Journal of African Population Studies (JAPS)

UAPS UEPA

Original Article

The effects of exclusive breastfeeding on child health in Chad: evidence from national representative survey data

Habib Tchoubou Foba [1]*, Folasade Adenike Bello [2] and Atinuke Olusola Adebanji [3,]

Citation: Foba, T.H.; Bello, F.A.; Adebanji, A.O. The effects of exclusive breastfeeding on child health in Chad: evidence from national representative survey data. *Journal of African Population Studies* **2024**, *37(1)*, 5288. https://doi.org/10.59147/dsw7mSZa

Academic Editor: Ngianga-Bakwin Kandala

Received: 9 October 2023
Accepted: 1 July 2024
Published: 31 July 2024

Publisher's Note: JAPS stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

[1] Pan African University Life and Earth Sciences Institute (Including Health and Agriculture), PAULESI, University of Ibadan, Ibadan, Oyo State 200284, Nigeria.
[2] College of Medicine, University of Ibadan, Queen Elizabeth II Road, Agodi 200285, Ibadan, Nigeria
[3] College of Science, Kwame Nkrumah University of Science and Technology (KNUST), P. O. Box UP 1279, KNUST, Kumasi, Ghana.
* Correspondence: habibfoba14@gmail.com

Abstract: Exclusive Breastfeeding (EBF) for the first six months of life is recommended by the World Health Organization (WHO) to ensure the health of the infant, but there is still debate surrounding the subject in many African countries, including Chad. Non-exclusive breastfeeding in the first six months of life is responsible for 1.4 million deaths and 10% of the burden of disease in children under 5. This study aims to examine how EBF practice affects children's health in Chad. The data for this study is from the 2019 Multiple Indicator Cluster Survey (MICS 2019) for Chad, which covered a sample of 2229 children under six months of age. Binary logistic regression was employed to predict the effect of exclusive breastfeeding practices on both infant morbidities and nutritional adverse outcomes. The results showed that EBF was significantly associated with a reduced occurrence of diarrhea and fever: children who were exclusively breastfed were 33% and 24% less likely to suffer from diarrhea and fever, respectively, compared to those who were not exclusively breastfed. However, there was no significant association between EBF and the incidence of Acute Respiratory Infection (ARI) or the child's nutritional status. This suggests that EBF may be protective against these two common illnesses in young children, but further research is needed to determine if there is a definitive link between EBF and ARI or a child's nutritional status in Chad.

Keywords: Exclusive Breastfeeding; Infant Morbidities; Adverse Nutrition; Chad

1. Introduction

Due to its numerous advantages for both mother and child, exclusive breastfeeding(EBF) has attracted more attention in the field of maternal and child health [1]. These benefits include the prevention of pediatric illnesses such as gastroenteritis, pneumonia, early childhood obesity, respiratory tract infections, fever, diarrhea, etc. [2, 3]. According to Brahm & Valdés [4], EBF also has a positive impact on neurodevelopment, raising IQ and reducing the risk of attention deficit disorder and other major developmental and behavioral issues. Non-exclusive breastfeeding during the first six months of life leads to 1.4 million deaths and accounts for 10% of the disease burden in children under five [5].

EBF, as defined by the World Health Organization (WHO), is when a baby only consumes breast milk with the exception of oral rehydration solution and drops or syrups of vitamins, minerals, or medications; no additional liquids or solids are provided, not even water [6]. In order to attain the best possible growth, development, and health, newborns should be exclusively breastfed during the first six months of life [6]. Thereafter, infants should continue breastfeeding for up to two years or longer while consuming complementary foods that are nutritionally adequate to suit their evolving dietary demands [6].
According to the WHO, 48% of newborns worldwide, aged 0 to 6 months, were exclusively breastfed in 2023 [7]. In Africa, the proportion of children under six months exclusively breastfed reached 45% during the 2015-2021 period,

approaching the World Health Assembly (WHA) target of 50% by 2025 [8].These rates vary by country, but they are typically low and fall short of the 50% worldwide target [9]. According to the sixth Multiple Indicator Cluster Survey (MICS) conducted in Chad in 2019, just 16.2% of children in Chad are breastfed exclusively; this equates to about 1 in 6 of the country's children [10].

