International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Longitudinal Study on Nutritional Assessment of Maternal and Infants (<1 Year) of Selected Rural Areas in Vijayapura District of Karnataka, India

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Abstract

Introduction

Breastfeeding plays a critical role in infant nutrition and development, offering numerous health benefits for both the mother and child. However, knowledge, attitude, and practices (KAP) related to breastfeeding vary among populations, influenced by socio-economic factors, cultural beliefs, and access to healthcare information. This study aimed to assess the knowledge, attitude, and practices of breastfeeding mothers in rural and urban areas and evaluate the impact of a nutrition education intervention on these parameters.

Methodology

A cross-sectional study was conducted among lactating mothers (N=100) to collect demographic details, dietary habits, and anthropometric measurements of infants. Data on mothers' knowledge, attitude, and practices (KAP) regarding breastfeeding were gathered using structured questionnaires. Nutrient intake was assessed through 24-hour dietary recall. Anthropometric measurements of infants were compared with WHO growth standards. A nutrition education intervention was implemented, and pre- and post-intervention data were analyzed to assess its impact. Statistical analyses, including chi-square tests and t-tests, were performed to determine significant differences ($p<0.05$).

Results

The majority of respondents (74%) were aged 18-25 years, with most living in joint families (82%) and having primary education (51%). While 91% received breastfeeding counseling, only 27% followed the recommended six-month exclusive breastfeeding practice. Attitudinal assessment revealed that 81% disagreed that formula feeding was more convenient than breastfeeding, and 69% strongly agreed that breastfeeding benefits extend beyond infancy. Practice analysis showed that 43% initiated breastfeeding within the first hour of birth, while 70% fed their infants every two hours. Nutrient intake analysis indicated deficiencies in energy (43.66% of RDA), iron (43.86%), vitamin C (29.24%), and calcium

(23.73%). Infant anthropometric measurements were lower than WHO reference values, particularly in weight and height. Post-intervention, the proportion of mothers with good knowledge increased from 60% to 80% ($p<0.05$), and those with a positive attitude rose from 10% to 40% ($p<0.05$), while improvements in breastfeeding practices were not statistically significant.

Conclusion

The study highlights gaps in breastfeeding knowledge and practices among mothers, despite awareness of its benefits. Nutritional deficiencies and growth faltering in infants emphasize the need for targeted interventions. The nutrition education program significantly improved maternal knowledge and attitudes toward breastfeeding, although changes in practice were minimal. Further interventions are required to address breastfeeding challenges and promote optimal infant nutrition.

Keywords: Nutritional assessment, Breastfeeding, Socio-economic factors, Maternal nutrition, Infant growth, Stunting, Complementary feeding

INTRODUCTION

Malnutrition remains a critical public health challenge, significantly affecting maternal and child health outcomes worldwide. According to the World Health Organization (WHO) and UNICEF, an estimated 45 million children under five suffer from wasting, and 149 million are stunted globally [12] In Africa, 34% of children under five are stunted, 13.5% suffer from wasting, and 23.6% are underweight, highlighting the severe nutritional disparities across regions [15]. Stunting, a key indicator of chronic under nutrition, is defined as a height-for-age measurement below two standard deviations from the WHO Child Growth Standards median [14]. It results from inadequate maternal nutrition, intrauterine growth retardation, suboptimal breastfeeding practices, and repeated infections, leading to irreversible consequences such as impaired cognitive and physical development, increased susceptibility to infections, and a higher risk of chronic diseases later in life [2]. Additionally, children who experience early-life stunting followed by rapid weight gain in later years are more prone to obesity and metabolic disorders, perpetuating a cycle of malnutrition and poor health outcomes [13].

Despite nationwide programs such as the Integrated Child Development Services (ICDS) and the Mid-Day Meal Scheme, undernutrition remains prevalent in India. The National Family Health Survey (NFHS-5, 2019–21) reported that 35.5% of children under five years are stunted, 32.1% are underweight, and 19.3% suffer from wasting [10]. These figures are even more concerning in Karnataka, particularly in Vijayapura, where stunting rates exceed 40%, indicating severe nutritional challenges [6]. Furthermore, India faces a triple burden of malnutrition—under nutrition, micronutrient deficiencies, and rising obesity—necessitating region-specific interventions that address the diverse nutritional needs of vulnerable populations.

