Section: Paediatrics

Systematic Review

BREASTFEEDING AND FORMULA FEEDING: IMPACTS ON INFANT HEALTH, OUTCOMES, GROWTH, AND DEVELOPMENT – A SYSTEMATIC REVIEW

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ABSTRACT

Background: Early life nutrition plays a pivotal role in determining infant growth, immune maturation, metabolic programming, and neurodevelopmental outcomes. Breastfeeding is considered the biological norm for infant feeding because of its unique nutritional and bioactive composition, whereas formula feeding serves as an essential alternative when breastfeeding is not feasible. Despite extensive research, comparative evidence on the growth patterns, developmental outcomes, and long-term health effects of breastfed and formula-fed infants remains heterogeneous and sometimes inconsistent. **Objective:** This systematic review aimed to compare the effectiveness and safety of breastfeeding and formula feeding in infants and young children, focusing on growth parameters, body composition, neurocognitive development, infectious morbidity, immune and metabolic outcomes, and long-term health implications. **Materials and Methods:** A systematic literature search was conducted in PubMed/MEDLINE, Scopus, Web of Science, and the Cochrane Library for studies published up to December 2025, according to the PRISMA 2020 guidelines. Randomised controlled trials and observational studies involving term or preterm infants comparing breastfeeding (exclusive or partial) with formula feeding and reporting at least one relevant outcome were included. Data were synthesised narratively due to substantial clinical and methodological heterogeneity across studies. The risk of bias was assessed using standard tools appropriate for the study design. **Results:** Fifteen studies involving over 116,000 infants were included. Both feeding modes supported adequate growth and survival. Formula feeding was consistently associated with faster early weight gain, higher growth indices, and differences in body composition, including greater fat-free mass and adiposity-related markers. Breastfeeding was associated with lower infectious morbidity, enhanced immune profiles, favourable endocrine and molecular markers related to metabolic programming, and comparable or superior neurocognitive outcomes. Differences were most pronounced in early infancy and tended to attenuate during the second year of life. The interpretation of the findings is limited by heterogeneity across studies and the predominance of observational designs. **Conclusion:** Breastfeeding and formula feeding are both effective in supporting infant growth; however, breastfeeding provides additional advantages in terms of immune protection, metabolic health, and neurodevelopment. Breastfeeding should be promoted as the preferred feeding method whenever possible, whereas formula feeding remains an appropriate alternative when necessary. Individualised feeding decisions and large-scale longitudinal studies are required to clarify subgroup-specific and long-term effects.

INTRODUCTION

Optimal nutrition during infancy is important for lifelong health, growth, and neurodevelopment, with early feeding practices influencing physical and cognitive outcomes. Undernutrition contributes substantially to childhood mortality globally, while exclusive breastfeeding rates remain suboptimal, with only approximately 44% of infants exclusively breastfed.[1] Human milk is the main source of infant nutrition, uniquely adapted to the metabolic and immunological needs of infants from birth to early childhood. Breastfeeding provides protective benefits in both the short- and long-term, whereas formula feeding serves as an alternative when breastfeeding is not possible or is contraindicated.[2] However, variations in health outcomes between breastfed and formula-fed infants are not yet fully understood.

Human milk contains a complex composition of essential nutrients, immunological elements, and bioactive substances that promote immune defense, brain development, and a healthy gut microbiome. These properties are associated with a reduced risk of several diseases, including obesity, type 2 diabetes, and cardiovascular disease, later in life. In contrast, although infant formula is formulated to match the nutritional profile of human milk and support early growth, it lacks the majority of bioactive components. As a result, formula-fed infants may exhibit differences in gut microbial colonisation and, in some settings, a higher susceptibility to infections and allergic disorders.[2,3] Therefore, exclusive breastfeeding in the first six months of life is suggested as important for reducing mortality and improving infants' resistance to infections.[1]

