

Optimization Of Formula-Feeding Knowledge and Safe Feeding Practices Among Primiparous mothers in a Selected Community Area of Odisha: A Pre-Experimental Evaluative Study

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Abstract

Introduction

Safe formula feeding depends on caregiver's understanding and consistent application of appropriate preparation and handling practices. Primiparous mothers may be particularly vulnerable to gaps in knowledge because of their limited previous experience with infant feeding. Inadequate attention to hygiene, measurement, equipment sterilization, preparation, storage, and feeding procedures may increase avoidable risks to infant health. Structured, evidence-informed maternal education delivered by nurses may therefore provide an important opportunity to strengthen knowledge and promote safer feeding practices.

Objective

To evaluate the effectiveness of a planned teaching programme in improving knowledge and safe formula-feeding practices among primiparous mothers in a selected community area of Odisha.

Methods

A quantitative, pre-experimental, one-group pre-test–post-test design was employed. The study comprised 100 primiparous mothers of infants aged 0–12 months, recruited using purposive sampling. Baseline assessment was undertaken using a structured knowledge questionnaire and a practice assessment tool. Participants subsequently received a planned teaching programme addressing essential components of safe formula feeding, including preparation, hand hygiene, sterilization of feeding equipment, accurate measurement, storage, feeding procedures, and prevention of unsafe practices. A post-test assessment was conducted following the intervention. Descriptive statistics were used to summarize participant characteristics and outcome measures, while paired-samples t tests were applied to assess changes in knowledge and practice scores. Chi-square tests were used to examine associations between post-test outcomes and selected socio-demographic characteristics. The dissertation reports the use of a 100-participant pre-experimental one-group pre-test–post-test design.

Results

A marked improvement was observed in both knowledge and safe feeding practices following the planned teaching programme. The mean knowledge score increased from 7.0 ± 1.82 at baseline to 13.7 ± 1.15 following the intervention, representing a mean increase of 6.70 points; this difference was statistically significant (paired $t = 31.32$, $df = 99$, $p < 0.001$). The proportion of mothers achieving an adequate level of knowledge increased from 0% before the intervention to 95% after the intervention. Similarly, the mean practice score increased from 8.9 ± 1.94 at pre-test to 17.8 at post-test, corresponding to a reported mean improvement of 8.90 points (paired $t = 38.25$, $df = 99$, $p < 0.001$). The proportion demonstrating adequate feeding practice increased from 0% to 92%. Educational attainment was reported to have a statistically significant association with post-test knowledge and practice outcomes.

Conclusion

The findings indicate that the planned teaching programme was associated with substantial short-term improvements in mother's knowledge and safe formula-feeding practices. A structured educational approach may therefore be a valuable component of community-based maternal and child health nursing services, particularly for first-time mothers requiring guidance on safe formula preparation and feeding. Nevertheless, interpretation should consider the absence of a comparison group and the short post-intervention assessment period. Further controlled studies with larger samples and longer follow-up are warranted to determine whether these improvements are sustained and translate into consistent real-world feeding practices.

Keywords: Infant Formula, Formula Feeding, Primiparous Mothers, Maternal Knowledge, Safe Feeding Practices, Planned Teaching Programme, Maternal Education, Community Health Nursing, Infant Feeding, Odisha.

1. Introduction

1.1 Background

The first year of life is a critical period for growth and development, making safe and adequate infant feeding essential for optimal health. Although breastfeeding is the recommended method of infant feeding, some mothers use infant formula when breastfeeding is not possible, insufficient, contraindicated, or when an alternative feeding method is required. In these circumstances, the safety of formula feeding depends substantially on correct preparation, handling, storage, and administration. Unsafe formula-feeding practices may result from errors in hand hygiene, cleaning and sterilization of feeding equipment, measurement and dilution of formula, water safety, preparation, storage, and feeding practices. Such errors may increase the risk of microbial contamination and inappropriate nutrient intake. Therefore, maternal knowledge and practical adherence to recommended formula-feeding procedures are important components of infant safety.

