

Infant Feeding Practices and Their Association with Stunting, Overweight, Obesity, and Other Cardiometabolic Risks in African Children: A Systematic Review

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Abstract

Introduction: Feeding patterns among infants, particularly in Africa, play a central role in shaping child growth and long-term health outcomes such as stunting, overweight, and obesity in early childhood.

Objectives: This systematic review assessed infant feeding practices and their association with stunting, overweight, obesity, and cardiometabolic risk in children in Africa.

Methods: PubMed, Springer Link, Web of Science, Google Scholar, and Science Direct databases were searched for articles published between 2004 and 2024. Infant feeding indicators (exclusive breastfeeding, complementary feeding, and dietary variety) and outcomes of the children (stunting, overweight, obesity, blood pressure, and lipid profiles) were retrieved.

Results: The review identified 12 studies (7 cohort, 5 cross-sectional) involving approximately 15,620 participants. Cardiometabolic risk markers such as hypertension were identified in 2 studies, with the prevalence ranging from 9.1% to 32.7%. Obesity was reported in 5 studies, with prevalence ranging from 4.0% to 21.0%. Six studies identified stunting and overweight, with their prevalence ranging from 9.3% to 42% and 9.1% to 30.0%, respectively. Diabetes was reported in just 1 of the studies in South Africa and was observed more in males (2.6%) than females (1.9%).

Conclusion: Stunting and early cardiometabolic risk are common in Africa and are associated with suboptimal infant feeding patterns. Inappropriate complementary feeding and early weaning of breastfeeding are linked to stunting as well as early overweight/obesity. Exclusive breastfeeding for up to 6 months is still a poorly achieved target in most settings, even though it is crucial for optimal growth.

Keywords: Cardiovascular Diseases; Breast Feeding; Infant Nutritional Physiological Phenomena; Infant.

Introduction

Cardiovascular diseases (CVDs) are among the major global health issues, with behavioural and metabolic risk factors often emerging early in life.¹⁻³ In Africa, where diverse nutritional practices and socioeconomic conditions prevail, examining the influence of infant feeding on long-term CVD risk is crucial.^{1,2}

Breastfeeding is widely acknowledged because of its health benefits, such as decreasing the risk of chronic diseases.³ Exclusive breastfeeding for the first 6 months has been recommended by the World Health Organisation (WHO), as it is associated with a lower incidence CVD risk, such as obesity, later in life.³ Previous research has indicated that breastfeeding can reduce the risk of

obesity by up to 22% compared to formula feeding.^{4,5} In contrast, formula feeding, particularly without adequate nutritional support, is linked to higher risks of rapid weight gain and obesity.^{6,7} Formula-fed infants have been reported to be approximately 30% more likely to be overweight by age 2 compared to breastfed infants.⁶

Feeding practices have been reported to significantly influence cardiovascular risk factors.⁸ Rapid weight gain in infancy has been linked to inadequate or excessive feeding and increases the risk of hypertension and metabolic syndrome.⁹ Studies have shown that infants who experience rapid weight gain are up to 50% more likely to develop obesity-related conditions by age 5.⁹ Also, inappropriate infant feeding and poor nutritional intake have been associated with abnormal metabolic markers, such as abnormal lipid parameters, later in life.¹⁰

In Africa, the prevalence of breastfeeding varies, and it has been reported to be influenced by various factors, including socioeconomic status and cultural beliefs.¹¹ In sub-Saharan Africa, for the recommended 6 months, only about 10% to 60% of infants are exclusively breastfed, with rates depending on the country.¹² Early introduction of complementary foods is common, with around 60% of infants receiving solids before 6 months, which can impact nutritional outcomes.¹³