Breastfeeding and complementary feeding practices play a crucial role in shaping infant growth and development. According to NFHS-5, only 41.8% of Indian infants initiate breastfeeding within the first hour of birth, and just 63.7% receive exclusive breastfeeding for six months [10]. Delayed initiation of breastfeeding and improper complementary feeding contribute to malnutrition, further exacerbating health disparities among infants in urban and rural communities. The nutritional status of lactating mothers also directly impacts infant health, highlighting the need for targeted interventions focusing on maternal diet, feeding knowledge, and socio-economic determinants. The NITI Aayog (2022) report revealed that Vijayapura alone accounts for 103,806 stunted children, 33,924 wasted children, 88,201

underweight children, and 132,459 cases of anemia. While child wasting declined by 4% between 2016 and 2020, stunting and anemia showed only marginal improvements, signifying persistent nutritional challenges that require urgent attention.

This longitudinal study aims to assess the nutritional status of lactating mothers and infants (<1 year) in selected urban areas of Vijayapura district, Karnataka, India. The research focuses on evaluating maternal anthropometric measurements, infant growth parameters, and maternal knowledge, attitudes, and practices (KAP) related to breastfeeding and complementary feeding before and after an intervention. By analyzing the impact of nutrition education on improving maternal awareness and feeding practices, this study seeks to provide evidence-based recommendations for enhancing maternal and child nutrition outcomes in urban Karnataka.

Specific Objectives:

- Assessing the socioeconomic and nutritional status of lactating mothers and infants.
- Studying the knowledge, attitudes, and practices of breastfeeding and complementary feeding.
- Evaluating the impact of nutrition interventions on maternal and child nutrition.

Methodology:

A random sampling method was employed to select 100 lactating mothers (aged 18-35 years) with infants (aged 0-12 months) from selected rural areas of Vijayapura district, Karnataka, India. Participant recruitment was conducted through Anganwadi centers, primary health centers (PHCs), and village health camps. The study objectives were thoroughly explained to the participants, and informed consent was obtained before initiating data collection. A structured questionnaire was used to collect demographic and socio-economic information, including age, education, occupation, family structure, family size, and annual income. The knowledge, attitude, and practices (KAP) of respondents regarding breastfeeding and complementary feeding were assessed using the same structured questionnaire.

The nutritional status of lactating mothers was evaluated using a 24-hour dietary recall method over three consecutive days, excluding holidays, festivals, and special occasions to ensure dietary intake consistency. Additionally, anthropometric measurements such as height and weight were recorded for all lactating mothers. The nutritional status of infants was assessed through anthropometric measurements, including weight, length/height, and head circumference, following Jelliffe's (1966) guidelines. Weight was measured using an infant weighing scale with an accuracy of 0.2 kg; while length/height was recorded using an infant meter with precision up to 0.1 cm. Head circumference was measured using a flexible, non-stretchable measuring tape to ensure consistency in data collection. Anthropometric measurements of infants were recorded every month for seven months to monitor their growth patterns.

Result:

Table No.1: Socio economic profile of the Respondents N=100

Characteristics	Category	Number of Subjects (n=100)	Percent %
Age of Respondent (Years)	18-25	74.0	74.00
	26-30	25.0	25.00
	31-35	1.00	1.00
	>35	0.00	0.00
	Total	**100**	**100**
Religion	Hindu	98.0	98.00
	Christian	0.00	0.00
	Muslim	2.00	2.00
	Others	0.00	0.00
	Total	**100**	**100**
Nature of family	Nuclear	18.0	18.00
	Joint	82.0	82.00
	Total	**100**	**100**
Education	Illiterate	0.00	0.00
	Primary	51.0	51.00
	High school	32.0	32.00
	PUC	10.0	10.00
	Degree	7.00	7.00
	Diploma	0.00	0.00
	>Degree	0.00	0.00
	Total	**100**	**100**
Occupation	House wives	97.0	97.00
	Labor	0.00	0.00
	Govt-employee	3.00	3.00
	Non-Govt employee	0.00	0.00
	Total	**100**	**100**
Monthly income	5000-10000	37.0	37.00
	10000-20000	44.0	44.00
	20000-30000	8.00	8.00
	30000 and above	11.0	11.00
	Total	**100**	**100**

Result: Table No 1 shows that the majority of the respondents (74%) were aged between 18-25 years and belonged to the Hindu religion (98%). Most lived in joint families (82%) and had completed primary education (51%). Significant proportions were housewives (97%), and the predominant monthly income range was ₹10,000-₹20,000 (44%).

