evidenced by findings from studies showing that the prevalence of ARIs among hospitalized children reaches 37% (242 out of 657 children), making it the most common cause of hospitalization in children under five years (Bhurtel et al., 2022).

In this context, it is crucial to analyze the contribution of ARIs to the occurrence of stunting and the factors influencing this relationship. This study aims to map the various factors associated with the incidence of ARIs in stunted toddlers.

SUBJECTS AND METHOD

1. Study Design

This study employs a scoping review methodology following the framework proposed by Arksey and O'Malley, which allows for the exploration and mapping of literature related to the relationship between Acute Respiratory Infections (ARIs) and stunting in toddlers.

2. Steps of Scoping Review

To conduct a scoping review for the research titled "Child Stunting Against ARI in Developing Countries: A Scoping Review", the first step is identification of relevant articles by searching using the keywords: (“stunting” OR “malnutrition”) AND (“acute respiratory infections”) AND (“toddler” OR “children” OR “child”) in the PubMed Central database. The next step is screening, where articles will be selected after filtering. Articles older than 10 years and those not relevant to the keywords will be excluded. After filtering, articles with keywords in the title (e.g., 45 articles) will be retained. In the eligibility stage, articles that are not relevant to the topic or those that do not discuss the relationship between ARI and stunting in toddlers will be removed. This will leave only articles that directly address the relationship between ARIs and stunting. In the final

stage, inclusion, articles that meet the eligibility criteria will be included in the review, with a total of 8 relevant articles. This process ensures that only articles aligned with the topic and objectives of the research are used in the scoping review.

3. Inclusion Criteria

The inclusion criteria for this research are as follows: articles published between 2014 and 2024, with titles containing the relevant keywords, and articles that discuss topics directly related to the focus of the research. These criteria ensure that the selected studies are recent, relevant, and aligned with the research objectives.

4. Exclusion Criteria

The exclusion criteria for this research are as follows: articles published more than 10 years ago, articles whose titles do not contain the targeted keywords, and articles whose content does not align with the research focus. These criteria help ensure that only the most relevant and up-to-date studies are included in the review.

5. Study Variables

The primary variables of interest in this study are the incidence of Acute Respiratory Infections (ARIs) and the occurrence of stunting in toddlers. These variables were examined to understand the relationship and factors influencing the interaction between ARIs and stunting.

6. Operational Definition of Variables

Acute Respiratory Infections (ARIs): Infections affecting the respiratory tract, including both upper and lower respiratory infections, caused by pathogens such as viruses, bacteria, fungi, or parasites.

Stunting: A condition where a child's height-for-age is below -2 standard deviations from the median growth standards established by the World Health Organization (WHO), indicating a growth impairment that occurs during a critical period in early childhood.

7. Study Instruments

Data were collected from PubMed Central using a keyword search: ("stunting" OR "malnutrition") AND ("acute respiratory infections") AND ("toddler" OR "children" OR "child"). This search strategy was designed to identify relevant literature for the scoping review.

8. Data analysis

Data from the relevant studies were synthesized to provide a comprehensive overview of the factors influencing the relationship between ARIs and stunting. This included analyzing emerging themes from the literature and identifying gaps in the existing research. The selected studies were analyzed qualitatively to map the factors that contribute to both ARIs and stunting in toddlers.

RESULTS

1. Study Selection

Based on figure 1 show that the study selection of the scoping review. A total of 712 articles were identified from various databases, and then excluded 134 articles were removed. No articles were removed due to duplication. Records screened at the year level were 578 articles, A total of 444 articles were excluded on the grounds that 533 articles were not relevant to the keywords and 37 articles were not in accordance with the discussion. The remaining articles were 8 articles.

2. Include Study

Based on Table 1 show that the primary studies included in the scoping review. A total of 8 articles were included. A total of 8 articles came from Ethiopia (n= 3), Indonesia (n= 3), Africa (n= 1) and Nigeria (n= 1).