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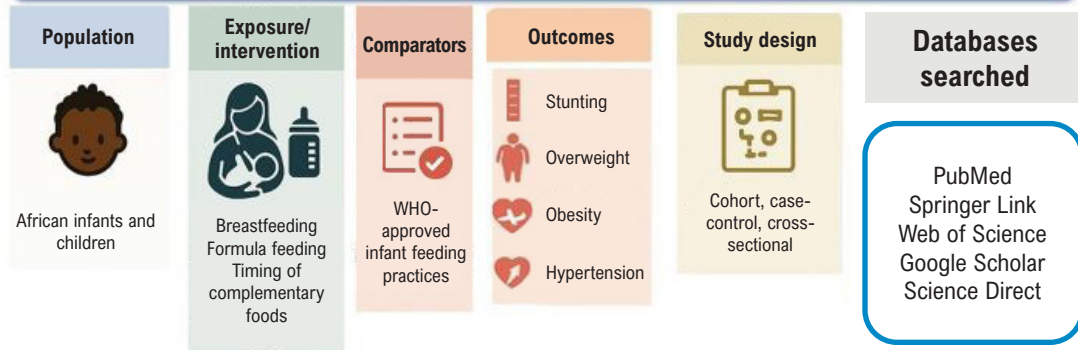
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Central Illustration: Infant Feeding Practices and Their Association with Stunting, Overweight, Obesity, and Other Cardiometabolic Risks in African Children: A Systematic Review



Key question: What is the relationship between infant feeding practices and the risk of stunting, overweight/obesity, and other cardiometabolic risks? What is the relationship between infant feeding practices and the risk of stunting, overweight/obesity, and other cardiometabolic risks?



Summary of results

Stunting and early cardiometabolic risk are common in Africa and are associated with suboptimal infant feeding patterns.

	Stunting: 9.3%–42.0%
	Overweight: 9.1%–30.0%
	Obesity: 4.0%–21.0%
	Hypertension: 9.1%–32.7%

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Understanding these dynamics in the African context is vital for developing effective public health interventions. This review assessed infant feeding practices and their association with stunting, overweight, obesity, and cardiometabolic risk in children in Africa.

Material and methods

Eligibility Criteria

The protocol is registered with PROSPERO (registration no. CRD42024586026). The review included full English articles reporting stunting, overweight, obesity, and other cardiometabolic risks in African children. The review also included studies published from 2004 onwards with a cross-sectional, cohort, or case-control study design. Those excluded were grey literature, non-peer-reviewed articles, CVD in adults, non-English language publications, and studies with unclear indications of cardiometabolic risk factors. The PICOS, which is summarized in the Central Illustration, was as follows:

- Population: Studies involving African infants and children.
- Intervention/Exposure: Infant feeding practices, including breastfeeding, formula feeding, and timing of complementary foods.

- Comparators: Observed feeding practices in African populations (often including early weaning, suboptimal complementary feeding, etc.) and the WHO-recommended practices (exclusive breastfeeding for the first 6 months, appropriate complementary feeding from 6 months, and continued breastfeeding up to 2 years or beyond).

- Outcomes: Stunting, overweight, obesity, blood pressure, cholesterol level, diabetes mellitus, and metabolic syndrome.
- Study Design: Cohort studies, case-control studies, and cross-sectional studies.
- Language: English

Information sources and search strategy

The search strategy was comprehensive, which helped to identify relevant studies that reported stunting, overweight, obesity, and other cardiometabolic risks in African children. PubMed, Springer Link, Web of Science, Google Scholar, and Science Direct were scientific search engines and databases. The search was done using a combination of Medical Subject Heading (MeSH) terms and keywords such as “Infant feeding practices,” “Breastfeeding,” “Formula feeding,” “Complementary feeding,” “cardiovascular disease risk factors,” “Blood pressure,” “Diastolic blood pressure,” “Systolic blood pressure,” “Obesity,” and “Africa”

(Supplementary Table S1). The search included studies published from 2004 to the present.

Data extraction procedure and quality assessment

A standardised form was used for data extraction, capturing details on study characteristics (study design, author, year, location), participant demographics (age, sex), prevalence of stunting, overweight, obesity, and other cardiometabolic risks. Two reviewers independently reviewed the identified articles (titles and abstracts) to determine their relevance. The reviewers also conducted the extraction independently to ensure accuracy and reliability. The eligibility of full articles was assessed based on the inclusion and exclusion criteria. Any disagreement was resolved via discussion and consultation with a third reviewer. The Joanna Briggs Institute (JBI) SUMARI and Newcastle–Ottawa Scale (NOS) checklist was used to assess the quality of all included studies (Supplementary Tables S2a and S2b). The studies were evaluated for methodological rigour, sampling methods, and data reporting.

Data synthesis

Quantitative data were synthesised where appropriate to estimate pooled prevalence and risk factors. Qualitative data were summarised narratively. Subgroup analyses were conducted based on sex, study design, geographic regions, and quality. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and checklists (Supplementary Tables S3 and S4) were used to report the findings.