In Chad, mothers are expected to feed their children a combination of breast milk and other foods, such as porridge or other liquids [11]. In fact, there is a widespread belief in Chad that breast milk is insufficient to nourish a baby and does not contain enough water to quench a baby's thirst [11]. This study aims to investigate the effect of exclusive breastfeeding (EBF) practices on child health and nutritional outcomes in the specific context of Chad. This research will thus contribute to informing policies and interventions aimed at improving the well-being and nutrition of infants in this country.

2. Materials and Methods

2.1. Study design, data source, and population

This study uses a retrospective cross-sectional design based on data from the Multiple Indicator Cluster Survey (MICS). The survey was conducted in 2019 in Chad by the National Institute of Statistics, Economic, and Demographic Studies (INSEED) as part of the MICS global program, with technical and financial assistance from the United Nations Children's Fund (UNICEF). The sample, based on a two-stage stratified area sampling, was determined in two steps. The primary sampling strata were the urban and rural areas within each province of Chad. In each stratum, a certain number of Enumeration Areas (EAs) were systematically selected with probability proportional to size. Once the household lists were established in the selected EAs, a systematic sample of 25 households was drawn in each EA. In total, 804 EAs and 20,100 households were selected for the survey.

Data were downloaded from the MICS-UNICEF website (https://mics.unicef.org/). In addition, all other documents and details relating to this survey are available there (https://mics.unicef.org/). The reason for using this dataset is that one of the main objectives of MICS is to collect data on child nutrition practices, including breastfeeding, and to assess the nutritional status of children under the age of 5. MICS data enabled the researchers to measure the impact of exclusive breastfeeding (EBF) on child morbidity (diarrhea, fever and acute respiratory infections) and adverse nutritional outcomes, depending on whether or not children have been exposed to this practice. In other words, these data allowed the researchers to compare the health of exclusively breastfed children with that of non-exclusively breastfed children. In this study, children have been considered the unit of analysis. Given that exclusive breastfeeding concerns the first six months of a child's life, this study focuses on children aged 0 to 5 months at the time of the survey. The sample includes 2229 children under 6 months old, each coming from a different mother among the total of 2229 mothers.

2.2. Outcome and exposure variables

The primary outcome groups measured in this study are infant morbidities, including diarrhea, acute respiratory infection (ARI), and fever, as well as nutritional adverse outcomes (secondary outcomes) such as being underweight, stunting, and wasting.

The determination of infant morbidities was based on responses obtained from the children's mothers during the MICS survey. The following questions were asked to ascertain the presence indicating (Yes) or absence indicating (No) of diarrhea, acute respiratory infection (ARI), and fever in the infants: (a) Has (name) had diarrhea in the past two weeks? (b) At any time during the past two weeks, has (name) been sick with a fever? (c) At any time in the past two weeks, has (name) had an illness with a cough? (d) At any time during the past two weeks, has (name) had rapid, heavy breathing or difficulty breathing? (e) Was the rapid breathing due to a bronchial problem, a nasal bronchial problem, or a blocked or runny nose?

The assessment of nutritional adverse outcomes was based on three indices: weight for height z-score (WHZ), weight for age z-score (WAZ), and height for age z-score (HAZ), which were measured during the MICS. A child was classified as stunted if their HAZ score was below -2.0 standard deviations from the WHO child growth standards. Wasting was defined as a WHZ score below -2.0 standard deviations from WHO child growth norms. Similarly, a child was considered underweight if his/her WAZ score was less than 2.0 standard deviations from the WHO child growth standards.

The exposure variable of interest in this study is exclusive breastfeeding practice. This was assessed using responses to the following questions asked during the MICS survey: "Is (child's name) still being breastfed?" and "During the previous day or night, did (child's name) consume any food or drink other than breast milk?[1]". Other explanatory variables related to mother and child characteristics, such as mother's age, level of education, parity achieved, marital status, place of residence, socio-economic status, child's age, and sex.

2.3. Data analysis

The statistical analyses performed in this study focused on examining predictors of EBF on two sets of outcomes: infant morbidities (including diarrhea, fever, and acute respiratory infections) and nutritional status (underweight, stunting, and wasting). Each outcome was analyzed separately using unadjusted and adjusted multivariate logistic regression models to understand the effects of EBF on children's health. The significance level was set at a 95% confidence interval for this study. In each model, exclusive breastfeeding was considered the primary explanatory variable. Statistical analysis was performed using Stata software version 17.0.