Primiparous mothers represent a particularly relevant population because they are undertaking infant-feeding responsibilities for the first time. Their feeding practices may be influenced by family members, healthcare professionals, peers, digital media, and other information sources, which may vary in accuracy. Structured education can provide standardized information, correct misconceptions, and translate recommended practices into practical skills. Demonstration-based teaching may be particularly useful for procedures involving hygiene, preparation, storage, and administration.

Community-based education provides an opportunity to address these knowledge and practice gaps within routine maternal and child health services. Nurses are well positioned to provide individualized counselling, demonstration, reinforcement, and follow-up related to safe infant feeding. However, evidence regarding the effectiveness of structured educational interventions specifically targeting formula-feeding knowledge and practices among primiparous mothers in community settings remains limited.

Therefore, the present study evaluated the effectiveness of a planned teaching programme on knowledge and safe formula-feeding practices among primiparous mothers in a selected community area of Odisha. The study assessed changes in knowledge and formula-feeding practices following the educational intervention.

1.2 Rationale for the Study

Global: Powdered infant formula is not sterile and can become contaminated during preparation or storage. WHO therefore recommends strict hygiene, sterilization of feeding equipment and safe preparation practices.

India: A community-based study among 300 mothers in Kerala reported formula-feeding prevalence of 53.3% (95% CI: 47.5–59.1%), indicating substantial exposure to formula-feeding practices.

Practice Evidence: A study of 151 parents found that only 78.3% of kettle users and 14.9% of formula-preparation machine users achieved the recommended water temperature of $\geq 70^{\circ}\text{C}$, demonstrating important gaps in safe preparation practices.

Odisha: A 2026 community-based intervention study among mothers in a tribal area of Odisha reported the need for structured education to improve maternal and infant-care practices, supporting the relevance of community-based health education. Despite these concerns, evidence evaluating structured formula-feeding education among primiparous mothers in community settings of Odisha remains limited. Therefore, the present study evaluated the effectiveness of a planned teaching programme on mother's knowledge and safe formula-feeding practices.

1.3 Objective

To evaluate the effectiveness of a planned teaching programme on knowledge and safe formula-feeding practices among primiparous mothers in a selected community area of Odisha, and to examine their association with selected socio-demographic characteristics.

1.4 Hypotheses

H1: The planned teaching programme will significantly improve knowledge and safe formula-feeding practice scores among primiparous mothers.

H2: Post-test knowledge and practice levels will be significantly associated with selected socio-demographic characteristics.

1.5 Conceptual Framework

The study was guided by Ludwig von Bertalanffy's General Systems Theory, comprising input, process, output, and feedback. Baseline maternal knowledge and formula-feeding practices constituted the input; the planned teaching programme represented the process; post-intervention knowledge and practice constituted the output; and reassessment provided the feedback for evaluating change.

2. Methods

2.1 Study Design and Research Approach

A quantitative evaluative approach was used with a pre-experimental, one-group pre-test–post-test design to evaluate changes in formula-feeding knowledge and safe feeding practices following a planned teaching programme. The study included 100 primiparous mothers.

The study design was represented as:

$O_1 \rightarrow X \rightarrow O_2$

where O_1 represents the pre-test assessment of knowledge and safe feeding practices, X represents the planned teaching programme, and O_2 represents the post-test assessment using the same outcome measures. This design enabled comparison of participants' outcomes before and after the intervention.

2.2 Study Setting

The study was conducted at Primary Health Centre (PHC), Karngamal, Odisha and selected Anganwadi (AWW) centres in Boden, Odisha.

The selection of a community setting was appropriate for evaluating an educational intervention focused on maternal knowledge and infant-feeding practices, as community-based nursing services provide opportunities for health education, counselling, and reinforcement of appropriate maternal practices.

2.3 Study Population

The study population comprised primiparous mothers of infants aged 0–12 months residing in the selected community area of Odisha.

2.4 Sample Size and Sampling Technique

A total of 100 primiparous mothers were included in the study. Participants were selected using purposive sampling based on the predetermined eligibility criteria.

2.5 Eligibility Criteria

2.5.1 Inclusion Criteria

Mothers were eligible if they were primiparous, had an infant aged 0–12 months, resided in the selected area, were currently using or planning to initiate formula feeding, understood Odia, and were willing to participate and complete the intervention and 7-day post-test.