Beyond the risk of early infection, prolonged breastfeeding is associated with healthier growth patterns and a reduced risk of being overweight and obese later in childhood and adolescence.[4] Formula-fed infants may show differences in weight gain patterns and body composition, thereby increasing the possibility of obesity and metabolic issues in the future.[5] Neurocognitive outcomes also change with the feeding type, with several studies suggesting associations between breastfeeding and enhanced cognitive performance.[6,7] Breastfed infants have been reported to demonstrate favourable neurodevelopmental outcomes, including language and cognitive performance, although these associations may be influenced by confounding factors. This advantage of breastfeeding could be due to the unique nutrient content of human milk, including long-chain polyunsaturated fatty acids, which are important for brain development.[7,8]

High-quality studies directly comparing breastfeeding and formula feeding across multiple growth, developmental, and health outcomes are limited and heterogeneous. An evidence-based understanding of feeding practices is important to maximise infant health benefits while reducing the risks associated with suboptimal feeding. Therefore, this systematic review aimed to compare the effects of breastfeeding and formula feeding on infant growth parameters, including weight, length, and head circumference, as well as neurocognitive and developmental outcomes.

Objectives

Primary objective

To compare breastfeeding and formula feeding with respect to infant growth, development, and health outcomes.

Secondary objectives

To evaluate differences in (i) growth parameters, including weight, length, and head circumference; (ii) cognitive and neurodevelopmental outcomes; (iii) incidence of infectious and metabolic diseases; (iv) body composition and nutritional status; and (v) long-term health outcomes, including obesity, diabetes, and cardiovascular risks.

MATERIALS AND METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The review protocol was not registered in PROSPERO, as the review was undertaken as an academic synthesis with predefined objectives, eligibility criteria, and outcomes established prior to study selection.

Search strategy

A comprehensive electronic search was conducted in PubMed/MEDLINE, Scopus, Web of Science, and the Cochrane Library for studies published until December 2025. The search strategy combined Medical Subject Headings (MeSH) and free-text terms, including "breast feeding", "infant formula", "body composition", and "infant nutrition", with appropriate Boolean operators. The reference lists of the included studies were manually screened to identify additional relevant articles.

Study selection

Studies were considered eligible for inclusion if they met the following criteria: they involved human infants, including preterm or term infants, with clearly defined feeding exposure such as breastfeeding (exclusive or predominant), formula feeding, or mixed feeding. Studies enrolling preterm populations, including low birth weight (LBW), very low birth weight (VLBW), or extremely low birth weight (ELBW) infants, were eligible, provided that the feeding type was specified and outcomes were reported separately where applicable. Both hospital- and community-based cohorts were included. The exposure of interest was breastfeeding (exclusive or partial), compared with formula feeding (standard or non-standard formulas, including hydrolysed or modified formulas). Eligible studies were required to report at least one relevant outcome aligned with the review objectives, including growth parameters (weight, length/height, head circumference, or

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corresponding z-scores), growth velocity, body composition (fat mass, fat-free mass, body fat percentage), neurocognitive or developmental outcomes (for example, Bayley Scales or equivalent), infectious morbidity, haematological or immune parameters, metabolic or endocrine markers, or long-term health outcomes such as overweight, obesity, or cardiometabolic risk indicators.

Both randomised controlled trials, quasi-randomised trials, and observational study designs (prospective or retrospective cohort studies, case–control studies, and cross-sectional studies) published in English were eligible for inclusion. Only studies published in English were included because of feasibility and resource constraints. No restrictions were applied based on geographical locations. Studies were excluded if they were case reports, case series without a comparator group, editorials, letters to the editor, conference abstracts, narrative reviews, or unpublished studies. Studies were also excluded if they involved animals, infants with major congenital anomalies or chromosomal abnormalities, or if the feeding exposure could not be clearly classified as breastfeeding or as formula feeding. Studies that focused exclusively on feeding frequency, feeding schedules, or feeding techniques (e.g. continuous vs. bolus feeding) without evaluating the feeding type were not considered eligible.