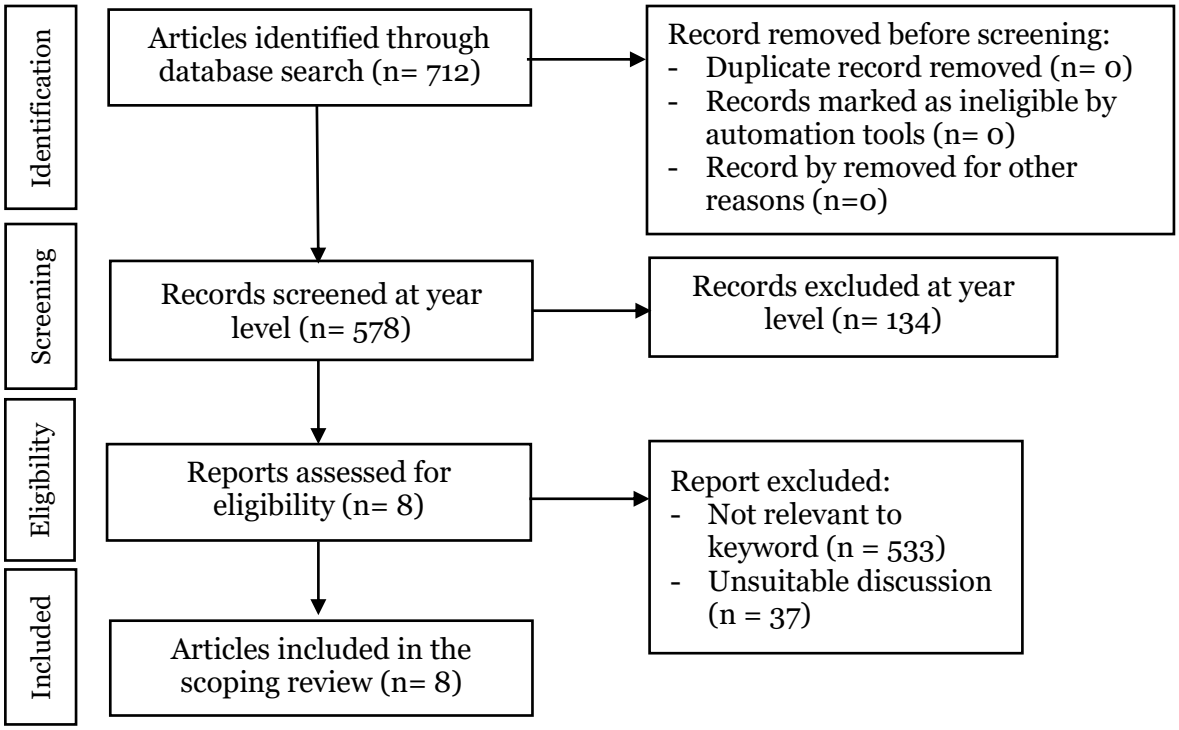

Figure 1. PRISMA Flow Diagram

Table 1. Review of research on stunting of child against incidence of ARI

Author (year)	Method and Location	Subject	Stunting	ARI	Result
Anteneh and Hassen (2020)	Multilevel analysis using Ethiopian Demographic and Health Survey (2016); Ethiopia	10,006 children under fivein Ethiopia	Stunting: 36.4% (AOR: 0.94; 95% CI: 0.81 to 1.09)	ARI: 8.8% (AOR: 1.90; 95% CI: 1.15 to 3.15 for households using animal dungfuel)	ARI prevalencewas higher among childrenaged 6–23 months (AOR:1.47; 95% CI: 1.14 to 1.74), thosewith low birth weight (AOR:1.39, 95% CI: 1.19–1.61), and thoseliving at higher altitudes (AOR: 2.24, 95% CI: 1.02 to 4.91).
Batiro et al. (2017)	Unmatched case-control study; Kindo Didaye Woreda, Wolaita Zone, Southern Ethiopia	465 children aged 6-59months (155 cases and 310 controls)	46.5% (AOR: 7.06; 95% CI= 4.40 to 20.42 for unsafe water consumption)	ARI: 26.5% (AOR: 3.04, 95% CI: 1.04 to 13.35)	Stunting was significantly associated withunsafe water consumption, ARI in the pasttwo weeks, late initiation ofbreastfeeding (AOR: 5.16; 95% CI: 2.24 to 15.90), lack of vaccination (AOR: 6.38, 95% CI: 2.54 to 17.10), and poor dietarypractices.
Anastasia et al. (2023)	Secondary data analysisusing the 2013 and 2018 Indonesian Basic Health Survey; South	10,206 children (2013), 10,862 children (2018) in South Sulawesi;2,436 children (2013), 2,663 children	South Sulawesi (2018): Stunting prevalence 31.2% (APR: 1.9; 95% CI: 1.3 to 2.7 for low maternal education). West	West Sulawesi (2018): 56.0% (APR: 1.6; 95% CI: 1.04–2.5 for ARI).	Determinants of stunting include maternal education, child's age (12 to 23 months) APR= 2.1; 95% CI: 1.4 to 3.0), LBW (APR: 1.5; 95% CI:1.2 to 1.9), and ARI. Children with ARI showed a

