BREASTFEEDING AND ACUTE RESPIRATORY INFECTION (ARI) IN INFANTS: A SYSTEMATIC REVIEW IN NIGERIA

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ABSTRACT

Background: **Acute Respiratory Infections (ARIs) significantly contribute to infant morbidity and mortality worldwide, especially in developing countries like Nigeria, where factors such as inadequate nutrition, poor environmental conditions, and partial immunization increase their incidence, while exclusive breastfeeding (EBF) offers immune protection that can reduce their incidence and severity. Therefore this review assessed the role of breastfeeding, especially exclusive breastfeeding, in reducing the risk and severity of ARIs in Nigerian infants, while also evaluating factors influencing breastfeeding practices.**

Methods: **A systematic review was conducted following PRISMA guidelines, involving a comprehensive search of databases such as PubMed, Scopus, ScienceDirect, Google Scholar, and African Journals Online. Twelve studies conducted between 2004 and 2024 focusing on breastfeeding practices and their impact on ARIs in Nigerian infants aged 0-6 months were selected. The review focused on primary studies with observational and cohort designs.**

Results: **The review found that exclusive breastfeeding significantly reduces the risk of ARIs in infants, with non-exclusively breastfed infants facing a fourfold increase in ARI risk. Breast milk contains immunologically active components like secretory IgA, lactoferrin, and lysozyme, which enhance immune defenses and reduce the severity of ARIs such as pneumonia. However, only 25-40% of infants in Nigeria are exclusively breastfed for six months due to cultural beliefs, maternal employment, lack of education etc.**

Conclusion: **Exclusive breastfeeding significantly protects Nigerian infants against ARIs, but cultural misconceptions, socioeconomic barriers, insufficient maternal education etc hinder optimal practices, necessitating targeted public health initiatives and policy interventions to improve infant health outcomes.**

Keywords: Exclusive breastfeeding, Acute respiratory infections, Infant health, Breastfeeding practices, Public health strategies

BACKGROUND

Infectious diseases have constituted a great menace to public health.[1] Some of these infectious diseases such as respiratory tract infections (RTIs) are a leading cause of morbidity and hospitalization in infants, children and adults.[2,3] The RTIs encompass a range of infections including Acute Respiratory Infections (ARIs), which can be caused by either viruses, fungi or bacteria. The ARIs can affect the upper respiratory tract infections (URTIs), lower respiratory tract infections (LRTIs) or both respiratory tracts.[4] The URTIs encompass conditions like laryngitis, the common cold, pharyngitis, acute rhinitis, tonsillitis, acute rhinosinus-itis, and otitis media,[5] while the LRTIs include acute bronchiolitis, bronchitis, tracheitis, and pneumonia.[6,7] The ARI is characterized by varying symptoms depending on whether the upper or lower respiratory tract is affected, and can include conges-tion in the nasal sinuses or lungs, a runny nose, coughing, sore throat, body aches, and fatigue.[2] Globally, ARIs are responsible for about 12 million morbidities and 1.3 million fatalities

in infants and under-five years of age children,[8] with three-fourths occurring in Sub-Saharan Africa (SSA).[9,10] The likelihood of children under five in West Africa experiencing a higher ARI symptoms compared to those in East Africa, is notably high.[11] In Nigeria, the prevalence of ARI symptoms among children under five has shown some variation over the years. As of 2018, about 2.6% of children in Nigeria had symptoms of ARI in the two weeks preceding the survey.[2] The prevalence is higher in the North East region, with 8.2% of children affected, while the South West region has the lowest prevalence.[11] The underlying factors contributing to the high incidence of ARIs in children include unfavourable environmental conditions (such as poor ventilation and exposure to cigarette smoke), partial immunizations, low birth weight, low parental education, underdeveloped immune system, and inadequate nutrition (non-exclusive breastfeeding).[12]