Data extraction

All retrieved records were imported into EndNote X9 for deduplication. Two independent reviewers screened the titles and abstracts for relevance, followed by a full-text evaluation of the potentially eligible studies. Any disagreements during the selection process were resolved through discussion or by consulting a third reviewer, if necessary. The final selection of studies is summarised using a PRISMA flow diagram. [Figure 1]

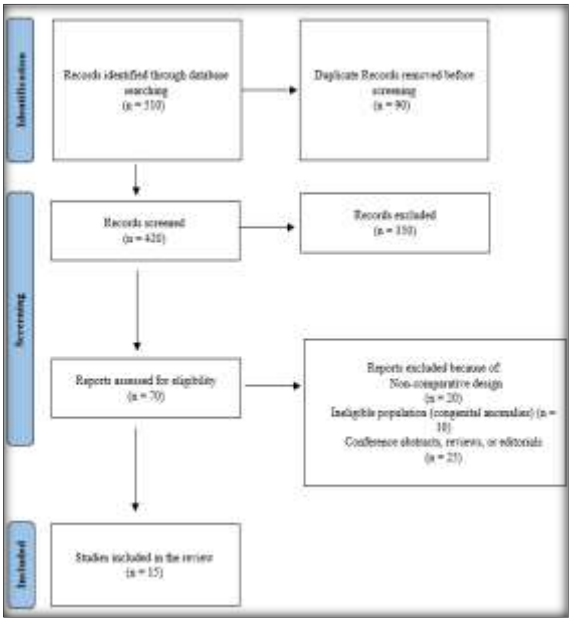

Figure 1: PRISMA 2020 flow diagram showing study selection process

Data extraction was performed independently by two reviewers using a standardised data extraction template. The following information was extracted from each eligible study: first author and year of publication, study design, study setting, country or region, sample size, and baseline infant characteristics, including gestational age, birth weight, sex distribution, and mode of delivery and maternal characteristics, where reported. Details of feeding exposure were extracted, including type of feeding (exclusive breastfeeding, partial or mixed feeding, or exclusive formula feeding), duration and exclusivity of breastfeeding, type of formula (standard, preterm, hydrolysed, lactose-reduced, or other modified formulas), and timing of feeding assessment or classification. Where applicable, information on feeding transitions over time and definitions used to categorise the feeding groups were recorded.

The extracted outcome data were aligned with the primary and secondary objectives of the review and included growth parameters (weight, length/height, head circumference, growth velocity, and corresponding z-scores), body composition measures (fat mass, fat-free mass, body fat percentage, or related indices), neurocognitive and developmental outcomes (for example, Bayley Scales or equivalent tools), infectious morbidity, haematological and immune parameters, metabolic or endocrine markers, and long-term health outcomes such as overweight, obesity, or cardiometabolic risk indicators when reported. Information on outcome definitions, measurement methods, timing of assessments, and follow-up duration was also extracted.

Any discrepancies between the reviewers during data extraction were resolved through discussion, and a third reviewer was consulted when a consensus could not be achieved. When outcome data were missing, incomplete, or ambiguously reported, analyses were limited to the available published information, and data imputation was not performed.

Risk of bias, data synthesis, and certainty of evidence

The risk of bias was assessed independently by two reviewers. Randomised controlled trials were evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool, whereas observational studies were assessed using the Newcastle–Ottawa Scale. Disagreements were resolved through discussions. Effect estimates, including risk ratios, odds ratios, mean differences, and adjusted estimates, were extracted as reported in the original studies. Where multiple effect measures were presented, preference was given to the adjusted estimates. Owing to clinical and methodological heterogeneity across studies, including variability in infant populations (preterm vs. term), feeding definitions (exclusive, partial, or mixed feeding), duration of exposure, outcome measurement methods, and follow-up periods, a quantitative meta-analysis was not performed. The findings were analysed narratively and summarised in tables. Publication bias was not assessed because a meta-

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analysis was not performed, and the number of studies per outcome was limited. Subgroup and sensitivity analyses were not performed because of large clinical and methodological heterogeneity. The certainty of the evidence was qualitatively evaluated by considering the study design, risk of bias, consistency of results, and precision of reported outcomes. A formal GRADE assessment was not performed because the findings were synthesised narratively.