Author (year)	Method and Location	Subject	Stunting	ARI	Result
	andWest Sulawesi, Indonesia	(2018) in West Sulawesi	Sulawesi (2018): Stunting prevalence 37.7% (APR: 1.6; 95% CI: 1.04 to 2.5 for ARI).		higher prevalence of stunting, particularly in West Sulawesi (APR: 1.6; CI:1.04 to 2.5). Other factors included maternal weight, height, and BMI.
Geberetsadik et al. (2015)	Secondary data analysisfrom the2011 Ethiopia Demographic and Health Survey (EDHS); Ethiopia	11,645 children under fiveyears of age a and their mothers	Severely stunted children:7.43% prevalence; ARI notdirectly linked tostunting butto wasting(AOR: 1.7; 95% CI: 1.1 to 2.5 for severely wasted children)	ARI: 7% overall prevalence; AOR: 0.5; 95% CI: 0.3 to 0.8) for older children(48–59 months)	ARI was associated with wasting, low parental education, and maternal unemployment. Severe wasting increased ARI risk. Children of mothers inprofessional roles and fathers with higher education significantly reduced odds of ARI.
Kinyoki et al. (2017)	Bayesian hierarchical geostatistical shared component model; Somalia	73,778 children under fiveyears oldacross 1,066 clusters(2007 to 2010 FSNAU data)	ARI: 31% prevalence (shared residual component with ARI. OR: 1.03; 95% CI: 1.01 to 1.05).	17% prevalence (shared residual component with stunting: OR: 1.03, 95% CI: 1.01 to 1.05).	Stunting, ARI, and diarrhea show significant spatial overlap, particularly in South Central Somalia. ARI is moderately correlated withstunting (r=0.37). Shared risk factors include malnutrition, poor food security, and crowded living conditions. Hotspots of comorbidity were found in areas with high population displacement and inadequate health careaccess.
Orunmoluyiet al. (2022)	Bayesian spatial shared component model; Nigeria	61,579 children under five years oldacross three Nigerian DHS datasets(2008, 2013, 2018)	14.5% in pooled analysis (OR:0.89; 95% CI: 0.83 to 0.95 for children of educated mothers)	4.7% inpooled analysis (OR: 0.79, 95% CI = 0.73 to 0.85 for female children)	Stunting and ARI co-occurred in northeastern and southern regions of Nigeria. Major determinants include lowmaternal education, poorsocioeconomic status, andrural residency.Urban children were more likely to experience diarrhea. Spatial co-occurrence maps identifiedhotspots requiring targeted interventions.
Soekatri et al. (2020)	Cross-sectional study using SEANUTS data; Indonesia	2236 children aged 0.5–12 years	31.4% prevalence ofstunting (lower HAZ with increasing episodes of illness, OR:1.5, 95% CI: 1.1 to 2.0 forpoor SES)	49.7% prevalence of ARI inrural children, significantly higher than in urbanchildren (43.3%)	Stunting issignificantly associated with repeated illnesses (including ARI) and lower socioeconomic status. Parental education strongly influences stunting risk,with higher maternal and paternal education associated with better HAZ scores. Rural children reported higher ARI prevalence and more frequent illnesses, which contribute tostunting.
Ariniet al. (2020)	study; Surabaya, East	152 children under fiveyears	50% normal, 28.9% short, 21.1%	65.8% rarely experienced ARI,	Stunting issignificantly associated with the

Author (year)	Method and Location	Subject	Stunting	ARI	Result
	Java,Indonesia		veryshort (p= 0.005 fordiarrhea frequency; p = 0.003 for diarrhea duration)	25.7% often, 8.6%not long (p = 0.001 for ARI frequency; p= 0.001 for ARI duration)	frequency and duration of diarrhea and ARI. Children experiencing repeated diarrhea or ARI episodes were more likely to be stunted.