Breastfeeding is perhaps the oldest practice in human history, healthiest, simplest and least expensive means of meeting the nutritional needs of newborns and infants. Breast milk contains arrays of essential nutrients including carbohydrates, essential fats, proteins, minerals, and immunological factors etc, required for the optimal growth and development of infants; hence, making it the ideal meal for them.[13] In addition to the nutrients, it also has a great array of 'bioactive factors' which strengthens their immune systems thereby protecting them against the risk and impact of neonatal infections.[14] For instance, infants that are not breastfed are at a higher risk of hospitalization in their early life in relation to a wide range of common infections including digestive and respiratory tract infections. Based on this, breastfeeding had been recognized by World Health Organization (WHO) and UNICEF for its essential role in infants, hence recommending exclusive breastfeeding for the first six months of life.[15] Infants who are not exclusively breastfed have a 4.96-fold higher incidence of ARI compared to those who are exclusively breastfed.[16]

According to the World Health Organization (WHO), exclusive breastfeeding (EBF) means that an infant receives only breast milk, without any additional food or drink, not even water, for the first six months of life to ensure optimal growth, development, and health.[17] EBF has proven that poor breastfeeding, mostly non-exclusive breastfeeding in the first six months of life, is estimated to have led to 1.4 million mortality and 10% of diseases among under-fives including ARI prevalence.[18] This review aims to summarize the role of breastfeeding and the composition of breast milk in reducing the risk and severity of ARIs in infants in Nigeria, while also examining factors that influence breastfeeding practices in the country. This review will enhance understanding of breastfeeding trends on ARIs in Nigeria.

MATERIALS AND METHODS

Study Design

This study used a systematic review to gather and summarize research on the factors influencing breastfeeding practices among nursing mothers and how these affect infants aged 0–6 months in Nigeria. The decision to focus on infants within this age range stems from the critical role of exclusive breastfeeding (EBF) during the first six months of life. This period is recommended by the World Health Organization (WHO) as essential for optimal growth, development, and health, particularly in preventing infections such as acute respiratory infections (ARI). By limiting the review to this age group, the study targets the most vulnerable phase of infancy, where breastfeeding has the most significant influence on health outcomes. A systematic review was chosen because it allows for a thorough and organized examination of existing studies. The study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which provide a clear and standardized process to select and analyze relevant studies, ensuring accuracy and reducing bias.[19] Twelve articles were carefully selected to focus on the breastfeeding practices of mothers and their impact on infants, particularly regarding acute respiratory infections (ARI) in Nigeria.

The screening and selection of studies were conducted independently by two reviewers. Any discrepancies during the selection process were resolved through discussion, and a third reviewer was consulted when necessary to ensure objectivity. This multi-reviewer approach added rigor to the methodology and improved the reliability of the selection process.

Literature Search

A detailed search for relevant studies was conducted using databases like PubMed, Scopus, ScienceDirect, Google Scholar, ResearchGate, and African Journals Online. These databases were chosen because they provide high-quality research and are easy to search. The search used terms such as "breastfeeding," "acute respiratory infections," "infant health," "exclusive breastfeeding," "nursing mothers," "infants," "0–6 months," and "Nigeria." The goal was to find up-to-date and high-quality studies that could help understand the factors affecting exclusive breastfeeding (EBF) and its impact on infants in Nigeria (Figure 1 shows the PRISMA diagram of the study selection process).

Data Extraction

Data extraction was carried out using a standardized data extraction form to ensure consistency. The form

collected key information from each study, including the study design, sample characteristics, geographic location, breastfeeding practices, and health outcomes (e.g., acute respiratory infections). Additionally, any factors influencing breastfeeding practices, such as socio-economic or cultural determinants, were recorded. This standardized approach ensured that relevant data were extracted systematically across all included studies.

Inclusion and Exclusion Criteria

The criteria for selecting studies were designed to ensure relevance and quality. The included studies met the following conditions: i) They were conducted in Nigeria, ensuring they apply to the local context; ii) They were published in reliable, peer-reviewed journals or academic databases to ensure credibility; iii) They were written in English to allow for clear understanding and analysis; iv) They were published between 2004 and the present to focus on recent developments; and v) They were primary studies with a cross-sectional design for consistency. The review included observational and cohort studies related to breastfeeding and ARIs in infants.