Table 2: Nutritional information of the Subjects

Characteristics	Particulars	Number of Subjects (N=100)	Percentage (%)
Type of food habit	Vegetarian	26	26.00
	Non-vegetarian	36	36.00
	Eggetarian	40	40.00
Number of meals per day	1	00	00.00
	2	00	00.00
	3	94	94.00
	4	06	06.00
Are you getting supplements from anganwadis?	Yes	100	100.0
	No	00	00.00

The majority of the respondents were eggetarian (40%), followed closely by non-vegetarians (36%). Most of the subjects (94%) consumed three meals per day and all 100% respondents (Table No. 2)

Fig 1. Classification of Respondents according to BMI

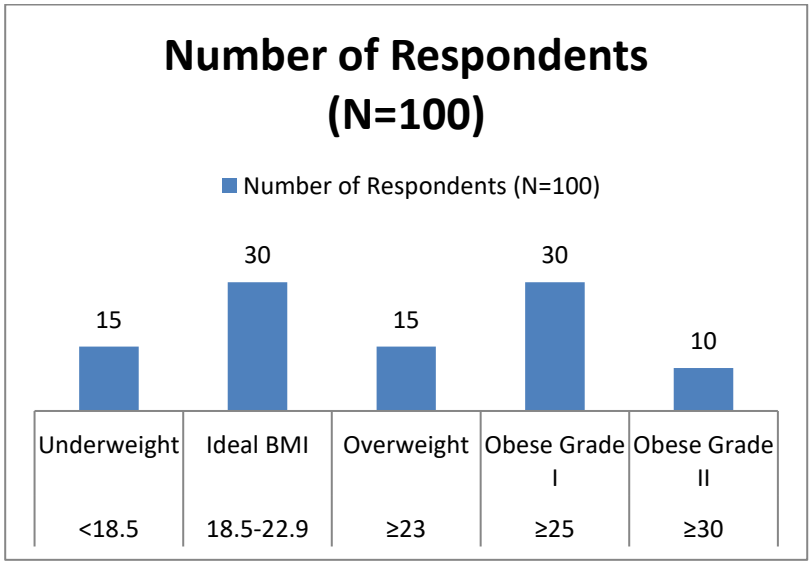

Fig.1 shows that the majorities of respondents had either an ideal BMI (30%) or were classified as Obese Grade I (30%). Smaller proportions were underweight (15%) or overweight (15%), while 10% fell into the Obese Grade II category.

Table No.3: Knowledge of the mother about breast feeding **N=100**

Characteristics	Particulars	Number of Subjects	Percentage (%)
Have you heard about exclusive breast feeding	YES	89.0	89.00
	NO	11.0	11.00

Did you receive any counseling/ information on breast feeding during postnatal period	YES	91.0	91.00
	NO	09.0	9.00
If yes then which was/were the sources?	Mother	52.0	52.00
	Media	00.0	0.00
	Hospital /Asha worker	48.0	48.00
	Relative	00.0	0.00
Duration of exclusive breast feeding	3 months	45.0	45.00
	6months	27.0	27.00
	9months	03.0	3.00
	12months	24.0	24.00
Your opinion regarding colostrums?	Good for health	72.0	72.00
	No should be discarded	00.0	0.00
	Don't know	28.0	28.00
What are the advantages of breast milk?	Nutritious	37	37.00
	Protective	53	53.00
	Economic	00	0.00
	Good for mother	10	10 .00
	All above	00	0.00

Table No.3 data shows that the Knowledge of the mother about breast feeding. The majority of mothers (89%) had heard about exclusive breastfeeding, and 91% had received counseling or information on breastfeeding during the postnatal period. The primary sources of information were mothers (52%) and hospital staff or ASHA workers (48%). Regarding the duration of exclusive breastfeeding, 45% practiced it for 3 months, while only 27% followed the recommended 6 months. Most mothers (72%) believed colostrum is good for health, while 28% were unaware of its benefits. When asked about the advantages of breast milk, 53% recognized its protective benefits, while 37% considered it nutritious.