In addition to EBF, the adjusted logistic regression model included several other explanatory variables related to the characteristics of the mother and child, such as the mother's age, level of education, parity achieved, marital status, place of residence, socio-economic status, and the child's sex. These factors are biologically and socially relevant to child health and can directly or indirectly affect breastfeeding practices and overall child health outcomes. These variables were included in the model to evaluate the strength of the EBF prediction on outcome variables after adjusting for maternal and child factors.

The variables used for mapping are the 22 provinces of Chad, as delineated in 2022, and the prevalences of EBF measured in each of these provinces as part of the MICS [10]. These regions are as follows: Batha, Borkou and Tibesti, Chari Baguirmi, Guera, Hadjer Lamis, Kanem, Lac, Logone Occidental, Logone Oriental, Mandoul, Mayo Kebbi Est, Mayo Kebbi Ouest, Moyen Chari, Ouaddai, Salamat, Tandjile, Wadi Fira, N'Djamena, Barh El Gazal, Ennedi Ouest, Sila, and Ennedi Est. The mapping was carried out by Datawrapper.

3. Results

3.1. Sociodemographic characteristics and Exclusive Breastfeeding practice

This study included a total of 2229 children under 6 months of age, half of whom were female (50.2%). The average age of these children was 2.6 months. The mothers had an average of four children, and the average age at delivery was 27 years. Most of them live in rural areas (84%). The socio-economic status of mothers is diverse but tends to be concentrated in the lower economic categories. Nearly half of the mothers (46.5%) live in households considered poor. About one in five mothers belong to the middle class (20.5%), while one in three (33%) are considered to belong to wealthy households. This high percentage of poor households highlights the potential economic difficulties faced by the mothers of the children in this study. Approximately 8 out of 10 mothers (89%) have primary school attendance or less, with only 10.8% having reached secondary school or higher levels of education. Most of the mothers are married (98%), with a small fraction (2%) being single.

As for EBF practices, only 17% (373/1856) of mothers breastfeed their children exclusively (**Figure 1**). The mapping of EBF in Chad reveals notable disparities in breastfeeding rates across the country's various provinces (**Figure 2**). The northern region stands out with particularly high rates, generally ranging between 20% and 28%. Conversely, the southern and central provinces display more moderate rates, ranging between 5% and 20%. The provinces of Hadjer-Lamis and Logone Occidental record the lowest rates, with less than 5% of children exclusively breastfed in these provinces.

[1] The child may receive oral rehydration salts, drops, and syrups (vitamins, minerals, and medicines)