2.5.2 Exclusion Criteria

Mothers were excluded if they were health professionals, had infants requiring specialized feeding, had received similar formula-feeding education within the previous three months, or were unavailable during the data-collection period.

2.6 Study Variables

Independent variable: Planned teaching programme on safe formula feeding.

Dependent variables: Knowledge regarding formula feeding and safe formula-feeding practices.

Selected socio-demographic variables: Age, education, occupation, monthly family income, type of family, residence, and source of information.

2.7 Planned Teaching Programme

The planned teaching programme provided structured education on safe and appropriate formula feeding. The content included formula-feeding principles, hand hygiene, sterilization of feeding equipment, correct measurement and reconstitution of formula, safe storage and handling, and appropriate feeding practices. The programme was delivered using lecture-cum-discussion and PowerPoint presentation, with emphasis on practical guidance for safe formula preparation and feeding.

2.8 Data Collection Instruments

Data were collected using a structured assessment package comprising a socio-demographic proforma, knowledge questionnaire, and practice assessment tool.

2.8.1 Socio-demographic Proforma

The socio-demographic proforma was used to obtain selected participant characteristics, including age, educational attainment, occupation, monthly family income, type of family, residence, and source of information. These characteristics were subsequently considered in the analysis of associations with post-test outcomes.

2.8.2 Structured Knowledge Questionnaire

Maternal knowledge regarding formula feeding was assessed using a 15-item structured knowledge questionnaire covering key aspects of safe formula feeding. Each correct response received one mark, with a maximum score of 15. Knowledge levels were categorized as inadequate (<50%), average (50–75%), and adequate (>75%).

2.8.3 Practice Assessment Tool

Safe formula-feeding practices were assessed using a 10-item structured practice tool with a maximum score of 20. Practice levels were categorized as inadequate (<50%), average (50–75%), and adequate (>75%). Pre-test and post-test practice scores were compared to assess changes following the planned teaching programme.

2.9 Establishment of Validity and Reliability

The instruments were reviewed for content validity by the research guide and four experts from obstetric and gynecological nursing, paediatrics, nutrition, and biostatistics. Reliability of the knowledge questionnaire was assessed using Cronbach's alpha, with a coefficient of ≥ 0.70 , indicating satisfactory internal consistency. A pilot study involving 10 primiparous mothers was conducted to assess the feasibility, clarity, and applicability of the instruments and study procedures before the main study.

2.10 Data Collection Procedure

Data collection was conducted from 20 March 2025 to 25 May 2025 at the selected study settings following approval from the relevant authorities. Eligible primiparous mothers were informed about the study objectives and procedures, and written informed consent was obtained before enrolment.

Baseline assessment of formula-feeding knowledge and safe feeding practices was conducted using the structured study instruments. The planned teaching programme was subsequently administered using standardized educational content and appropriate teaching methods. A post-test was conducted after 7 days using the same instruments. Pre-test and post-test scores were compared to evaluate changes in knowledge and safe formula-feeding practices following the intervention.

2.11 Ethical Considerations

Ethical principles were maintained throughout the research process. Permission was obtained from the concerned authorities before commencement of the study.

Participants were informed about the purpose and procedures of the research, and participation was entirely voluntary. Written informed consent was obtained before enrolment.

Participants were informed of their right to withdraw from the study without any adverse consequences. Privacy was maintained during data collection, and confidentiality of participant information was protected throughout the study. All information obtained during the research process was used exclusively for academic and research purposes.

2.12 Statistical Analysis

Data were coded, tabulated, and analyzed using descriptive and inferential statistics. Categorical variables were summarized using frequencies and percentages, while continuous outcome scores were presented as mean $\pm$ standard deviation (SD). Pre-test and post-test knowledge and safe feeding practice scores were compared using the paired-samples t-test. Associations between post-test knowledge and practice categories and selected sociodemographic characteristics were assessed using the chi-square test. All tests were two-sided, and $p < 0.05$ was considered statistically significant.