Results

As shown in Figure 1, 146 articles were identified from an initial search of the different databases. After screening by title and removing duplicates, 52 were selected for full-text screening. In the final analysis, 12 studies that met the predefined inclusion criteria were included (Figure 1).

The review included 12 studies involving over 11,085 participants from 4 countries: Sierra Leone (1), South Africa

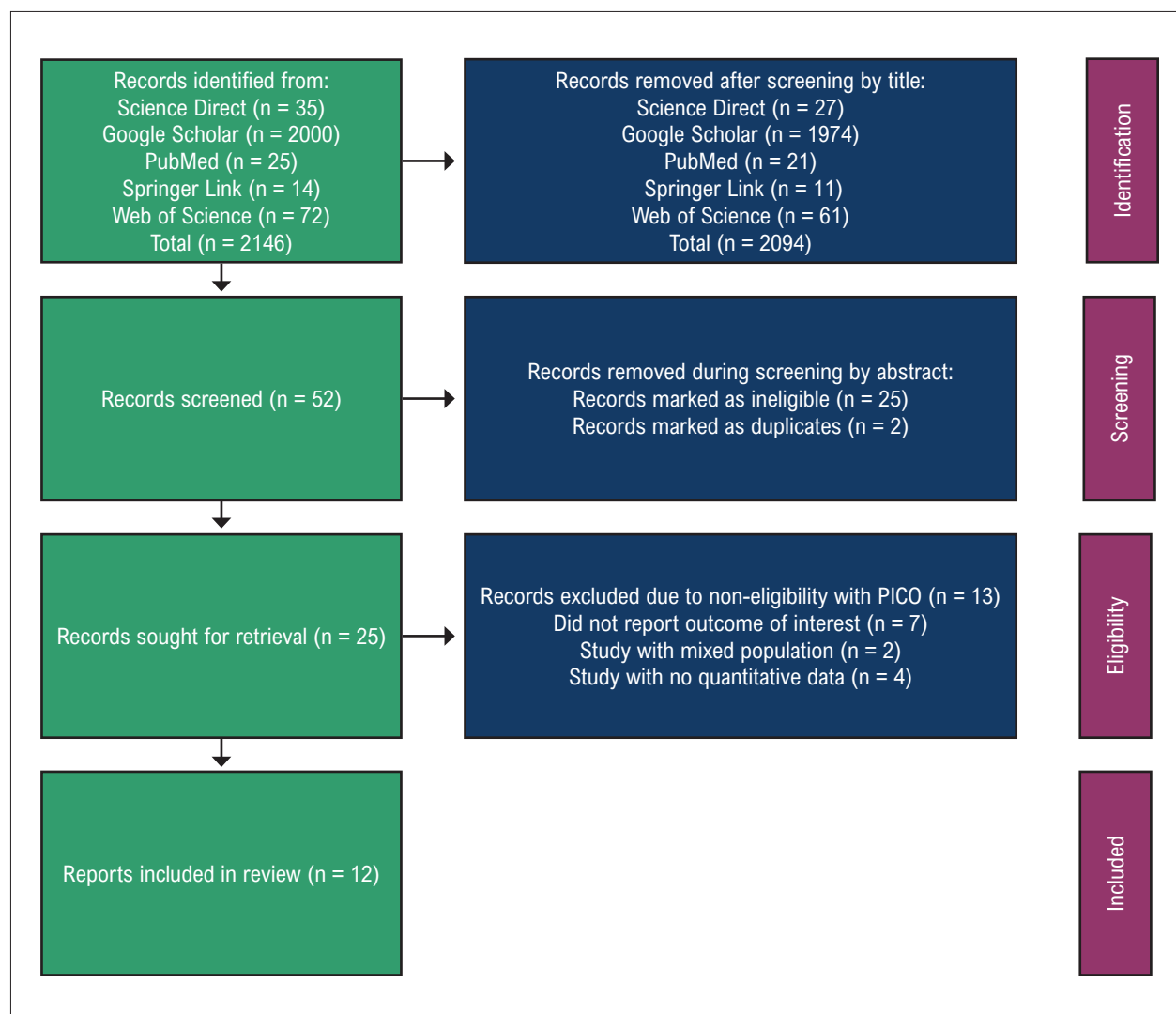


Figure 1 – PRISMA flow diagram.