Figure 1: EBF rates during the first six months of life in Chad, 2019

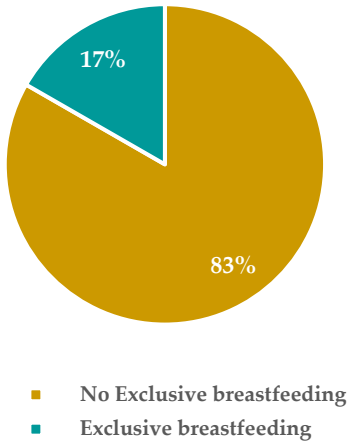

Figure 2: EBF rate by province, Tchad, 2019

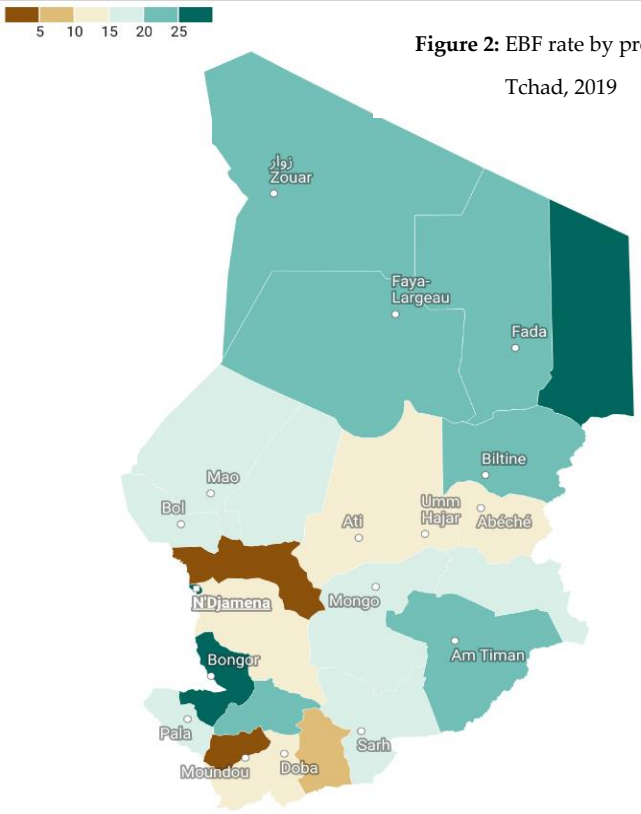

Table 1. Sociodemographic characteristics of the mother and child

Variables	Frequency (%) or Mean (SD)
Age of the Child (month)	2.60 (1.69)
Sex of the child	
Male	1111 (49.8%)
Female	1118 (50.2%)
Age at delivery	27.49 (6.79)
Parity	3.93 (2.26)
Highest level of mother's education	
Primary school	1989 (89.2%)
Secondary School and above	240 (10.8%)
Location of household	
Urban	353 (15.8%)
Rural	1876 (84.2%)
Socio-economics status	
Poor	1036 (46.5%)
Average	457 (20.5%)
Rich	736 (33.0%)
Marital Status	
Married	2167 (97.6%)
Single	52 (2.3%)

3.2. Morbidity and nutritional status of children

Approximately 2 out of 5 children (41%) developed at least one of the following morbidities: diarrhea, fever, or ARI during the two weeks preceding the survey. Fever had the highest prevalence (29%). The proportions of those who suffered from diarrhea and ARI are 27% and 4%, respectively.

Analysis of the nutritional adverse outcome measured by the Z-score reveals that about 3 out of 10 children (32%) have at least one nutritional problem that can cause stunting, being underweight, or wasting.

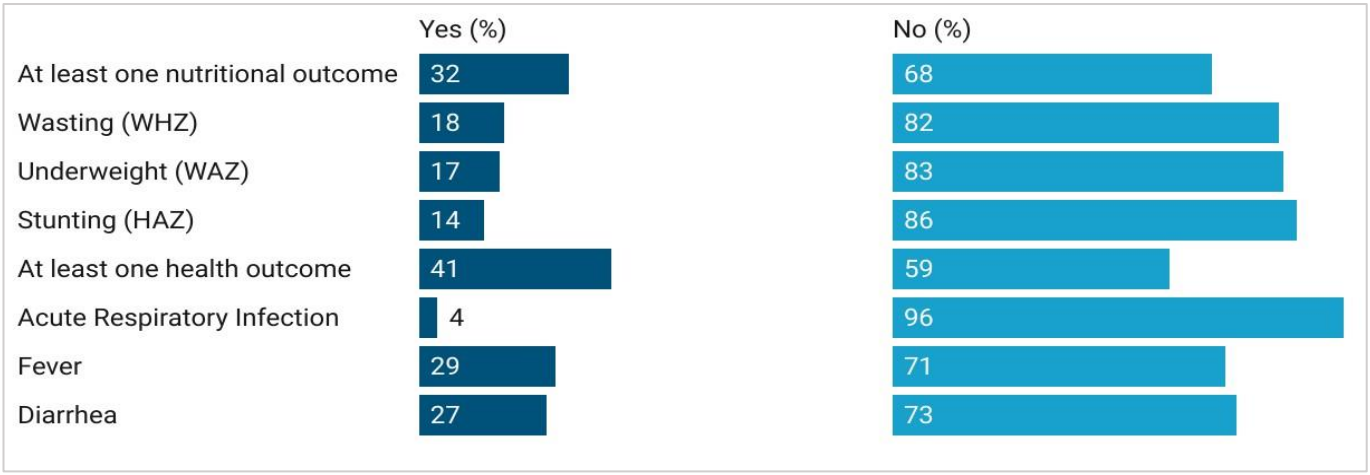

Figure 3: Morbidity and nutritional status of children

3.3. Effects of exclusive breastfeeding on the morbidity and nutritional status of the child

Table 2 presents the analysis of EBF practices and their association with different health outcomes in children, including diarrhea, fever, ARI, and the presence of at least one morbidity. The result of the analyses shows that EBF is significantly associated with a decreased risk of diarrhea and fever. In fact, exclusively breastfed children are 33% (AOR=0.67; 95% CI [0.51-0.88]) and 24% (AOR=0.76; 95% CI [0.58-0.98]) less likely to have diarrhea and fever, respectively, than those who are not exclusively breastfed. However, the analyses show that there is no significant association between the practice of breastfeeding and the occurrence of ARI (AOR=1.14; 95% CI [0.64-2.04]).