Studies were excluded if they did not meet these criteria, such as those conducted outside Nigeria, those unrelated to exclusive breastfeeding (EBF), gray literature (unpublished works), conference abstracts, commentaries, and review papers. Excluding secondary literature ensured that the analysis was based solely on primary research, improving the reliability and focus of the findings.

Quality Assessment and Risk of Bias

The methodological quality and risk of bias of the included studies were assessed using the Newcastle-Ottawa Scale, which is commonly used for evaluating cross-sectional and observational studies.[20] This tool assesses the selection of study participants, comparability of study groups, and the measurement of outcomes. Each study was evaluated, and any with a high risk of bias were flagged and noted during the interpretation of the results. This step was crucial to ensure that only studies with reliable data contributed to the overall findings, strengthening the validity of the conclusions drawn from this review.[20]

RESULTS

Description of reviewed papers and sample characteristics

In the initial phase of our screening process, a total of 33 articles were identified through database searches. After carefully reviewing these records, we removed 12 articles that were either duplicates or did not meet the relevance criteria, reducing the number of eligible

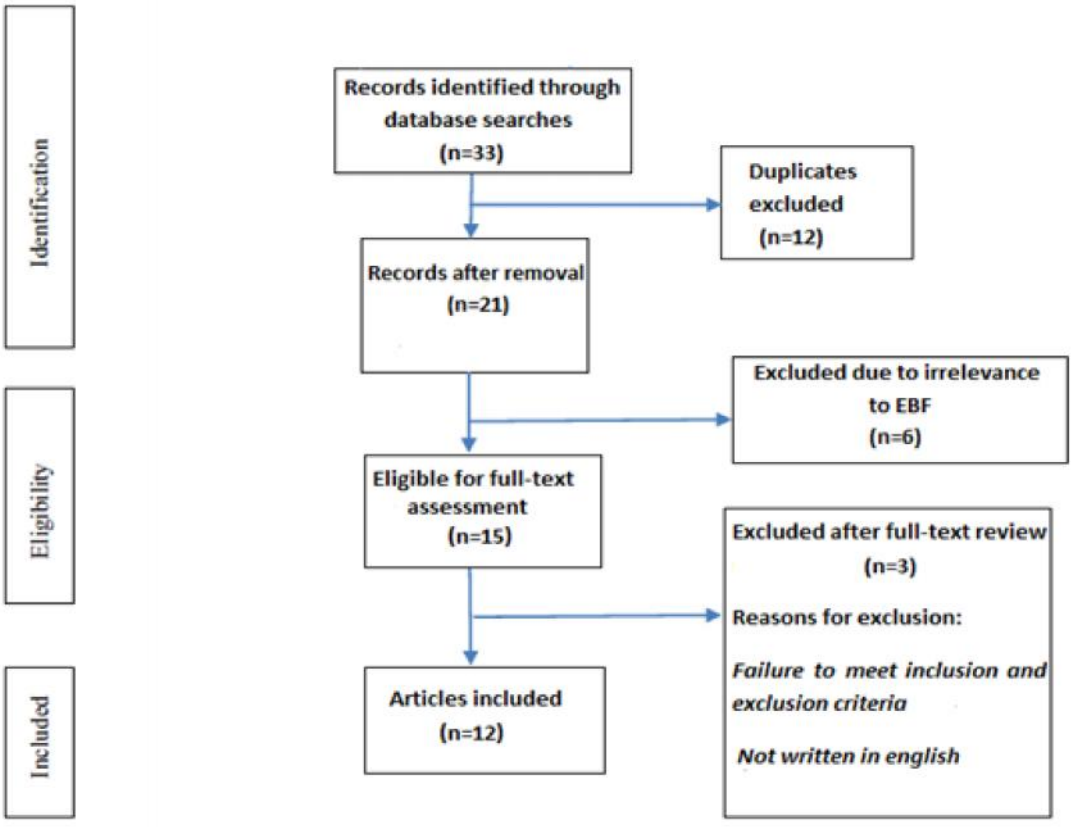

Figure 1: PRISMA flowchart

articles to 21. Next, we conducted a more detailed review of the remaining 21 articles. During this phase, 6 articles were excluded because their results were found to be irrelevant to the scope of our study upon closer examination. This left us with 15 articles for full-text screening. Following a thorough assessment based on our predefined inclusion and exclusion criteria, an additional 3 articles were excluded. The reasons for exclusion included lack of relevant data, inappropriate study design, or failure to meet other essential criteria. As a result, 12 articles were determined to meet all the necessary criteria and were included in the final review for analysis (as illustrated in Figure 1).

DISCUSSION

The findings of this review underscore the significant role that EBF plays in reducing the incidence and severity of ARIs in Nigerian infants. This protective effect is consistent with global evidence, which highlights the immunological benefits of breastfeeding in preventing respiratory illnesses such as pneumonia. However, a more nuanced analysis of the results in the context of existing literature reveals both strengths and areas requiring further exploration.

Influence of Breastfeeding on Acute Respiratory Infections (ARIs)