Table 4: Attitude of the respondents towards breast feeding

Q.No	Questions	Rural (N=100)	Chi-square	Significance

		Strong Disagree	Disagree	Neutral	Agree	Strong agree	P value	
1	**Formula feeding is more convenient than the breast feeding**	81	20	0	0	0	NA	NS
2	**Breast feeding increases infant and mother bonding**	0	2	7	60	32	NA	NS
3	**Breast fed babies are healthier and stronger than the formula fed babies**	0	0	27	58	18	NA	NS
4	**Formula feeding is the better choice if the mother plans to go back to her work**	49	45	5	0	1	0.00	*
5	**Mother who formula feeds miss one of the great joys of motherhood**	13	8	0	64	15	NA	NS
6	**Breast fed babies are more likely to be over fed than formula fed babies**	0	0	1	58	31	NA	NS
7	**Breast milk is the ideal food for babies**	0	3	13	46	41	NA	NS
8	**Breast milk is more easily digested than formulas milk**		0	17	54	30	NA	NS
9	**Breast milk is cheaper than formula milk**	4	1	10	40	50	0.00	*
10	**Benefit of breast feeding last only as long as the babies breast**	0	0	1	31	69	0.00	*

Data related to Attitude of the respondents towards breast feeding presented in the table no.4 and it shows that the majority of respondents (81%) strongly disagreed that formula feeding is more

convenient than breastfeeding. Most participants (60% agreed, 32% strongly agreed) believed that breastfeeding strengthens mother-infant bonding. A significant proportion (58% agreed, 18% strongly agreed) stated that breastfed babies are healthier and stronger than formula-fed babies. Regarding formula feeding for working mothers, the majority (49% disagreed, 45% strongly disagreed) opposed the idea that it is a better choice ($p<0.05$). Most respondents (64%) agreed that mothers who formula feed miss out on the joys of motherhood. A large number (58% agreed, 31% strongly agreed) believed that breastfed babies are more likely to be overfed than formula-fed babies. The majority (46% agreed, 41% strongly agreed) recognized breast milk as the ideal food for infants. Additionally, half of the respondents (50%) strongly agreed that breast milk is cheaper than formula ($p<0.05$). Lastly, the majority (69% strongly agreed) believed that the benefits of breastfeeding extend beyond infancy ($p<0.05$).

Table No 5: Practice of Subjects towards breast feeding

Characteristics	Particulars	Number of Subjects	Percentage(%)
When did you initiate breast feeding?	Within 1hr	43	43.00
	1-4 hrs	21	21.00
	After 2days	20	20.00
	After 5 days	16	16.00
How often do you feed your baby?	Every 2hrs	70	70.00
	3-4 hrs	15	15.00
	Whenever baby cries	15	15.00
	On demand	0.0	0.00
Have you given colostrum's to your baby soon after delivery?	Yes	81	81.00
	No	19	19.00
Did your child receive anything before put to the breast?	Yes	39	39.00
	No	61	61.00
If yes, what was given to the child?	Sugar water	02	2.00
	Honey	29	29.00
	Plain water	06	6.00
	Cow's milk	02	2.00
Did you introduce any type of food other than breast milk within first 6 months?	Yes	56	56.00
	No	47	47.00
If yes, which type of food did you introduce?	Fruit juices	00	0.00
	Cereals/Porridge	34	34 .00
	Cow's milk	15	15.00
	Formula milk	07	7.00

The table no.5 shows that Practice of Subjects towards breast feeding. The majority of respondents (43%) initiated breastfeeding within the first hour of birth. Most mothers (70%) fed their babies every two hours. A significant proportion (81%) provided colostrum to their babies immediately after delivery.

Additionally, 61% of mothers did not give anything to their child before initiating breastfeeding. Among those who did, honey was the most commonly given substance (29%). More than half of the respondents (56%) introduced foods other than breast milk within the first six months, with cereals or porridge being the most commonly introduced food (34%).