(7), Rwanda (3), and Ethiopia (1). The studies used diverse methodologies, including 7 cohort/longitudinal and 5 cross-sectional/observational studies (Table 1). Some of the key cardiometabolic outcomes recorded were stunting, overweight, obesity, hypertension, and diabetes. Stunting was reported by 6 of the studies, with an average prevalence of 30.6%, ranging from 9.3%¹⁴ to 42%¹⁵ (Table 1). The average prevalence of overweight recorded among the 6 studies that reported it was 16.7%, ranging from 9.1%¹⁶ to 30%⁷ (Table 1). Obesity was reported by 5 of the studies with an average prevalence of 9.6%, ranging from 4.0%¹⁵ to 21.0%¹⁴ (Table 1). Hypertension was reported by 2 studies with an average prevalence of 20.9%, ranging from 9.1%¹⁷ to 32.7%¹⁸ (Table 1). Lastly, diabetes was reported in just 1 of the studies, and the average prevalence was 2.28%, ranging from 1.9% (females) to 2.6% (males)¹⁸ (Table 1).

Discussion

Infant feeding practices remain central to children's nutritional and long-term health status, particularly in Africa, where the double burden of cardiometabolic abnormalities such as malnutrition/underweight and overweight/obesity increases.³ Infant feeding practices in Africa are characterised by low rates of exclusive breastfeeding and the early introduction of nutritionally inadequate complementary foods.²² According to the Africa Health Organisation, only slightly more than 43% of infants under six months are exclusively breastfed, while less than a quarter of children aged 6 to 23 months meet the minimum standards for dietary diversity and feeding frequency.²² The identified studies for this review employed various methodologies (cohort, longitudinal, and cross-sectional) to assess the contribution of infant and young children's feeding practices on their cardiometabolic health.

The review identified studies that underscore the protective role of exclusive breastfeeding in preventing both stunting and the early onset of overweight and obesity.^{5,7,8} In Ethiopia, it was reported that children exclusively breastfed for 6 months had lower levels of adiposity and improved cardiometabolic profiles by age 5.⁵ Similarly, findings from some localities of South Africa revealed that children who were not breastfed at 12 weeks exhibited accelerated weight gain and higher BMI-for-age Z-scores by 24 months, suggesting an increased risk of childhood overweight.⁷ Another study conducted in South Africa further supported reports of a reduced risk of both obesity and prehypertension in children who were breastfed during infancy.¹⁷ These findings affirm the WHO recommendation for exclusive breastfeeding during the first 6 months of life as a critical strategy for promoting healthy growth and preventing early metabolic disturbances.³

Some of the identified studies reported that ineffective complementary feeding practices were recurrently associated with overweight and stunting.^{8,15,16,19} Extended breastfeeding duration, which was reported by a multi-country cohort study, has limited long-term adult obesity, hypertension, or diabetes protection.¹⁸ This could have been related to several confounding variables, such as diet, physical activity, and socioeconomic status, which could overshadow breastfeeding influences later in life.³ Studies conducted in Rwanda documented stunting levels ranging from 35.1% to 42%, with

significantly higher levels recorded in children aged 18 to 24 months.^{8,15} Some factors, such as the early introduction of solid foods and low dietary diversity, were reported to be common in South Africa and were highly associated with stunting.⁸

Also, findings from South Africa indicated that the trends of overweight in infancy were attributed to low-quality complementary foods.^{16,19} More exclusive breastfeeding was linked to children with more fat-free mass but also with higher blood pressure and LDL cholesterol in Ethiopia.⁵ This reveals the trade-offs between growth and metabolic programming, which are exquisitely nuanced.⁵

Some studies highlight the multiplicative influence of socioeconomic status and contextual factors on feeding practices/behaviour and nutritional outcomes.^{11,15} Factors such as food insecurity, maternal education, poverty, and limited access to health care could restrict the optimal following of feeding guidelines.^{3,11,21} They are the most commonly linked factors to early weaning and inappropriate nutrient intake during the complementary feeding phase.^{3,11,21} In some localities in South Africa, stunting was attributed to both suboptimal feeding practices and underlying socioeconomic vulnerabilities.¹¹ Likewise, in Rwanda, children from poor households exhibited higher rates of stunting.^{15,21} This suggested that structural inequalities and limited access to diverse nutritious foods could be a critical factor.^{15,21} Some other confounding variables, such as HIV exposure, were also reported to interact with the feeding patterns and hence influence early cardiovascular risk factors such as prehypertension and overfat status in South African children.¹⁷ These findings underscore the need for context-specific tailored interventions that could address the unique challenges faced by these African communities.