3. Results

3.1 Participant Characteristics

A total of 100 primiparous mothers participated in the study. The largest proportion were aged 21–25 years (45%), followed by 26–30 years (40%) and >30 years (15%). Regarding educational attainment, 45% had secondary education, 30% were graduates or above, and 25% had primary education. Most participants were homemakers (70%), and 55% belonged to nuclear families. Nearly two-thirds (65%) resided in rural areas.

With respect to family income, 35% reported a monthly income of ₹10,001–20,000, while 25% reported 20,001–30,000 and 20% each reported <₹10,000 and >₹30,000. Healthcare personnel were the most frequently reported source of formula-feeding information (40%), followed by family or friends (30%) and media sources, including television and the internet (30%).

Table 1. Socio-demographic Characteristics of the Study Participants (N = 100)

Characteristic	Category	n (%)
Age (years)	21–25	45 (45.0)
	26–30	40 (40.0)
	>30	15 (15.0)
Education	Primary	25 (25.0)
	Secondary	45 (45.0)
	Graduate and above	30 (30.0)
Occupation	Homemaker	70 (70.0)
	Working	30 (30.0)
Monthly family income	<10,000	20 (20.0)
	10,001–20,000	35 (35.0)
	20,001–30,000	25 (25.0)
	>₹30,000	20 (20.0)
Type of family	Nuclear	55 (55.0)
	Joint	35 (35.0)
	Extended	10 (10.0)
Residence	Rural	65 (65.0)
	Urban	35 (35.0)
Source of information	Healthcare personnel	40 (40.0)
	Family/friends	30 (30.0)
	Media (TV/internet)	30 (30.0)

3.2 Baseline Knowledge Regarding Formula Feeding

At baseline, none of the participants demonstrated adequate knowledge regarding safe formula feeding. Of the 100 mothers, 68 (68%) had an average level of knowledge, while 32 (32%) had inadequate knowledge, indicating substantial gaps in baseline understanding of safe formula-feeding practices.

Table 2. Pre-Test and Post-Test Distribution of Mothers According to Knowledge Level (N = 100)

Knowledge level	Score interpretation	Pre-test n (%)	Post-test n (%)
Inadequate	<50%	32 (32.0)	0 (0.0)
Average	50–75%	68 (68.0)	5 (5.0)
Adequate	>75%	0 (0.0)	95 (95.0)
Total		100 (100.0)	100 (100.0)

The findings demonstrate a marked redistribution of participants from the inadequate and average categories toward the adequate category following the intervention.

3.3 Post-Intervention Knowledge

Following the planned teaching programme, knowledge regarding safe formula feeding improved markedly. The proportion of mothers with adequate knowledge increased from 0% at pre-test to 95% at post-test, whereas inadequate knowledge decreased from 32% to 0%. At post-test, only 5% of mothers remained in the average knowledge category.

Consistent with these categorical findings, the mean knowledge score increased from 7.0 ± 1.82 at pre-test to 13.7 ± 1.15 at post-test, with a mean increase of 6.70 points.

3.4 Baseline Safe Formula-Feeding Practices

At baseline, safe formula-feeding practices were predominantly classified as average. Among the 100 participants, 72 (72%) demonstrated average practice, while 28 (28%) demonstrated inadequate practice. No participant achieved the adequate-practice category before the intervention.

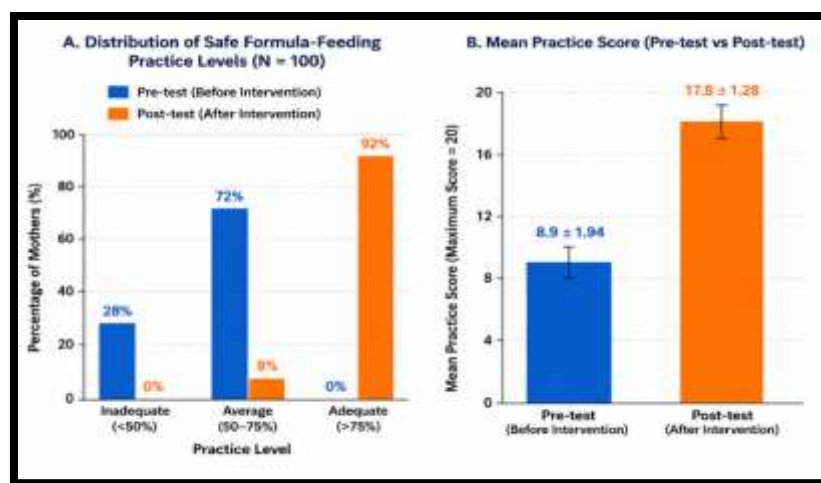
Table 3. Pre-Test and Post-Test Distribution of Mothers According to Practice Level (N = 100)