Table 6 Mean Nutrients intake and Adequacy of the subjects N=30

Nutrients	Actual intake	RDA	Nutrient adequacy (%)
Energy (Kcal)	1135.16	2600kcal	43.66
Protein (g)	42.91	68g	63.10
Fat (g)	28.43	30g	94.77
Iron (mg)	09.21	21mg	43.86
Calcium (mg)	284.72	1200mg	23.73
Vitamin C (mg)	30.7	105mg	29.24

The nutrient intake of the subjects showed (table no.6) varying levels of adequacy. Fat intake was the highest at 94.77% of the recommended dietary allowance (RDA). Protein intake was moderately adequate, covering 63.10% of the requirement. Energy (43.66%), iron (43.86%), vitamin C (29.24%), and calcium (23.73%) intake were all significantly lower than the recommended levels, indicating potential nutritional deficiencies in these areas.

Table 7: Mean Anthropometric Measurements of infants with WHO Standard

Male infants (55)						
Age Group (months) N=55	Weight (kg)		Height (cm)		Head Circumference (cm)	
	Mean	WHO Weight Range (5th-95th percentile)	Mean	WHO Range (5th-95th percentile)	Mean	WHO Range (5th-95th percentile)
0-3	5.66	4.6 - 6.8	56.87	50.8 - 62.1	37.8-43.4	37.8 - 43.4
3-6	5.82	6.2 - 8.9	62.11	57.5 - 67.5	41.6-47.1	41.6 - 47.1
6-9	5.21	7.6 - 10.3	60.55	62.8 - 72.3	43.8-49.1	43.8 - 49.1
9-12	7.00,	8.7 - 11.6	55.00	66.1 - 75.5	45.0-50.2	45.0 - 50.2
Female infants with Rural (45)						
0-3	4.35	4.5 - 6.7	58.16	50.7 - 62.0	37.33	37.5 - 43.1
3-6	5.72	6.0 - 8.7	61.78	57.3 - 67.4	43.80	41.2 - 46.8
6-9	6.37	7.3 - 10.0	66.82	62.3 - 71.8	41.81	43.4 - 48.7
9-12	8.50	8.4 - 11.3	0.00	65.4 - 74.9	0.00	44.6 - 49.9

Table No. 7 presents the anthropometric measurements of male and female infants in comparison to WHO reference standards. The anthropometric measurements of male infants showed that their mean weight was lower than the WHO reference range across all age groups, with the most noticeable deficit

in the 6-9 month group (5.21 kg vs. WHO range 7.6-10.3 kg). Their mean height also remained below the WHO range, particularly in the 9-12 month group (55.00 cm vs. WHO range 66.1-75.5 cm). However, head circumference values were within the WHO range for all age groups.

For female infants in rural areas, their mean weight was generally lower than the WHO reference, particularly in the 0-3 month group (4.35 kg vs. WHO range 4.5-6.7 kg). Height measurements also lagged behind, especially in the 9-12 month group where data was unavailable. Head circumference values were mostly within the WHO range except for missing data in the 9-12 month category. These findings suggest growth faltering in both male and female infants compared to WHO standards.

Table No. 8 presents the mean indices values of male infants' growth in rural areas. The weight of infants showed a significant increase across all age groups, with the highest growth rate observed in the 0-3 month group (1.47 kg), followed by a gradual decline in growth rate as age increased. Similarly, height showed a consistent but slower increase, with the highest growth rate recorded in the 0-3 month group (1.09 cm). The head circumference also exhibited steady growth, with the most notable increase in the 0-3 month group (1.06 cm). All measurements showed statistically significant differences (p=0.000, *), indicating steady but moderate growth in male infants.

The data presents in the Table No. 9 shows that the mean indices values of female infants' growth in rural areas. The weight of infants increased significantly across all age groups, with the highest growth rate observed in the 0-3 month group (1.45 kg), followed by a gradual decline as age progressed. Height also showed a steady increase, with the highest growth rate in the 0-3 month group (1.08 cm). The head circumference exhibited slower but consistent growth, with the most notable increase in the 0-3 month group (1.05 cm). All measurements showed statistically significant differences (p=0.00, *), indicating a consistent growth pattern in female infants.