Breastfeeding, particularly exclusive breastfeeding (EBF), has been consistently documented to reduce the incidence of acute respiratory infections (ARIs) in infants. ARIs, including pneumonia, are a leading cause of infant morbidity and mortality worldwide, especially in Nigeria. In regions with higher breastfeeding rates, there is a lower prevalence of ARIs. For example, in Onitsha (South-East Nigeria), where the rate of breastfeeding initiation is high, the prevalence of ARIs is lower compared to Nasarawa State (North-Central Nigeria), where exclusive breastfeeding rates are significantly lower.[21] Despite these protective benefits, ARI prevalence remains a critical public health issue in Nigeria, with reports indicating high rates across various regions. In fact, several studies have reported varying ARI prevalence rates, such as 20.5% among infants [7], 27.1%,[22] and as high as 71% pneumonia prevalence in Ondo State, Nigeria.[23]

The composition of breast milk provides critical immunological protection for infants. Key bioactive components include secretory IgA, lactoferrin, and lysozyme, all of which have been shown to play a role in neutralizing pathogens and preventing bacterial and viral growth.[5] Secretory IgA prevents pathogens from attaching to mucosal surfaces, lactoferrin binds iron to inhibit bacterial growth, and lysozyme contributes to the destruction of bacterial cell walls. These components of breast milk provide a robust defense against infections, particularly ARIs.

Breast milk also contains macronutrients such as casein, á-lactalbumin, lactose, and essential fatty acids that contribute to both immune protection and the infant's growth.[24] It is rich in vitamins and minerals, including vitamins A, B1, B2, B6, B12, and D, although vitamin K levels remain low, often necessitating supplementation.[13,25] Additionally, studies have identified essential minerals like iron, copper, chromium, and zinc in breast milk, which are integral to an infant's health.[26,27]

The protective effect of breastfeeding, particularly EBF, against ARIs is well-supported by numerous studies. Findings from regions with higher rates of exclusive breastfeeding show a clear inverse relationship between breastfeeding and ARI prevalence. In line with these data, Gabriel-Job and Azubogu[28] reported that ARI cases were significantly lower among exclusively breastfed children. For instance, Igweonu-Nwakile *et al.*[29] found that pneumonia was more prevalent in 12.5% of exclusively breastfed children compared to 13.1% in those not exclusively breastfed. Similarly, Gabriel-Job and Azubogu[28] observed that pneumonia cases were more prevalent among children who were not exclusively breastfed (67.1%) compared to those who were exclusively breastfed (32.9%). Amai *et al.*[30] also found that inadequate breastfeeding was significantly associated with increased risk of ARIs, including pneumonia.