RESULTS AND DISCUSSION

A total of 510 records were identified through database searches in PubMed/MEDLINE, Scopus, Web of Science, and the Cochrane Library. After the removal of 90 duplicate records, 420 records were screened by title and abstract, of which 350 were excluded. Seventy full-text articles were assessed for eligibility, and 55 were excluded because of non-comparative study design (n = 20), ineligible population such as congenital anomalies (n = 10), or publication type including conference abstracts, reviews, and editorials (n = 25). Finally, 15 studies met the inclusion criteria and were included in this systematic review. [Figure 1]

1. Study selection and characteristics

The systematic review included 15 studies, comprising 2 randomised controlled trials, 9 cohort studies, 3 cross-sectional studies, and 1 case–control study, enrolling a total of >116,000 infants. The sample sizes ranged from 27 to 109,052 infants. The study population included preterm infants (gestational age <37 weeks; birth weight 500–2500 g) and term infants (≥37 weeks). Feeding exposures included exclusive breastfeeding, partial or mixed feeding, and exclusive formula feeding, with follow-up ranging from 2 to 48 months. The randomised controlled trials showed a low to moderate risk of bias, while most observational studies had a moderate risk, mainly due to confounding and exposure classification.

2. Growth parameters: weight, length, and head circumference

In preterm infants followed up to 24 months, Paygozar et al. reported comparable growth trajectories between feeding groups. At 24 months, mean weight was 11.0 kg in breastfed infants vs 11.5 kg in formula-fed infants, length 90 cm vs 91 cm, and head circumference 48 cm vs 49 cm, with no statistically significant differences ($p > 0.05$).9 Among healthy term infants, Vaishnavi et al. observed significantly higher body weight in formula-fed infants from 4 months onward, with a difference of approximately 890 g at 12 months ($p < 0.05$), while length-for-age and head-circumference-for-age z-scores remained similar.[10] Amin and Abdulla similarly reported that breastfed infants demonstrated steady growth within WHO reference ranges, whereas formula-fed and mixed-fed infants showed faster and more variable weight gain, with formula-fed boys approaching +1 SD for weight-for-age at 15 months, indicating a tendency toward early excess weight gain.[11]

Cheshmeh et al. reported significantly higher mean weight (8.3 ± 0.54 kg vs. 7.3 ± 0.98 kg), length (70.5 ± 2.0 cm vs. 65.4 ± 4.5 cm), and head circumference (44.9 ± 1.4 cm vs. 42.8 ± 1.99 cm) in formula-fed compared with exclusively breastfed infants at 5–6 months (all $p < 0.001$).[12] Formula feeding is associated with higher anthropometric measures in early infancy, particularly body weight, whereas linear growth and head circumference show smaller and less consistent differences, suggesting preferential effects on somatic growth rather than skeletal or cranial growth.

3. Growth velocity

Early postnatal growth velocity differed modestly according to feeding mode. Ziegler reported similar weight gain during the first 6–8 weeks. However, between 42 and 112 days, formula-fed males gained 28.5 ± 6.4 g/day vs 25.4 ± 6.2 g/day in breastfed males ($p < 0.001$), with comparable differences observed in females.[13] In preterm infants, Lucas et al. demonstrated significantly faster early weight gain in those fed preterm formula compared with donor breast milk (16.0 ± 0.3 vs 13.4 ± 0.3 g/kg/day, $p < 0.0001$), showing higher nutrient density of formula feeds.[14]

De Curtis et al. showed similar overall weight gain during the first 2 months (7.7 ± 1.3 vs 8.4 ± 2.1 g/kg/day), with differences below the threshold for statistical significance.[15] Differences in growth velocity emerge mainly after the early neonatal period, with formula feeding supporting faster postnatal weight gain, while early neonatal growth appears largely similar between feeding modes.