Practice level	Score interpretation	Pre-test n (%)	Post-test n (%)
Inadequate	<50%	28 (28.0)	0 (0.0)
Average	50–75%	72 (72.0)	8 (8.0)
Adequate	>75%	0 (0.0)	92 (92.0)
Total		100 (100.0)	100 (100.0)

3.5 Post-Intervention Safe Formula-Feeding Practices

Following the planned teaching programme, a marked improvement was observed in mothers' safe formula-feeding practices. The proportion demonstrating adequate practice increased from 0% at pre-test to 92% at post-test, while inadequate practice decreased from 28% to 0%. The proportion with average practice decreased from 72% to 8%.

The mean practice score increased from 8.9 ± 1.94 at pre-test to 17.8 ± 1.28 at post-test, indicating a substantial improvement in safe formula-feeding practices following the intervention.



3.6 Pre–Post Comparison of Knowledge

The paired analysis demonstrated a statistically significant improvement in knowledge following the planned teaching programme.

The mean knowledge score increased from 7.0 ± 1.82 at pre-test to 13.7 ± 1.15 at post-test, producing a mean difference of 6.70 points. The reported paired t statistic was 31.32 with 99 degrees of freedom, and the difference was statistically significant at $p < 0.001$.

Table 4. Pre-Test and Post-Test Knowledge Scores Following the Planned Teaching Programme

Assessment	Mean $\pm$ SD	Mean difference	t	df	p
Pre-test	7.00 ± 1.82	6.70	31.32	99	<0.001
Post-test	13.70 ± 1.15				

Thus, the study demonstrated a statistically significant increase in maternal knowledge following the planned teaching programme.

3.7 Pre–Post Comparison of Safe Formula-Feeding Practices

A statistically significant improvement was observed in safe formula-feeding practices following the planned teaching programme. The mean practice score increased from 8.90 ± 1.94 at pre-test to 17.80 ± 1.28 at post-test, yielding a mean improvement of 8.90 points. The paired-samples t test demonstrated a statistically significant difference between pre-test and post-test practice scores ($t = 38.25$, $df = 99$, $p < 0.001$).

Table 5. Pre-Test and Post-Test Safe Formula-Feeding Practice Scores

Assessment	Mean $\pm$ SD	Mean Difference	t	df	p value
Pre-test	8.90 ± 1.94	8.90	38.25	99	<0.001
Post-test	17.80 ± 1.28				

3.8 Association between Post-Test Knowledge and Socio-demographic Characteristics

The chi-square analysis showed that educational attainment was significantly associated with both post-test knowledge ($\chi^2 = 11.42$, $df = 2$, $p = 0.003$) and safe feeding practices ($\chi^2 = 10.85$, $df = 2$, $p = 0.004$). Source of formula-feeding information was also significantly associated with post-test knowledge ($\chi^2 = 6.21$, $df = 2$, $p = 0.045$) and safe feeding practices ($\chi^2 = 7.03$, $df = 2$, $p = 0.030$). In contrast, age, occupation, monthly family income, type of family, and residence were not significantly associated with either post-test knowledge or safe feeding practices ($p > 0.05$). Overall, the findings suggest that educational attainment and the source of formula-feeding information were the socio-demographic factors most strongly associated with post-intervention outcomes.