Compared to existing literature, the reported effects of breastfeeding on ARI prevention in Nigerian regions align with global findings, emphasizing the protective immunological mechanisms provided by breast milk. The studies of Kuti and Oyelami[31] and Ujunwa and Ezeonu[32] further corroborate these findings, reporting that non-exclusively breastfed children had higher rates of pneumonia with effusion. This contrasts with a lower percentage of pneumonia cases among exclusively breastfed children. The substantial role of breast milk's immunological components, such as secretory IgA and lactoferrin, in preventing respiratory infections supports similar findings across both local and international studies.[5,33]

While the presented studies emphasize the protective role of breastfeeding, disparities in ARI prevalence across Nigerian states, such as the 71% pneumonia prevalence in Ondo State,[23] underscore the ongoing public health challenge and the need for further promotion of exclusive breastfeeding practices. Additionally, Olujimi *et al.*[26] identified higher levels of critical elements like iron and zinc in breast milk from

mothers in Eastern Nigeria compared to other regions, suggesting possible regional variations in nutrient composition, which may influence ARI susceptibility. The findings align with the broader body of literature on breastfeeding and ARI prevention, confirming that exclusive breastfeeding is a key factor in reducing the incidence and severity of ARIs. Numerous studies, both within Nigeria and globally, document the protective effects of breastfeeding against ARIs. For example, Ujunwa and Ezeonu[32] and Johnson [34] both emphasized poor breastfeeding practices as a significant risk factor for ARIs. Similarly, studies by Osibogun *et al.*[35] and Agunbiade and Ogunloye[36] echo the conclusion that inadequate breastfeeding contributes to higher ARI rates. The consistency of these findings across different contexts strengthens the argument that promoting exclusive breastfeeding can lead to substantial public health benefits, particularly in reducing infant mortality from respiratory infections.

Exclusive Breastfeeding Practices in Nigeria

Exclusive breastfeeding (EBF) in Nigeria, defined as providing only breast milk for the first six months of an infant's life, remains challenging despite its well-established health benefits. National data indicate that only 25.2% of infants aged 0-5 months are exclusively breastfed, with rates varying across the country's regions, from as low as 10.3% in the Northwest to 39.8% in the Southwest.[37] Studies such as those by Ipinnimo *et al.*[38] and Akpan *et al.*[39] reported EBF rates near 40%, which is consistent with findings from certain regions of Nigeria. However, Obinna[40] reported that the country faces significant economic and health losses due to poor breastfeeding practices, amounting to over $21 billion in economic losses annually and contributing to 103,742 child deaths. Regional differences also emerge, with higher EBF rates reported in urban centers like Lagos compared to rural areas, according to Okoroiwu *et al.*[41]

Knowledge of EBF among Nigerian mothers is generally high. Akingbade *et al.*[42] found that most mothers are aware of the benefits of EBF, though this knowledge does not always result in sustained practice. Gabriel-Job & Azubogu[28] noted that while breastfeeding initiation is often high, the challenge lies in maintaining EBF for the full six-month period.

The reviewed articles reveal a troubling disparity between awareness of EBF benefits and its actual practice across Nigeria. While national and regional figures suggest some progress, such as in the Southwest where EBF rates are relatively higher, the overall rate of 25.2% remains far from ideal. The large economic and health losses outlined by Obinna[40] underscore the need for more effective interventions. The findings from Akingbade *et al.*[42] that high levels of awareness do not necessarily lead to better EBF practices suggest that cultural, socio-economic, or structural barriers may be preventing mothers from practicing EBF.

When compared to the global recommendations of the World Health Organization, Nigeria's EBF rates are significantly lower. The regional differences - such as the higher rates in urban centers like Lagos - suggest that infrastructure, access to healthcare, and education may play a role in influencing EBF practices. Okoroiwu *et al.*[41] highlighted that urban areas are more likely to have support systems that encourage breastfeeding, contrasting with the lower rates in rural regions where such support may be limited.