4. Body composition outcomes

Body composition analyses demonstrated differences that were not always apparent from anthropometry alone. Tahir et al. reported higher fat-free mass in formula-fed infants at 6 months (5470 ± 600 g vs. 5105 ± 640 g, $p = 0.002$), while breastfed infants had higher body fat percentage (33.1 ± 3.6% vs. 30.1 ± 3.1%, $p < 0.001$).[16] Bellù et al. found significantly higher fat mass in formula-fed infants at 12 months (2.76 ± 0.39 kg vs. 2.18 ± 0.47 kg, $p = 0.02$).[17] Vaishnavi et al. reported an upward centile crossing for weight-for-length in 40% of formula-fed infants vs. 4% of breastfed infants ($p = 0.003$).[10] Several longitudinal studies demonstrated attenuation of these differences by 18–24 months.[18,19] Feeding mode influences early body composition more than size-based growth alone, with formula feeding associated with accelerated lean mass accretion and higher adiposity risk markers during infancy, while breastfeeding supports a slower, more proportionate growth pattern.

5. Neurocognitive and developmental outcomes

Neurodevelopmental outcomes were assessed in four studies. Paygozar et al. observed higher Bayley cognitive scores in breastfed preterm infants at 24 months (100 vs 98), without statistical significance.[9]

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In contrast, Kamal et al. reported differences: 34.2% of exclusively breastfed children demonstrated above-average cognitive scores compared with 6.5% of formula-fed children, while 52.4% of formula-fed children were below average ($p = 0.001$). Neurodevelopmental delay was reported in 14.1% of exclusively breastfed, 62.8% of partially breastfed, and 77.0% of formula-fed children ($p = 0.001$).[20] While controlled longitudinal studies suggest comparable neurodevelopmental outcomes, observational evidence associates exclusive breastfeeding with more favourable cognitive profiles and lower prevalence of developmental delay.

6. Infectious morbidity

Infectious outcomes were primarily reported by Kamal et al. Among exclusively breastfed children, infection rates were 32%, 39.7%, and 40% for colds, pneumonia, and diarrhoea, compared with 67.2%, 71.4%, and 77.0% in formula-fed children (all $p = 0.001$).[20] Partial breastfeeding was associated with intermediate infection risk. Exclusive breastfeeding is associated with reduced infectious morbidity in early childhood, with partial breastfeeding conferring intermediate protection, supporting a dose–response relationship between human milk exposure and the risk of infection.

7. Immune and haematological parameters

Hamdan et al. demonstrated significantly higher haemoglobin, packed cell volume, and red blood cell counts in breastfed infants at 1 month ($p < 0.05$–0.001). White blood cell counts were also higher at 1 and 6 months ($p < 0.01$–0.001). Flow cytometry revealed higher frequencies of $CD4^+$ and $CD8^+$ T cells, B lymphocytes, NK cells, monocytes, and dendritic cells in breastfed infants, with differences in early infancy and diminishing by 9–12 months.[21] Breastfeeding is associated with improved early immune maturation, affecting both innate and adaptive immune systems, with effects in early life and diminishing as the infants age.

8. Metabolic, endocrine, and molecular outcomes

Endocrine and molecular differences have been reported by Cheshmeh and Ziegler et al. Plasma IGF-1 concentrations at 4 months were significantly lower in breastfed infants (32.0 ± 18.7 µg/L) than in formula-fed infants (58.9–80.7 µg/L, $p < 0.01$).[12,13] Cheshmeh et al. reported lower expression of obesity-associated genes in breastfed infants, including FTO (3.39 ± 1.1 vs. 23.6 ± 10.98) and CPT1A (13.5 ± 6.0 vs. 42.8 ± 18.1), with higher expression of PPAR-α (85.4 ± 17.8 vs. 23.6 ± 11.0) (all $p < 0.001$).[12] These findings indicate that breastfeeding is associated with a distinct endocrine and molecular profile characterised by lower anabolic signalling and reduced expression of obesity-related genes, suggesting early metabolic differences by feeding mode.

9. Long-term growth outcomes

Large cohort analyses by Rani et al. showed that, at 12 months, formula-fed infants had significantly higher adjusted weight-for-age z-scores than breastfed infants (aMD 0.324–0.471, $p < 0.0001$). At 24 months, differences persisted for weight-for-age (aMD 0.093, $p = 0.012$), while BMI and length differences were attenuated.[22] National survey data from Zong et al. demonstrated that differences in weight and length were small (<0.3 kg and <0.3 cm, respectively).[23] Although formula feeding is associated with higher standardised growth indices in the first two years, the magnitude of differences, and clinical significance remains uncertain beyond infancy.