Furthermore, infant feeding patterns vary widely across regions based on their cultural norms, socioeconomic conditions, and the capacity of health systems.²² In Africa, common practices such as early weaning, late complementary feeding, and low dietary diversity factors have been linked not only to stunting but also to cardiometabolic risks such as obesity and insulin resistance.²³ Similar trends have been reported in Asia and Latin America, where early-life exposure to poor nutrient but energy-dense foods has been linked with increased adiposity and metabolic dysfunction.¹⁸

Limitations

The included studies were fairly heterogeneous in study design (cohort vs. cross-sectional), follow-up duration, and study population, making quantitative pooling of data impossible. There was also heterogeneity between the definition and measurement of infant feeding practices and the definition and measurement of cardiometabolic outcomes between studies.

Most of the evidence came from anthropometric indicators like stunting or BMI, with fewer addressing metabolic markers like insulin resistance, lipids, or blood pressure.

While the review attempted to capture data from the general African population, some regions were unfairly represented, with limited data from West and Central Africa. This constrains the generalisability of results to the African population.

Table 1 – Characteristics of included studies on infant feeding practices and cardiometabolic risk factors

s n	Country/ Reference	Study design	Sample size	Population	Exposure	Outcome	Instruments	Key findings
1	South Africa ¹⁸	Prospective cohort study	1620	Individuals from five cohorts followed from infancy to young adulthood	Infant feeding patterns, including duration of breastfeeding and timing of complementary food introduction. South Africa: 94.9% breastfeed More than 90% of babies in all cohorts were initially breastfed. The most frequent duration of breastfeeding was > 2 years in South Africa, and the most frequent age at the introduction of complementary foods was 0–3 months in South Africa.	Hypertension 32.7% (M 41.4%, F 25.1%), diabetes 2.28% (M 2.6%, F 1.9753%), overweight 15.9% (M 7.9%, F 23.2%), obesity 5.1% (M 3.1%, F 6.8%).	Longitudinal health data assessments	No evidence of longer breastfeeding duration protection against adult hypertension, diabetes, or overweight/ adiposity in low-/ middle-income populations. However, delaying complementary foods until 6 months, as the World Health Organisation recommends, may slightly reduce the risk of adult overweight/ adiposity.
2	South Africa ⁷	Cohort study	641	HIV- unexposed d South	Early feeding practices	Overweight 30%, obese 8.7%.	Anthropometric measurements	Early feeding practices influence growth velocity and the risk of overweight/obesity in children.

3	South Africa ¹⁶	Longitudinal study March 2012– March 2015	1009	South African infants	Infant feeding practices Breastfeeding initiated: 86% Exclusive for 6 months: 13% Complementary 6 months: 73%	Overweight/obese: 9.1% (EBF with fruit juice at 9 months: 8.5%; EBF with poor quality of food at 12 months: 10%).	Surveys and anthropometric measurements	Diverse infant feeding practices were observed, with implications for child health outcomes.
4	South Africa ¹⁹	Longitudinal study	585	Participants were infants born to women who were recruited while attending prenatal clinics at 9 randomly selected local clinics situated around the referral hospital, Mankweng Hospital, during their third trimester in Limpopo Province, South Africa	Feeding practices Breast milk only: 44.1%, formula only: 8.2%, and combined: 47.7% Exclusive: 9.7%	Overweight: 12% at 12 months. Stunting increased from 9.6% at birth to 34.6% at 12 months. Wasted: 7.3%.	Anthropometric measurements	Feeding practices are closely linked to growth outcomes in infants.
5	South Africa ¹¹	Cross-sectional study	427	Children under 2 years in Gauteng, South Africa	Feeding practices and socio-demographic factors Never breastfed (7%), delayed initiation of breastfeeding (58%), sub-optimal exclusive breastfeeding (29%), discontinued breastfeeding (44%), early introduction of solid foods (41%), and low dietary diversity (97%).	Stunting 16%	Surveys and anthropometric measurements	Identified associations between feeding practices, socio-demographic factors, and stunting.
6	South Africa ¹⁷	Cohort study 2012–2014	1536 (477 HIV-exposed, 1057 HIV-unexposed, 278 HIV-affected)	HIV-negative children age 7 to 11 years in rural South Africa	Breastfeeding and HIV exposure	Overfat: 7%, overweight: 13.2%, and prehypertensive: 9.1%.	Anthropometric and blood pressure measurements	Explored the interplay between breastfeeding, HIV exposure, and early cardiovascular risk factors.
7	South Africa ¹⁴	Cross-sectional study January and August 2017	774	Mother-child pairs at primary health care clinics in KwaZulu-Natal, South Africa	Infant feeding practices 93% initiated breastfeeding, and the introduction of other foods started early, with 17.6% EBF at 6 months: 23.5%	Stunting: 9.3% to 21.7% and obesity: 4.0% to 21.0%	Surveys and anthropometric measurements	Emphasized the coexistence of undernutrition and overnutrition within the same households.