The data presented aligns with global and national findings on the benefits and challenges of EBF. The economic and health impacts reported by Obinna[40] are in line with other studies highlighting the cost of inadequate breastfeeding on public health and economic development. Similar studies, such as that by Akingbade *et al.*[42] point to the gap between knowledge and practice, a common issue in many developing countries where awareness campaigns do not always translate into behavior change.

The regional variation in EBF rates reported by NPC[37] and Okoroiwu *et al.*[41] reflects findings in other low- and middle-income countries, where rural areas typically lag behind urban centers in breastfeeding practices. These findings suggest that more targeted interventions are needed to address regional disparities and the socio-economic barriers that prevent sustained breastfeeding practices.

Factors Affecting Exclusive Breastfeeding in Nigeria

This review identified several factors influencing EBF in Nigeria, despite widespread awareness of its benefits. Socioeconomic status plays a significant role, with lower-income families experiencing challenges that hinder EBF due to economic constraints.[43] Employment status also has a considerable impact on EBF rates, particularly in urban areas where mothers face difficulties balancing work commitments with breastfeeding. Work resumption has been identified as a major reason for discontinuing EBF in these areas.[44]

Maternal education is a critical factor in EBF practices. Educated mothers are more likely to breastfeed exclusively,[38] but cultural beliefs and misconceptions - such as concerns over sagging breasts or negative perceptions about colostrum - discourage some mothers from breastfeeding (Jacdonmi *et al.*, 2016).[45]

Physical discomfort, including issues such as cracked nipples and breast engorgement, also contributes to the early cessation of breastfeeding.

Other common barriers include the practice of giving prelacteal feeds and introducing water before breastfeeding, which diminishes the likelihood of EBF.[42] Regional disparities also exist, with rural areas generally showing lower EBF rates compared to urban centers.[39] Additionally, perceived insufficiency of breast milk is a significant issue, as many mothers turn to supplementary feeding due to concerns about their milk supply.[38]

The findings highlight a complex set of factors influencing EBF practices, which go beyond simple awareness of its benefits. Socioeconomic status is a key determinant of EBF success, with both lower-income and higher-income mothers encountering different challenges. Lower-income families may struggle with economic constraints, forcing early cessation of breastfeeding due to a need for formula or complementary feeding.[43]

Employment is a significant barrier to sustained breastfeeding. As many urban mothers return to work shortly after childbirth, the challenges of maintaining EBF become more pronounced. This is consistent with findings by Balogun *et al.*,[44] which indicate that work-related obligations are a major reason for the early discontinuation of EBF.

While maternal education improves the likelihood of EBF,[38] cultural beliefs and misconceptions persist, complicating efforts to improve breastfeeding rates. Misunderstandings about the effects of breastfeeding on physical appearance and skepticism about colostrum negatively impact EBF practices.[46] Additionally, physical discomforts like cracked nipples and breast engorgement contribute to breastfeeding difficulties.

Regional disparities in EBF rates, particularly between rural and urban areas, further complicate efforts to improve breastfeeding practices. Rural regions typically have lower rates of EBF, as Akpan *et al.*[39] pointed out, possibly due to limited access to healthcare services and breastfeeding support. The perceived insufficiency of breast milk is another significant issue, with many mothers supplementing breastfeeding out of concern that their milk production is inadequate.[38]

The barriers to EBF identified in this review align with global and national studies on breastfeeding. The socioeconomic challenges highlighted by Adebayo *et al.*[43] is consistent with findings in other developing countries, where economic hardship often leads to early cessation of EBF. The impact of employment on breastfeeding practices, particularly among working mothers in urban areas, has also been well-documented globally. Balogun *et al.*[44] echo international findings that work commitments often force mothers to stop breastfeeding exclusively.

Cultural barriers and misconceptions about breastfeeding remain a common challenge in many regions, as documented by Jacdonmi *et al.* [46]. These beliefs—whether related to aesthetics, such as fears of breast sagging, or negative attitudes towards colostrum—are similar to those found in other parts of the world where cultural norms influence health behaviors. Physical discomfort, such as breast engorgement and cracked nipples, is also a frequent reason for early cessation of breastfeeding, as seen in other studies.