10. Summary of key findings

In 15 studies, breastfeeding and formula feeding supported adequate infant growth. Formula feeding was associated with faster early weight gain, higher fat-free mass, and higher growth indices, whereas breastfeeding was associated with lower infectious morbidity, favourable immune profiles, lower obesity-related gene expression, and comparable or superior neurodevelopmental outcomes. Differences were most evident in early infancy and tended to diminish by the second year of life.

Findings were synthesised narratively due to significant heterogeneity; meta-analysis and publication bias assessment were not performed. The overall certainty of evidence was low to moderate, reflecting heterogeneity and the predominance of observational studies.

Table 1: Characteristics of studies included in the systematic review

Studies (Year)	Study design / Population	Feeding types compared	Growth outcomes (numerical)	Body composition / biological outcomes	Neurodevelopment/infection outcomes	Key findings/remarks
Paygozar et al.[9]	Comparative longitudinal cohort; preterm infants <37 weeks, n = 100	Breastfeeding vs formula feeding	At 24 months: weight 11.0 vs 11.5 kg; length 90 vs 91 cm; HC 48 vs 49 cm (all $p > 0.05$)	Not assessed	Bayley cognitive score at 24 months: 100 vs 98 (NS)	Comparable long-term growth and neurodevelopment; breastfeeding showed a small, non-significant cognitive advantage
Kamal et al.[20]	Cross-sectional; infants/children 1–32 months, n = 390	Exclusive BF vs partial BF vs FF	Anthropometry was not analysed as a continuous outcome	Not assessed	Infections: diarrhoea 40% (EBF) vs 77% (FF); pneumonia 39.7% vs 71.4%; neurodevelopmental delay 14.1%	Exclusive breastfeeding is strongly associated with reduced infections and better cognitive outcomes