EBF has a protective effect, reducing the likelihood of a child developing at least one illness (diarrhea, fever or ARI) by 28% (AOR=0.72; 95% CI [0.56-0.91]). In other words, children who are exclusively breastfed are significantly less likely to experience health issues compared to those who are not.

Table 3 presents the analysis of EBF practices and their association with different adverse nutritional outcomes in children, including stunting, underweight, wasting, and the presence of at least one nutritional status. The results show that there is no statistically significant association between EBF and adverse nutritional outcomes at the 5% level of significance: EBF does not have a significant influence on stunting (AOR=1.07; 95% CI [0.75; 1.52]), underweight (AOR=0.74; 95% [0.521-1.07]) and wasting (AOR=1.21; 95% [0.89-1.66]) in infants.

Table 2. Logistic regression models predicting for a child less than 6 months of age the probability of having morbidity related to diarrhea, fever, or acute respiratory infection

EBF Practice	Outcomes							
	Diarrhea		Fever		ARI		At least one Morbidity	
	cOR [CI: 95%]	aOR [CI : 95%]	cOR [CI : 95%]	aOR [CI : 95%]	cOR [CI : 95%]	aOR [CI : 95%]	cOR [CI : 95%]	aOR [CI : 95%]
No EBF	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
EBF	0.67 [0.51-0.8]	0.67 [0.51-0.88]	0.71 [0.54-0.92]	0.75 [0.58-0.98]	10.15 [0.65-20.04]	10.14 [0.64-20.04]	0.70 [0.55-0.89]	0.72 [0.56-0.91]
P-Value	0.004	0.005	0.011	0.041	0.626	0.651	0.004	0.008

Source: Author's own analysis based on data from the sixth Multiple Indicator Cluster Survey (MICS6) conducted

Table 3. Logistic regression models predicting nutritional status of children under 6 months of age

EBF Practice	Outcomes							
	Stunting		Underweight		Wasting		At least one nutritional status	
	cOR [CI : 95%]	aOR [CI : 95%]	cOR [CI : 95%]	Model 2 : aOR [CI : 95%]	cOR [CI : 95%]	aOR [CI: 95%]	cOR [CI : 95%]	aOR [CI : 95%]
No EBF	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
EBF	1.13 [0.80-1.60]	1.07 [0.75-1.52]	0.77 [0.54-1.10]	0.74 [0.52-1.07]	1.22 [0.90-1.65]	1.21 [0.89-1.66]	1.06 [0.82 1.36]	1.04 [0.81-1.35]
P	0.46	0.702	0.162	0.116	0.199	0.208	0.618	0.709

Source: Author's own analysis based on data from the sixth Multiple Indicator Cluster Survey (MICS6) conducted

cOR: crude odd ratio
aOR: adjusted odd ratio
Ref: Reference
P: P-Value

4. Discussion

The aim of this study is to evaluate the influence of EBF on the incidence of morbidity linked to fever, diarrhea, and acute respiratory infections (ARI), alongside its effects on the nutritional status of infants. This research operates under the hypothesis that EBF correlates with decreased vulnerability to illnesses and improved nutritional outcomes in infants.

The findings of this study show that EBF confers a positive effect on infant health. Specifically, EBF for the initial 6 months of life has been shown to lower the incidence of morbidity associated with diarrhea and fever (**Table 2**). Indeed, it has been observed that exclusively breastfed infants have a 33% lower likelihood of experiencing diarrhea (p=0.005), and a 25% lower likelihood of developing fever (p=0.041), compared to infants who are not exclusively breastfed. Numerous studies have demonstrated the effectiveness of exclusive breastfeeding in reducing diarrhea in infants [12–14]. Moreover, breast milk is a complex mixture of various components, such as proteins, vitamins, nucleotides, oligosaccharides, immunoglobulins, and minerals, including immune factors like colostrum, which is abundant in immunological components, such as secretory IgA, lactoferrin, and leukocytes [15]. These components can provide diverse protection against a range of pathogens.