Table 8. Mean indices values of Male infants Growth

Male infant Rural N= 30									P value	Significance
Age Group (months)	Measurements	M1	M2	M3	M4	M5	M6	Growth Rate		
0-3	Weight (kg)	3.2	3.7	4.0	4.1	4.4	4.7	1.47	0.000	*
	Height (cm)	49.5	50.5	51.5	52.0	52.8	53.8	1.09	0.000	*
	Head Circumference(cm)	33.8	34.3	34.8	35.0	35.3	35.7	1.06	0.000	*
3-6	Weight (kg)	4.7	5.0	5.2	5.3	5.4	5.6	1.19	0.000	*
	Height (cm)	52.5	53.2	53.8	54.3	54.8	55.3	1.05	0.000	*
	Head Circumference (cm)	35.7	36.2	36.5	36.8	37.0	37.3	1.04	0.000	*
6-9	Weight (kg)	5.6	5.7	5.8	5.9	6.0	6.1	1.09	0.000	*
	Height (cm)	57.5	58.0	58.5	59.0	59.3	59.8	1.04	0.000	*
	Head Circumference(cm)	37.3	37.5	37.7	37.8	38.0	38.3	1.03	0.000	*
9-12	Weight (kg)	6.7	6.8	6.9	7.0	7.1	7.2	1.07	0.000	*
	Height (cm)	62.0	62.5	63.0	63.5	64.0	64.5	1.04	0.000	*
	Head Circumference (cm)	39.5	39.8	40.0	40.3	40.5	40.8	1.03	0.000	*

Table 9. Mean indices values of Male infants Growth

Female infant Rural N= 30									P value	Significance
Age Group	Measurements	M1	M2	M3	M4	M5	M6	Growth Rate		

(months)										
0-3	Weight (kg)	2.9	3.4	3.7	3.8	4.0	4.2	1.45	0.00	*
	Height (cm)	48.5	49.5	50.5	51.0	51.5	52.5	1.08	0.00	*
	Head Circumference(cm)	33.0	33.5	34.0	34.2	34.5	34.8	1.05	0.00	*
3-6	Weight (kg)	4.2	4.5	4.7	4.8	5.0	5.1	1.21	0.00	*
	Height (cm)	51.8	52.5	53.0	53.5	54.0	54.5	1.05	0.00	*
	Head Circumference (cm)	34.8	35.2	35.5	35.7	35.9	36.1	1.04	0.00	*
6-9	Weight (kg)	5.1	5.3	5.4	5.5	5.6	5.7	1.12	0.00	*
	Height (cm)	55.0	55.5	56.0	56.5	57.0	57.5	1.05	0.00	*
	Head Circumference(cm)	36.1	36.3	36.5	36.7	36.8	37.0	1.02	0.00	*
9-12	Weight (kg)	5.8	5.9	6.0	6.1	6.2	6.3	1.09	0.00	*
	Height (cm)	58.0	58.5	59.0	59.5	60.0	60.5	1.04	0.00	*
	Head Circumference (cm)	37.2	37.4	37.6	37.8	38.0	38.2	1.03	0.00	*

Table 10. Impact of Nutrition Education Intervention on the Knowledge, Attitude, and Practices of Rural and Urban Breastfeeding Mothers

Parameters	Intervention Rural (n=60)		χ^2 Value
	Before (n=30) (%)	After (n=30) (%)	
I. Knowledge			
Good knowledge (9 to 12)	18 (60)	24 (80)	12.34*
Poor knowledge (6 to 9)	12 (40)	6 (20)	
II. Attitude			
Negative Attitude (10-24 point)	4 (13.3)	2 (6.7)	9.87*
Neutral Attitude (25-37 point)	23 (76.7)	16 (53.3)	
Positive Attitude (38-50 point)	3 (10)	12 (40)	
III. Practices			
Poor Practices (7-10 points)	2 (6.7)	1 (3.3)	3.65 NS

Good Practices (11-14 points)	28(93.3)	29(96.6)	

Note:Values in the parentheses indicate percentages * Significant, NS-Non-significant