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8	Ethiopia ⁸	Cohort study December 2008 and October 2012	Of the 644 mother-child pairs enrolled, a subpopulation of 306 children, who attended follow-up at 6 months	Ethiopian children, healthy newborns, born at term (≥ 37 weeks of pregnancy) with a birth weight ≥ 1500 g	Breastfeeding status at 6 months	Nonexclusive breastfeeding practices were associated with a lower BMI, blood pressure, and HDL cholesterol. "Predominantly" and "Almost exclusive" had shorter stature and a lower fat-free mass index but a similar fat mass index. "Predominantly" had higher insulin of 53%, "Almost exclusive" had lower total and LDL cholesterol, and "Partial or none" had a lower fat mass index	Anthropometric and biochemical measurements	Evaluated how breastfeeding status affects growth and cardiometabolic health over the long run.
9	Sierra Leone ²⁰	Cohort study	1270 children, 1092 of whom had data available at the 24-week follow-up visit	Infants in rural Sierra Leone	Breastfeeding practices of undernourished mothers 88% were EBF Water alone: 6.6% Glucose water 1.1% Milk product (formula) 1.8% Native herbs 2.4% Solids 0.4%	Infant growth and mortality	Anthropometric measurements and mortality records	Examined the effects of breastfeeding and mother diet on the health of the newborn.
10	Rwanda ²¹	Cross-sectional study	807	Rwandan children aged 6–23 months	Feeding practices and socioeconomic factors 71.8% received the deworming tablet, 62.8% received micronutrient supplementation powder, and 92.3% received vitamin A supplementation	Stunting: 34.1%	Surveys and anthropometric measurements	Determined the risk variables for stunting in kids from low-income families.
11	Rwanda ¹⁵	Cross-sectional study	138 children	5 to 30 months of age, children in northern Rwanda	Complementary feeding practices, continued breastfeeding 92% and exclusive breastfeeding 50%.	Stunting: 42%, overweight: 20% obese: 4%.	Surveys and anthropometric measurements	Emphasized the role of complementary feeding in helping to prevent stunting.
12	Rwanda ¹¹	Cross-sectional study 2010	1634 children	Rwandan children ≤ 2 years of age	Early feeding practices	Stunting: 35.1% (Significantly higher rates of stunting were observed in 18- to 24-month-old children [55.2%]).	Demographic and health survey data	Investigated the relationships between the prevalence of stunting and early feeding patterns.

BMI: body mass index; EBF: exclusive breastfeeding; F: female; HDL: high-density lipoprotein; M: male; LDL: low-density lipoprotein. Statistical significance of 5%

Few of the reviewed studies controlled potential confounding variables, such as maternal education, family-level socioeconomic status, birth weight, or physical activity. This could have led to biased measures of the associations between feeding patterns and health indicators.

Conclusion

The studies that were reviewed showed that inappropriate complementary feeding and early weaning of breastfeeding are linked to stunting as well as early overweight/obesity. Exclusive breastfeeding for up to 6 months is still a poorly achieved target in most settings, even though it is crucial for optimal growth. Socio-demographic determinants such as poverty, maternal education, and food insecurity continue to impede following suggested feeding patterns.

Therefore, integrated nutrition policies and community interventions addressing infant feeding education, improving food quality, and supporting mothers are proposed to address long-term health threats in Africa.

Author Contributions

Conception and design of the research, acquisition of data, analysis and interpretation of the data, statistical analysis, writing of the manuscript and critical revision of the manuscript for intellectual content: Enoh JE, Akah RT, Nkeh-Chungag BN.

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Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

The underlying content of the research text is contained within the manuscript.

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*Supplemental Materials

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