DISCUSSION

This study aimed to map the various factors associated with the incidence of Acute Respiratory Infections (ARIs) in stunted toddlers. The results of this scoping review highlight several key factors that influence the relationship between ARIs and stunting, which are consistent with previous research findings. The prevalence of ARIs in stunted children was found to be significantly higher, a relationship that has been supported by several studies. For example, Anteneh and Hassen (2020) found that stunting was associated with increased ARI prevalence, with children living in households using animal dung fuel exhibiting a higher risk (Anteneh and Hassen, 2020). Similarly, Batiro et al. (2017) identified unsafe water consumption, poor dietary practices, and lack of vaccination as key determinants influencing both ARI and stunting (Batiro et al., 2017).

Further, studies in South Sulawesi and West Sulawesi have demonstrated that factors such as low maternal education, ARI history, and low birth weight were significantly linked to higher rates of stunting (Anastasia et al., 2023). These findings align with the results of our scoping review, which highlighted maternal education and birth weight as key influencing factors. Additionally, Gebertsadik et al. (2015) found a significant relationship between stunting and wasting, with ARI being associated more strongly with wasting than stunting, though the relationship between ARIs and stunting was still evident (Geberetsadik et al., 2015). This suggests that stunting and ARIs may share common risk factors but may also exhibit different patterns of association in different populations.

Kinyoki et al. (2017) further emphasized the spatial overlap between stunting, ARIs, and diarrhea, particularly in regions with poor food security and overcrowded living conditions (Kinyoki et al., 2017). This finding underscores the importance of environmental factors such as living conditions and food security, which were also observed in our study as significant factors contributing to both ARIs and stunting. In addition, Orunmoluyi et al. (2022) highlighted that low maternal education and poor socioeconomic status were major determinants of both ARIs and stunting in Nigeria, particularly in rural areas (Orunmoluyi et al., 2022). Similarly, Soekatri et al. (2020) observed that repeated episodes of illness, including ARI, were significantly associated with stunting, particularly in rural children who were also at higher risk due to lower socioeconomic status (Soekatri et al., 2020).

The findings from Diyah Arini et al. (2020) also align with this study, demonstrating that repeated episodes of ARI and diarrhea were significantly associated with stunting, reinforcing the idea that frequent illness can disrupt growth in toddlers (Diyah Arini et al., 2020). These studies collectively emphasize the importance of addressing both the environmental and biological factors influencing ARIs and stunting, which can interact in complex ways to affect child health.

One limitation of this study is the reliance on studies that were available in the

public domain, which may have led to the exclusion of relevant articles not freely accessible. Additionally, while this review synthesizes a broad range of studies, it is important to note that the findings are based on data from diverse geographical regions, and the factors influencing ARIs and stunting may vary depending on local contexts and healthcare systems.

In conclusion, this scoping review provides valuable insights into the factors associated with ARIs in stunted toddlers, with maternal education, nutrition, socioeconomic status, and environmental conditions playing key roles. These findings suggest that a multidisciplinary approach, addressing both healthcare access and preventive measures such as improved nutrition and sanitation, is crucial in reducing the prevalence of ARIs and stunting in vulnerable populations. Policymakers should consider integrating these factors into national health strategies to better address the complex interplay between ARIs and stunting.

AUTHOR CONTRIBUTION

Akbar Kholish Fadhila served as the main researcher, responsible for designing the study, analyzing the data, and preparing the discussion of this research. Mohammad Zen Rahfiludin and Suyatno provided suggestions regarding data sourcing and data processing in this research.

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CONFLICT OF INTEREST

The author states that there is no conflict of interest in the writing of this article.

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