The greater occurrence of diarrhea and fever observed in infants who are not exclusively breastfed can be attributed to the various health risks associated with non-exclusive breastfeeding practices. The increased risk is mainly due to the potential for contamination from environmental contaminants and unhygienic preparation methods, such as the use of non-potable water or the inadvertent inclusion of microorganisms in the preparation of infant food. This risk is particularly relevant in African contexts, where approximately one-third of the population lacks access to safe drinking water [16]. Such factors are likely to increase the incidence of morbidity like diarrhea or fever in infants [17]. Additionally, non-exclusive breastfeeding practices can result in digestive problems for the infant, as the food provided may be inadequately mixed or administered in incorrect amounts.

The results of the present study did not find a statistically significant correlation between exclusive breastfeeding and the incidence of ARI in infants (**Table 2**). The research indicated a P-value (p)= 0.651 suggesting no substantial protective effect of EBF against ARI. However, previous studies have demonstrated that exclusive breastfeeding is associated with a lower risk of ARI [18, 19], which contrasts with the findings of this current study. While EBF confers various benefits to a child's immune system [20], it may not necessarily guarantee immunity to all infections. Furthermore, multiple social and environmental factors, including indoor air pollution, parental smoking, inadequate ventilation, overcrowding, industrialization, etc., can significantly impact the likelihood of developing ARI in children [21]. However, since these variables were not included in our database, they could not be taken into account when explaining the morbidity associated with ARI. Future research should aim to explore these variables to better understand the relationship between EBF and ARI.

The study findings indicate a lack of significant association between EBF and nutritional outcomes: wasting (p=0.208), stunting (p=0.702), and underweight (p=0.116) (**Table 3**). These results are consistent with previous research conducted in developing countries [22, 23]. The unexpected lack of correlation between EBF and adverse nutrition can be attributed to several factors, such as infantile diseases, which could play a significant role in the occurrence of malnutrition. Common illnesses, including respiratory infections, diarrhea, and intestinal infections, can adversely affect an infant's appetite, feeding abilities, and nutrient absorption, leading to adverse nutritional outcomes [24, 25].

5. Conclusion

This research aimed to investigate the effects of exclusive breastfeeding (EBF) on child health in Chad. The analysis focused on the relationship between exclusive breastfeeding (EBF) and morbidity, and nutritional outcomes. The EBF was used as the main explanatory variable, and morbidity and nutritional outcomes were used as the dependent variables. The analysis was conducted to determine whether EBF influenced child health. The results show that EBF is associated with a decreased risk of diarrhea and fever. However, the results of these studies have not proven the significant link at the 5% level between EBF and ARIs on the one hand and EBF and nutritional outcome on the other hand.

The results of the study demonstrate that exclusive breastfeeding plays a crucial role in promoting child health in Chad. Therefore, infants who were exclusively breastfed exhibited better health outcomes compared to those who did not

receive exclusive breastfeeding. These positive effects were observed in terms of a reduced incidence of diarrheal diseases and fever. To effectively promote child health in Chad, it is important to enhance education and support systems pertaining to exclusive breastfeeding, enhance maternity leave policies, establish conducive breastfeeding-friendly environments, and facilitate further scientific research on the topic of exclusive breastfeeding in the context of Chad.

The MICS database has certain limitations regarding the inclusion of additional variables that could enhance the explanation of our results. In our study, these missing variables were not included in analyzing morbidity associated with ARI and nutritional outcomes. Potentially relevant variables could include environmental factors such as indoor and outdoor air quality, overall sanitation conditions, and individual factors such as family history of respiratory illnesses and seasonal variations. In addition to the missing variables that could evaluate ARI-related morbidity, it is essential to consider factors influencing infant nutritional status, such as access to nutritional supplements. Future research should aim to explore these variables to better understand the relationship between breastfeeding and child health.

Author Contributions: Conceptualization, H.T.F.: methodology, H.T.F, F.A.B. and A.O.A.; formal analysis, H.T.F; writing—original draft preparation, H.T.F.; writing—review and editing, H.T.F., F.A.B. and A.O.A.; supervision, F.A.B. and A.O.A.