Table 6. Association of Post-Test Knowledge and Safe Formula-Feeding Practices with Selected Socio-demographic Characteristics (N = 100)

Socio-demographic variable	Outcome	χ^2	df	p value	Interpretation
Age	Knowledge	5.24	2	0.072	NS
Education	Knowledge	11.42	2	0.003	S
Occupation	Knowledge	4.89	2	0.086	NS
Monthly family income	Knowledge	3.76	3	0.289	NS
Type of family	Knowledge	2.94	2	0.230	NS
Residence	Knowledge	1.82	1	0.177	NS
Source of information	Knowledge	6.21	2	0.045	S
Age	Safe feeding practice	3.91	2	0.141	NS
Education	Safe feeding practice	10.85	2	0.004	S
Occupation	Safe feeding practice	3.27	1	0.071	NS
Monthly family income	Safe feeding practice	4.18	3	0.243	NS
Type of family	Safe feeding practice	2.61	2	0.271	NS
Residence	Safe feeding practice	2.47	1	0.116	NS
Source of information	Safe feeding practice	7.03	2	0.030	S

(χ^2 = chi-square statistic; df = degrees of freedom; S = statistically significant; NS = not statistically significant; statistical significance was set at two-sided $p < 0.05$.)

3.10 Summary of the Main Results

The planned teaching programme was associated with significant improvements in maternal knowledge and safe formula-feeding practices. Knowledge increased from 68% average and 32% inadequate at pre-test to 95% adequate and 5% average at post-test. Similarly, practice levels improved from 72% average and 28% inadequate to 92% adequate and 8% average, respectively. The mean knowledge score increased by 6.70 points ($t = 31.32$, $df = 99$, $p < 0.001$), while the mean practice score increased by 8.90 points ($t = 38.25$, $df = 99$, $p < 0.001$).

Educational attainment was significantly associated with post-test knowledge ($p = 0.003$) and practice ($p = 0.004$). Source of formula-feeding information was also significantly associated with post-test knowledge ($p = 0.045$) and practice ($p = 0.030$). Age, occupation, family income, family type, and residence were not significantly associated with either outcome ($p > 0.05$).

4. Discussion

The present study demonstrated significant improvements in maternal knowledge and safe formula-feeding practices following the planned teaching programme. Adequate knowledge increased from 0% to 95%, while adequate practice increased from 0% to 92% at post-test.

The mean knowledge score increased from 7.0 ± 1.82 to 13.7 ± 1.15 (mean difference = 6.70; $t = 31.32$, $df = 99$, $p < 0.001$). Similarly, the mean practice score increased from 8.9 ± 1.94 to 17.8 (mean difference = 8.90; $t = 38.25$, $df = 99$, $p < 0.001$). These findings indicate significant short-term improvement following structured education.

Educational attainment was significantly associated with post-test knowledge ($\chi^2 = 11.42$, $p = 0.003$) and practice ($\chi^2 = 10.85$, $p = 0.004$), suggesting that educational background may influence mothers' ability to understand and apply feeding-related information.

Overall, the findings support the potential value of structured education in strengthening formula-feeding knowledge and practices among primiparous mothers. However, the one-group pre-test–post-test design and absence of a comparison group limit causal inference; therefore, the observed improvements cannot be attributed solely to the intervention.

5.1 Strengths

The study addressed an important aspect of maternal and infant health by evaluating both formula-feeding knowledge and safe feeding practices among primiparous mothers. Its community-based setting enhances relevance to routine maternal and child health services, while the sample of 100 mothers provided an adequate basis for assessing pre–post changes.

5.2 Limitations

The one-group pre-test–post-test design without a comparison group limits causal inference. Purposive sampling may reduce generalizability, and the 7-day post-test interval limits assessment of long-term retention and sustainability of improved feeding practices. Future studies should consider controlled designs, probability sampling, larger samples, and longer follow-up periods.

6. Implications for Nursing

6.1 Nursing Practice

Structured formula-feeding education can be incorporated into community maternal and child health services. Nurses can provide practical counselling, demonstrations, and reinforcement of safe feeding practices for first-time mothers.

6.2 Nursing Education

Safe formula-feeding practices can be included in maternal and newborn health education. Nursing students and practicing nurses can be trained to provide standardized, practical, and easily understandable guidance.