The practice of prelacteal feeding and early introduction of water, noted by Akingbade *et al.*[42], reflects traditional feeding practices that are prevalent in many parts of Africa and Asia. The regional disparities in breastfeeding practices, with rural areas showing lower EBF rates, also align with global trends. Rural populations often have less access to healthcare resources and breastfeeding education, leading to lower EBF adherence.

Finally, the issue of perceived insufficient milk supply is a well-known barrier to EBF, not only in Nigeria but globally. The findings by Ipinnimo *et al.* [38] that mothers often supplement breastfeeding due to concerns about milk production are consistent with research from other countries.

Knowledge, Practical Implications, and Need for Further Research

This review has provided information on the prevalence of acute respiratory infections (ARIs) and also explains how exclusive breastfeeding (EBF) reduces ARIs in Nigerian infants. It highlights the protective benefits of EBF and the factors that influence breastfeeding practices. By combining findings from various studies, it shows the strong link between EBF and lower ARI rates. The review also points out the need to address barriers to EBF, such as socioeconomic challenges, employment issues, and cultural beliefs. It emphasizes the importance of targeted interventions like educational programs, cultural awareness, and supportive policies to increase EBF rates and reduce ARI-related health problems. Additionally, the review identifies gaps in understanding regional differences in EBF practices across Nigeria and calls for more research to explore these variations,

enabling tailored interventions to improve public health strategies and breastfeeding initiatives.

Limitations

This review has several limitations that should be noted. Firstly, there were a limited number of studies on the relationship between Acute Respiratory Infections (ARIs) and breastfeeding in Nigeria. This scarcity of research could be attributed to a lack of focus on ARIs in national health studies, limited funding for respiratory health research, and the broader health challenges that divert attention from specific areas like ARIs. The lack of sufficient studies affects this review by reducing the available data to draw more comprehensive conclusions, and it limits the ability to identify broader patterns between breastfeeding and ARI outcomes across various regions of Nigeria. Secondly, the studies included in this review varied in design, sample size, and data collection methods, leading to study heterogeneity. This variation limited the possibility of conducting a meta-analysis, which would have provided more statistically robust conclusions. Thirdly, the review focuses exclusively on studies conducted in Nigeria. While a global comparison might offer useful context, it is not essential here as the primary objective is to explore breastfeeding within Nigeria's sociocultural and economic environment. Factors such as cultural beliefs, maternal education, healthcare infrastructure etc heavily influence breastfeeding practices and health outcomes, and comparing Nigerian data with global trends might obscure the unique challenges Nigerian mothers face. Additionally, the reviewed studies primarily examined infants aged 0-6 months, providing limited data on the long-term effects of breastfeeding on respiratory health. Future research should explore longitudinal outcomes to better understand the extended benefits of breastfeeding. Finally, only peer-reviewed articles were included, excluding insights from gray literature like policy reports and non-peer-reviewed sources. Including gray literature in future reviews may offer a broader perspective on breastfeeding practices in Nigeria.

CONCLUSION

In conclusion, exclusive breastfeeding (EBF) is essential in reducing acute respiratory infections (ARIs) in infants by providing critical immune protection based on breastmilks's components like secretory immunoglobulin A (IgA), lactoferrin, and trace elements. Despite its benefits, Nigeria struggles with low EBF rates due to certain factors like socioeconomic, cultural, employment-related barriers etc. Addressing these challenges through education, better support for working mothers, and cultural interventions is crucial to improving EBF rates and, in turn, reducing infant morbidity and mortality from ARIs.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

Not applicable

Competing interests

None

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Authors' contributions

A.G., S.B., E.E., E.N.E. were involved in the conceptualization, supervision, investigation, methodology, data curation, and writing original draft. All authors have read and approved the final manuscript.

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