Funding: This research received no external funding

Acknowledgments: We would like to express our gratitude to the Pan African University Life and Earth Sciences Institute (Including Health and Agriculture), University of Ibadan, Nigeria, and the Union for African Population Studies (UAPS) through the African Research-Data (AfRes-Data) training support program.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Victora CG, Bahl R, Barros AJD, França GVA, Horton S, Krasevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet Lond Engl. 2016;387:475–90.
2. Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. Pediatrics. 1997;99:E5.
3. World Health Organization. Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services. World Health Organization; 2017.
4. Brahm P, Valdés V. [The benefits of breastfeeding and associated risks of replacement with baby formulas]. Rev Chil Pediatr. 2017;88:7–14.
5. World Health Organization. Infant and young child feeding : model chapter for textbooks for medical students and allied health professionals. 2009;99.
6. World Health Organization. Essential nutrition actions: improving maternal, newborn, infant and young child health and nutrition. Geneva: World Health Organization; 2013.
7. World Health Organization UNICEF. GLOBAL BREASTFEEDING SCORECARD 2023. 2023.
8. World Health Organization. Let's protect breastfeeding through further investment and conducive policies. 2023.
9. World Health Organization. Global nutrition targets 2025: breastfeeding policy brief. World Health Organization; 2014.
10. INSEED, UNICEF. MICS6-Tchad, 2019, Rapport final. N'Djamena, Tchad; 2020.
11. UNICEF. A village with not one malnourished child | UNICEF Chad. UNICEF Tchad. 2020. https://www.unicef.org/chad/stories/village-not-one-malnourished-child. Accessed 8 May 2023.
12. Ellis D. Promotion of breast-feeding. Can Med Assoc J. 1984;130:340–1.
13. UNICEF, OMS. SAISIR LE MOMENT La mise au sein précoce : le meilleur départ dans la vie pour chaque nouveau-né. New York: UNICEF; 2018.
14. Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. Pediatrics. 1997;99:E5.
15. Aly E, Darwish AA, Lopez-Nicolas R, Frontela-Saseta C, Ros-Berruezo G. Bioactive components of human milk: similarities and differences between human milk and infant formula. Sel Top Breastfeed. 2018;11.
16. WHO. 1 in 3 people globally do not have access to safe drinking water – UNICEF, WHO. 2019. https://www.who.int/news/item/18-06-2019-1-in-3-people-globally-do-not-have-access-to-safe-drinking-water-unicef-who. Accessed 8 May 2023.
17. Dunne EF, Angoran-Bénié H, Kamelan-Tano A, Sibailly TS, Monga BB, Kouadio L, et al. Is drinking water in Abidjan, Côte d'Ivoire, safe for infant formula? J Acquir Immune Defic Syndr 1999. 2001;28:393–8.
18. Cushing AH, Samet JM, Lambert WE, Skipper BJ, Hunt WC, Young SA, et al. Breastfeeding Reduces Risk of Respiratory Illness in Infants. Am J Epidemiol. 1998;147:863–70.
19. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. Pediatrics. 2001;108:E67.

20. Molès J-P, Tuaillon E, Kankasa C, Bedin A-S, Nagot N, Marchant A, et al. Breastmilk cell trafficking induces microchimerism-mediated immune system maturation in the infant. Pediatr Allergy Immunol. 2018;29:133–43.
21. Kapil Kumar Goel, Sartaj Ahmad, Gagan Agarwal, Parul Goel, and Vijay Kumar. A Cross Sectional Study on Prevalence of Acute Respiratory Infections (ARI) in Under-Five Children of Meerut District, India. J Community Med Health Educ. 2012;2012.
22. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, Onis M de, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013. https://doi.org/10.1016/s0140-6736(13)60937-x.
23. Khaliq A, Wraith D, Miller Y, Nambiar S. Association of Infant Feeding Indicators and Infant Feeding Practices with Coexisting Forms of Malnutrition in Children under Six Months of Age. Nutrients. 2022;14:4242.
24. Rodríguez L, Cervantes E, Ortiz R. Malnutrition and Gastrointestinal and Respiratory Infections in Children: A Public Health Problem. Int J Environ Res Public Health. 2011;8:1174–205.
25. Katona P, Katona-Apte J. The Interaction between Nutrition and Infection. Clin Infect Dis. 2008;46:1582–8.