6.3 Nursing Administration

Nursing administrators can facilitate the integration of standardized formula-feeding education into routine community and postnatal services through appropriate teaching protocols and educational resources.

6.4 Nursing Research

The findings provide a basis for further research on formula-feeding education. Future studies should consider larger samples, controlled designs, multiple settings, and longer follow-up to assess sustained improvements in knowledge and practice.

7. Conclusion

The planned teaching programme was associated with significant short-term improvements in knowledge and safe formula-feeding practices among primiparous mothers. Adequate knowledge increased from 0% to 95%, while adequate practice increased from 0% to 92%, with significant pre–post improvements in both outcomes ($p < 0.001$).

These findings suggest that structured maternal education may be a useful community-based nursing strategy for strengthening safe formula-feeding practices. However, the absence of a comparison group limits causal interpretation. Future controlled studies with larger, diverse samples and longer follow-up are warranted to determine the sustainability and generalizability of these effects.

8. Declarations

8.1 Ethical Approval and Consent to Participate

The study was conducted after obtaining permission from the concerned authorities and approval from the appropriate ethics committee. Written informed consent was obtained from all participants before enrolment. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without penalty or adverse consequences.

8.2 Funding

The authors received no external funding for this study.

8.3 Author Contributions

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9. References

1. Codex Alimentarius Commission. Standard for infant formula and formulas for special medical purposes intended for infants (CXS 72-1981). Rome: FAO/WHO; 2024.
2. World Health Organization. Safe preparation, storage and handling of powdered infant formula. Geneva: World Health Organization; 2007.
3. American Academy of Pediatrics. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics*. 2008;122(5):1142-52.
4. Rosenkranz RR, et al. Variability and error in measurement of infant formula powder and water. *Front Nutr*. 2024;11:1432105.
5. Appleton J, Laws R, Russell CG, Fowler C, Campbell K, Denney-Wilson E. Informing infant nutrition: timing of infant formula advice. *J Nutr Educ Behav*. 2022;54(12):1113-22. Available from: <https://www.jneb.org/article/S1499-4046%2822%2900419-5/fulltext>
6. Morin KH. Preparing infant formula: increasing caregiver knowledge. *MCN Am J Matern Child Nurs*. 2009;34(4):244-9.
7. Kesavelu D, et al. Optimization of infant nutrition: feeding practices among Indian mothers. *Cureus*. 2024;16(3).
8. Yadav A. Effectiveness of video-assisted planned teaching programme on weaning knowledge among mothers. *J Fam Med Prim Care*. 2025;14(1):88-94.
9. Abebe L, Aman M, Asfaw S, Gebreyesus H, Teweldemedhin M. Formula feeding practice and associated factors among urban and rural mothers in Jimma Zone, Ethiopia: a comparative study. *BMC Pediatr*. 2019;19:425. Available from: <https://bmcpediatr.biomedcentral.com/articles/10.1186/s12887-019-1789-8>
10. Ali MS, et al. Determinants of formula feeding among mothers of infants 0-6 months. *PLoS One*. 2024;19(6).
11. Raj D, et al. Evaluation of infant feeding knowledge and practices among mothers. *J Neonatal Nurs*. 2025. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S1355184125000791>
12. Hvatum I, Alver E, Fugelsnes K, McInnes RJ, Schytt E. Health professionals' counselling on the use of infant formula. *Public Health Nurs*. 2024;41(5):785-94. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/phn.13355>
13. Terefe Y, et al. Multilevel modelling analysis of bottle feeding and its determinants in East Africa: evidence from DHS. *Int Breastfeed J*. 2024;19(1):29. Available from: <https://internationalbreastfeedingjournal.biomedcentral.com/articles/10.1186/s13006-024-00629-w>
14. Hunde BM, Sitotaw IK, Elema TB. Magnitude of bottle-feeding practice and associated factors among mothers of 0-24 months' children in Asella town, Oromia region, Ethiopia. *BMC Nutr*. 2023;9(1):79. doi:10.1186/s40795-023-00733-w.
15. Alemu HA, Melese E, Abebe H, Getachew T. Formula feeding practice and associated factors among mothers with infants younger than six months in Bahir Dar, Ethiopia. *BMC Pediatr*. 2023;23(1):547. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10680373/>
16. Ventura AK, et al. Knowledge and use of paced bottle-feeding among mothers. *J Acad Nutr Diet*. 2023;123(10):1992-2003. Available from: <https://www.sciencedirect.com/science/article/pii/S1499404623004724>
17. Swigart TM, Hernandez-Villanueva M, Reifsnider E. Professional and non-professional sources of formula feeding advice for parents in the first six months. *Matern Child Nutr*. 2022;18(1). doi:10.1111/mcn.13271.