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					vs 77.0% (p = 0.001)	
Amin & Abdulla[1] [1]	Population-based analytical study; term infants 38–40 weeks, n = 207	BF vs FF vs mixed feeding	FF boys at 15 months approached +1 SD weight-for-age; BF remained within WHO median	BMI variability is higher in FF/MF; no persistent height difference at 48 months	Not assessed	Breastfeeding supported stable growth; formula feeding was associated with faster and more variable early weight gain
Vaishnavi et al.[10]	Prospective cohort; healthy term infants, n = 50	Exclusive BF vs exclusive FF	At 12 months: FF infants ~890 g heavier; WAZ 0.98 vs 0.07; WLZ 0.94 vs −0.02 (p ≤ 0.001)	Fat mass at 12 months: 2860 vs 2340 g; centile crossing 40% vs 4% (p = 0.003)	Not assessed	Formula feeding associated with accelerated weight gain and higher adiposity
Tahir et al.[16]	Observational cohort; term infants at 6 months, n = 259	Exclusive BF vs exclusive FF	Weight 7544 ± 1000 vs 7469 ± 966 g (p = 0.659)	Fat-free mass: 5470 g (FF) vs 5105 g (BF), p = 0.002.	Not assessed	Similar size-based growth but distinct body composition trajectories
Ziegler[13]	Quantitative synthesis of cohorts	BF vs FF	42–112 days: weight gain 25.4 vs 28.5 g/day (p < 0.001); higher FF growth up to 12 months	Higher IGF-1 (≈59–81 vs 32 μg/L) and insulin in FF infants	Not assessed	Faster growth in FF infants driven mainly by lean mass and endocrine differences
Zong et al.[23]	National cross-sectional surveys; 1–<12 months, n = 109,052	Exclusive BF vs partial BF vs FF	1–<6 months: BF heavier by 0.09–0.27 kg; length difference <0.3 cm	Not assessed	Not assessed	Feeding-related growth differences were statistically significant but clinically small
Cheshmeh et al.[12]	Case–control; term infants 5–6 months, n = 150	Exclusive BF vs FF vs mixed	Weight 7.3 vs 8.3 kg; length 65.4 vs 70.5 cm; HC 42.8 vs 44.9 cm (all p < 0.001)	FTO expression 3.39 vs 23.6; CPT1A 13.5 vs 42.8; PPAR-α higher in BF	Not assessed	Formula feeding associated with higher adiposity-related gene expression
Hamdan et al.[21]	Case–control; healthy term infants, n = 80	BF vs FF	Weight higher in BF at 6 months (6.86 vs 6.11 kg; p = 0.025)	Higher Hb, WBC, $CD4^+$, $CD8^+$, NK cells in BF infants	Not assessed	Breastfeeding associated with enhanced early immune maturation
Rani et al.[22]	Retrospective cohort; term infants, n = 5515	BF vs standard FF vs non-standard FF	At 12 months: WAZ aMD 0.324–0.471 vs BF (p < 0.0001); persistent WAZ difference at 24 months	Higher BMI z-score with non-standard FF at 12 months	Not assessed	Formula feeding, especially non-standard formula, is associated with higher early weight indices
Lucas et al.[14]	Randomised multicentre trial; preterm <1850 g, n = 502	Donor breast milk vs preterm formula	Weight gain 13.4 vs 16.0 g/kg/day; HC growth 1.30 vs 1.46 mm/day (p < 0.001)	Not assessed	MDI 99.9 vs 101.5; PDI 94.7 vs 94.4 (NS)	Faster growth with formula but equivalent neurodevelopment at 18 months
Bellù et al.[17]	Cross-sectional; term infants at 12 months, n = 79	≥6 months BF vs <2 months BF / FF	Weight 9.16 vs 10.14 kg; length 75.3 vs 77.8 cm (p ≤ 0.01)	Body fat % 23.8 vs 27.1 (p = 0.05)	Not assessed	Formula-fed infants are larger but with higher fat mass
de Bruin et al.[19]	Prospective longitudinal; term infants, n = 46	BF vs FF	No differences in weight, length, and HC up to 12 months	TBF and FFM are largely similar; transient sex-specific differences	Normal Bayley scores at 18 months	Feeding mode had minimal long-term impact on growth or body composition
Butte et al.[18]	Prospective cohort; term infants, n = 76	BF vs FF	Higher FF weight velocity at 3–6 months; no difference by 24 months	BF infants had higher FM at 3–6 months; differences resolved by 12–24 months	Not assessed	Feeding-related body composition differences limited to early infancy
De Curtis et al.[15]	Prospective cohort; term infants 0–2 months, n = 27	BF vs FF	Weight gain 7.7 vs 8.4 g/kg/day (NS)	FM gain 793 vs 909 g (p = 0.39); BMC similar	Not assessed	Early growth and body composition are remarkably similar

Footnotes: BF – Breastfeeding; EBF – Exclusive Breastfeeding; FF – Formula Feeding; MF – Mixed Feeding; HC – Head Circumference; WAZ – Weight-for-Age Z-score; LAZ – Length-for-Age Z-score; WLZ – Weight-for-Length Z-score; BMI – Body Mass Index; FFM – Fat-Free Mass; FM – Fat Mass; IGF-1 – Insulin-Like Growth Factor-1; MDI – Mental Development Index; PDI – Psychomotor

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Development Index; WHO – World Health Organization. TBF and FM were reported as defined in the original studies. Data are presented as mean ± standard deviation, median, frequency, and percentage. The chi-square test was used for comparison, and statistical significance was set at $p < 0.05$.

CONCLUSION

Both breastfeeding and formula feeding support adequate infant growth and survival. Formula feeding is associated with faster early weight gain, whereas breastfeeding is linked to lower infectious morbidity, favourable immune and metabolic profiles, and comparable or more favourable neurodevelopmental outcomes. These differences are most pronounced in early infancy and tend to diminish over time. Breastfeeding should be encouraged as the preferred feeding method whenever feasible, whereas formula feeding remains an appropriate alternative when breastfeeding is not possible. Feeding practices should be individualised based on gestational age, clinical condition, maternal factors, and available resources. Further large, well-designed longitudinal studies are needed to clarify subgroup-specific effects and long-term health implications of these associations.

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