Table 10 illustrates the impact of nutrition education intervention on the knowledge, attitude, and practices of rural breastfeeding mothers. The proportion of mothers with good knowledge increased from 60% before the intervention to 80% after, while those with poor knowledge decreased from 40% to 20%, showing a significant improvement ($\chi^2 = 12.34$, $p < 0.05$). In terms of attitude, the percentage of mothers with a positive attitude increased from 10% to 40%, while those with a neutral attitude decreased from 76.7% to 53.3%, indicating a significant shift ($\chi^2 = 9.87$, $p < 0.05$). The percentage of mothers with poor breastfeeding practices slightly declined from 6.7% to 3.3%, while good practices increased from 93.3% to 96.6%, but this change was not statistically significant ($\chi^2 = 3.65$, NS). These findings suggest that the intervention effectively improved knowledge and attitude but had a minimal impact on breastfeeding practices.

The findings indicated that a majority of respondents were young mothers aged 18-25 years, primarily housewives, living in joint families, and with primary-level education. The predominant monthly income range was ₹10,000-₹20,000, and most mothers followed an eggetarian or non-vegetarian diet. Similar demographic characteristics were reported in a study by Joshi et al. [17], where economic constraints and low education levels were found to influence infant feeding practices.

The nutrition education intervention significantly improved the knowledge and attitude of rural mothers toward breastfeeding. The proportion of mothers with good knowledge increased from 60% to 80% ($\chi^2 = 12.34$, $p < 0.05$). Attitudinal changes were also notable, with a rise in positive attitudes from 10% to 40% ($\chi^2 = 9.87$, $p < 0.05$). These findings align with Sharma et al. [19], who found that structured breastfeeding counseling session's enhanced maternal knowledge and attitudes toward breastfeeding.

However, while good breastfeeding practices slightly improved from 93.3% to 96.6%, this change was not statistically significant ($\chi^2 = 3.65$, NS). A possible reason for this could be deep-rooted traditional practices and beliefs that are less responsive to short-term interventions, as observed in a study by Patel et al. [18].

Despite increased awareness, breastfeeding practices revealed gaps. While 81% of mothers provided colostrum, only 27% exclusively breastfed for the recommended six months. This aligns with findings from Tiwari et al. [21], who reported that cultural beliefs and family influences often lead to early introduction of complementary foods. Additionally, 56% of mothers introduced complementary foods before six months, primarily cereals and porridge, which may indicate a lack of confidence in exclusive breastfeeding.

The nutrient intake analysis showed that fat intake (94.77% of RDA) was the most adequate, while protein intake met 63.10% of the RDA. However, significant deficiencies were observed in energy (43.66%), iron (43.86%), vitamin C (29.24%), and calcium (23.73%) intake. Such deficiencies have been linked to maternal under nutrition, as reported by Bhattacharya et al. (2020), where inadequate maternal dietary intake impacted both maternal health and breast milk composition.

The anthropometric measurements of male and female infants showed growth faltering when compared to WHO standards. Male infants exhibited the largest weight deficit at 6-9 months (5.21 kg vs. WHO standard 7.6-10.3 kg), while female infants also showed lower weight and height measurements, particularly in the 0-3 month group. Similar growth faltering trends were reported by Singh et al. [20], who identified maternal malnutrition and early complementary feeding as primary contributors.

However, weight and height indices showed steady but moderate growth among male and female infants post-birth, with the highest growth rates observed in the 0-3 month period. The statistically significant increase (p=0.000) in growth suggests that while infants are growing, they remain vulnerable to stunting and under nutrition, a concern echoed by Black et al. [9]. in their global burden of disease study on maternal and child malnutrition.

Conclusion:

The study highlights that nutrition education interventions effectively improve knowledge and attitudes regarding breastfeeding. However, sustained efforts are needed to translate this knowledge into practice. Addressing maternal dietary deficiencies and reinforcing exclusive breastfeeding recommendations through community-based programs, involving ASHA workers and family members, could enhance adherence. Additionally, targeted nutritional support for lactating mothers could improve infant growth outcomes.