18. Barnes LA, Coulthard H, Johnson L. Influencers of women's choice and experience of exclusive formula feeding: a qualitative study. *Midwifery*. 2021;101:103061.
19. Abebe K, Tesema GA, Mengesha ZB. Formula-feeding practice and associated factors among urban and rural mothers with infants 0-6 months of age: a comparative study in Jimma zone Western Ethiopia. *BMC Res Notes*. 2019;12(1):801. doi:10.1186/s13104-019-4828-x.
20. Rahman A, et al. Reasons for formula feeding among rural Bangladeshi mothers: a qualitative study. *PLoS One*. 2019;14(2). Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0211761>
21. Wong MS, Berliner P, Salem-Schatz L, Asiodu I, Ross-Johnson K, Watson S, et al. Effectiveness of educational and supportive interventions for improving infant feeding outcomes. *Int J Nurs Stud*. 2021;115:103856. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S0020748921000067>
22. Wagner CL, Greer FR; American Academy of Pediatrics Section on Breastfeeding; American Academy of Pediatrics Committee on Nutrition. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics*. 2008;122(5):1142-52. doi:10.1542/peds.2008-1862. Available from: <https://publications.aap.org/pediatrics/article/122/5/1142/71470/Prevention-of-Rickets-and-Vitamin-D-Deficiency-in>
23. Baghianimoghadam MH, Nadrian H, Rahaei Z. The effects of education on formula and bottle-feeding behaviors of nursing mothers based on PRECEDE model. *Iran J Pediatr*. 2009;19(4):359-66. Available from: <https://www.cabidigitallibrary.org/doi/pdf/10.5555/20103015319>
24. Getachew D, Yirsaw AN, Arefeayine GL, Andargie GA, Lakew AB, Tareke AA, et al. Prevalence of bottle-feeding practice and associated factors among mothers of children under five in the world, 2024: systematic review and meta-analysis. *Reprod Fem Child Health*. 2024;4:1-14. Available from: https://www.researchgate.net/publication/385159309_Prevalence_of_Bottle-Feeding_Practice_and_Associated_Factors_Among_Mothers_of_Children_Under_Five_in_the_World_2024_Systematic_Review_and_Meta-Analysis
25. Silano M, Paganin P, Davanzo R. Time for the 70°C water precautionary option in the home dilution of powdered infant formula. *Ital J Pediatr*. 2016;42:17. doi:10.1186/s13052-016-0228-9.
26. Grant A, Jones S, Sibson V, Ellis R, Dolling A, McNamara T, et al. The safety of at home powdered infant formula preparation: a community science project. *Matern Child Nutr*. 2024;20(1). doi:10.1111/mcn.13567.
27. Mohammed FZ, Gashu A, Walle AD, Tizazu MA, Urgie BM, Beshah SH. Infant formula feeding and associated factors in Debre Berhan City: a community based cross-sectional study. *Heliyon*. 2024;10(18). doi:10.1016/j.heliyon.2024.e37594.
28. Lawrence RA, Lawrence RM. *Breastfeeding: a guide for the medical profession*. 7th ed. Elsevier Mosby; 2011.
29. Kaur S, Singh T, Kaur H. Knowledge and practices of mothers regarding infant feeding practices. *Int J Nurs Educ*. 2015;7(2):134-8.
30. Kesavelu D, Dhanasekhar S, Akram W, Rachel A, Balakrishnan Sugumaran L. Optimization of infant nutrition: exploring feeding practices among Indian mothers. *Cureus*. 2024;16(11). doi:10.7759/cureus.73142.