Reference

1. Arimond, M., & Ruel, M. T. (2004). Dietary diversity is associated with child nutritional status: Evidence from 11 demographic and health surveys. The Journal of Nutrition, 134(10), 2579-2585. https://doi.org/10.1093/jn/134.10.2579
2. Bhutta, Z. A., Ahmed, T., Black, R. E., Cousens, S., Dewey, K., Giugliani, E., Haider, B. A., Kirkwood, B., Morris, S. S., Sachdev, H. P. S., & Shekar, M. (2008). What works? Interventions for maternal and child undernutrition and survival. The Lancet, 382(9890), 417-440. https://doi.org/10.1016/S0140-6736(08)60893-9
3. Dewey, K. G., & Adu-Afarwuah, S. (2008). Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. Maternal & Child Nutrition, 4(S1), 24-85. https://doi.org/10.1111/j.1740-8709.2007.00124.x
4. Horta, B. L., & Victora, C. G. (2013). Long-term effects of breastfeeding: A systematic review and meta-analysis. World Health Organization.
5. Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A., & Morris, S. S. (2003). How many child deaths can we prevent this year? The Lancet, 362(9377), 65-71. https://doi.org/10.1016/S0140-6736(03)13811-1
6. National Family Health Survey (NFHS-5). (2020). India fact sheet 2019-2021. Ministry of Health and Family Welfare, Government of India. Retrieved from https://rchiips.org/NFHS/NFHS-5_FCTS/India.pdf
7. Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., & Rollins, N. C. (2016). Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. The Lancet, 387(10017), 475-490. https://doi.org/10.1016/S0140-6736(15)01024-7
8. World Health Organization (WHO). (2021). Infant and young child feeding. WHO Guidelines. Retrieved from https://www.who.int
9. Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet, 382(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X

10. Ministry of Health and Family Welfare (MoHFW). (2021). National Family Health Survey (NFHS-5), 2019–21: India fact sheet. Government of India. Retrieved from https://rchiips.org/nfhs/NFHS-5_FCTS/India.pdf
11. NITI Aayog. (2022). State nutrition profile: Karnataka. Government of India. Retrieved from https://www.niti.gov.in
12. UNICEF, WHO, & World Bank. (2021). Levels and trends in child malnutrition: Joint child malnutrition estimates (JME) – Key findings of the 2021 edition. World Health Organization. Retrieved from https://www.who.int/publications/i/item/9789240025257
13. Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., & Sachdev, H. S. (2008). Maternal and child undernutrition: Consequences for adult health and human capital. The Lancet, 371(9609), 340–357. https://doi.org/10.1016/S0140-6736(07)61692-4
14. World Health Organization (WHO). (2006). WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. WHO. Retrieved from https://www.who.int/publications/i/item/924154693X
15. World Health Organization (WHO). (2022). Malnutrition fact sheet. WHO. Retrieved from https://www.who.int/news-room/fact-sheets/detail/malnutrition
16. Bhattacharya, S., Pal, B., Mukherjee, S., & Roy, S. K. (2020). Maternal undernutrition and its impact on birth weight: A systematic review of observational studies. Journal of Health, Population and Nutrition, 39(1), 1-13.
17. Joshi, P., Gupta, R., & Joshi, M. C. (2020). Influence of maternal education and socioeconomic status on infant feeding practices in rural Uttarakhand, India. International Journal of Community Medicine and Public Health, 7(5), 1765-1770.
18. Patel, A., Banerjee, A., & Kaletwad, A. (2018). Factors associated with prelacteal feeding and timely initiation of breastfeeding in hospital-delivered infants in India. Journal of Human Lactation, 34(4), 761-768.
19. Sharma, I. K., Byrne, A., & Sinha, B. (2019). Impact of breastfeeding counseling on breastfeeding practices, infant growth and mortality in low- and middle-income countries: A systematic review and meta-analysis. Bulletin of the World Health Organization, 97(6), 451-461.
20. Singh, K., Khan, S. M., & Dixit, P. (2021). Impact of maternal nutrition on infant growth in rural India: Evidence from a prospective cohort study. BMC Public Health, 21(1), 1-10.
21. Tiwari, M., Bharadva, K., & Yadav, B. (2021). Cultural beliefs and practices affecting infant feeding in rural India: A community-based study. Journal of Family Medicine and Primary Care, 10(3), 1108-1114.