ORIGINAL RESEARCH ARTICLE

# Effectiveness of Nutrition Education as Intervention on Complementary Feeding Practices & Growth of Children in Rural Area

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## ABSTRACT

**Background:** The first 2years of a child's, feeding-pattern is an important determinant of childhood-malnutrition. Nutritional education on complementary feeding was provided, and the impact on Minimum-Meal-Diversity [MMD], Minimum-Meal-Frequency [MMF] & the children's growth, was evaluated & compared between the education-intervention group and the control group.

**Methodology:** The study was conducted in 2villages of Vijayapura-district 5Anganwadi from each village was selected for study and compared. Primary-outcome: improvement in MMD, MMF Secondary-outcome: weight for age Z-score [WAZ], weight for age Z-score [HAZ] &mid-arm-circumference.

**Results:** Overall education-intervention-group showed better weight-gain than control-arm significant-difference was observed in WAZi.e1.36 v/s1 ($p<0.0017^*$) & HAZ-3.82 v/s -4 ($p<0.00078^*$) respectively. In Intervention-arm mothers following MMF significantly increased &was statistically significant. There was a significant rise in the percentage of mothers in the intervention group who adopted MMD for their children. ($p<0.0001^*$). Gender differences in mean WAZ scores &HAZ were observed in both groups persistently throughout the study period & were statistically significant.

**Conclusion**: Program interventions need to understand the local practices &needs of mothers & tailor interventions and nutritional education to improve child feeding practices including hygienic practices with regular follow-ups, is vital to prevent the vicious cycle of malnutrition.

**Key word:** Educational intervention, nutritional education, complementary-feeding

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## INTRODUCTION

In the global context, nearly 80% of children suffering from undernutrition are distributed worldwide, with India being a significant contributor, accounting for 43% of the burden of underweight children.[1] In India, 38.4% of under 5 children are affected by stunting, a consequence of chronic undernutrition, while 21% are afflicted by wasting, signifying acute undernutrition.[2] It is crucial to recognize that stunting and wasting in children are primarily attributable to inadequate nutrition during early childhood, resulting in compromised immunity and hindered physical and mental growth potential.[3]

The provision of complementary feeding plays a major role in meeting the caloric and nutritional requirements of growing children.[4] According to the Breastfeeding and Infant and Young-Child-Feeding-Practices Report (BF & IYCF) card for India in 2019, only41.5% of Indian children are breastfed within 1 hour of birth, and merely 42.2% receive complementary feeding between 6-9 months alongside breastfeeding.[5] Regional disparities exist, with Manipur ranking first at 78.8% for children receiving complementary feeding and Uttar-Pradesh lagging, with only 32.4% of children receiving complementary feeding at 6 to 9 months.

The adoption of complementary feeding practices is significantly influenced by the knowledge, beliefs, and attitudes of mothers.[6] These practices are often passed down through generations, with young mothers receiving guidance from their mothers or mothers-in-law, who are in turn influenced by cultural practices and superstitions.[6] Therefore, to enhance complementary feeding practices, it is imperative to comprehend the factors that influence mothers' decision-making processes in this regard.[7]

Vijayapura, located in North Karnataka, is a district grappling with a high prevalence of child malnutrition. According to the DLHS-4(2015-16) survey, Vijayapura district had a staggering 45% of under-5 children (48.0% in rural areas) suffering from stunting and 29.1% experiencing wasting.[8]

A review of the existing literature reveals a notable scarcity of studies that have explored nutritional education as an intervention for mothers aiming to improve complementary feeding practices and assessing its impact on child are very less. The current study was designed to investigate the Knowledge, Attitudes, and Practices (KAP) of mothers with weaning children and implement nutritional education as a tool to enhance both the quality and frequency of their children's diets. Additionally, the child's weight was monitored as an outcome, alongside Minimum meal frequency and Minimum meal diversity.[9]

## METHODOLOGY

**Study-area & participants:** The current research was carried out in 2villages located in the Vijayapura district. The interventional village has a total population of 8519 and covers an area of 7,584.75 hectares of land. There is a total of 11 Anganwadi centers located in this village.

The control village has a total population of 6553 and covers an area of 5,264.84 hectares of land. There is a total of 10 Anganwadi centers that are currently serving the population. The educational intervention village was situated 19 kilometers away from Vijayapura and had access to a rural health center providing round-the-clock healthcare services. The other village, located 23 kilometers away from Vijayapura, therefore it was chosen as the control village. The interventional village was approximately 42 kilometers away from the control village.

Using a technique, 5 Anganwadi-Centres from the educational intervention village were chosen to receive Nutritional education, while an additional 5 Anganwadi-centres from the control village were selected as the control-group. In the control-group, no nutritional education was administered; however, it was assumed that the mothers within the selected Anganwadi areas would receive routine care under the Reproductive and Child Health (RCH) and Integrated Child Development Services (ICDS)programs.

### Eligibility-criteria

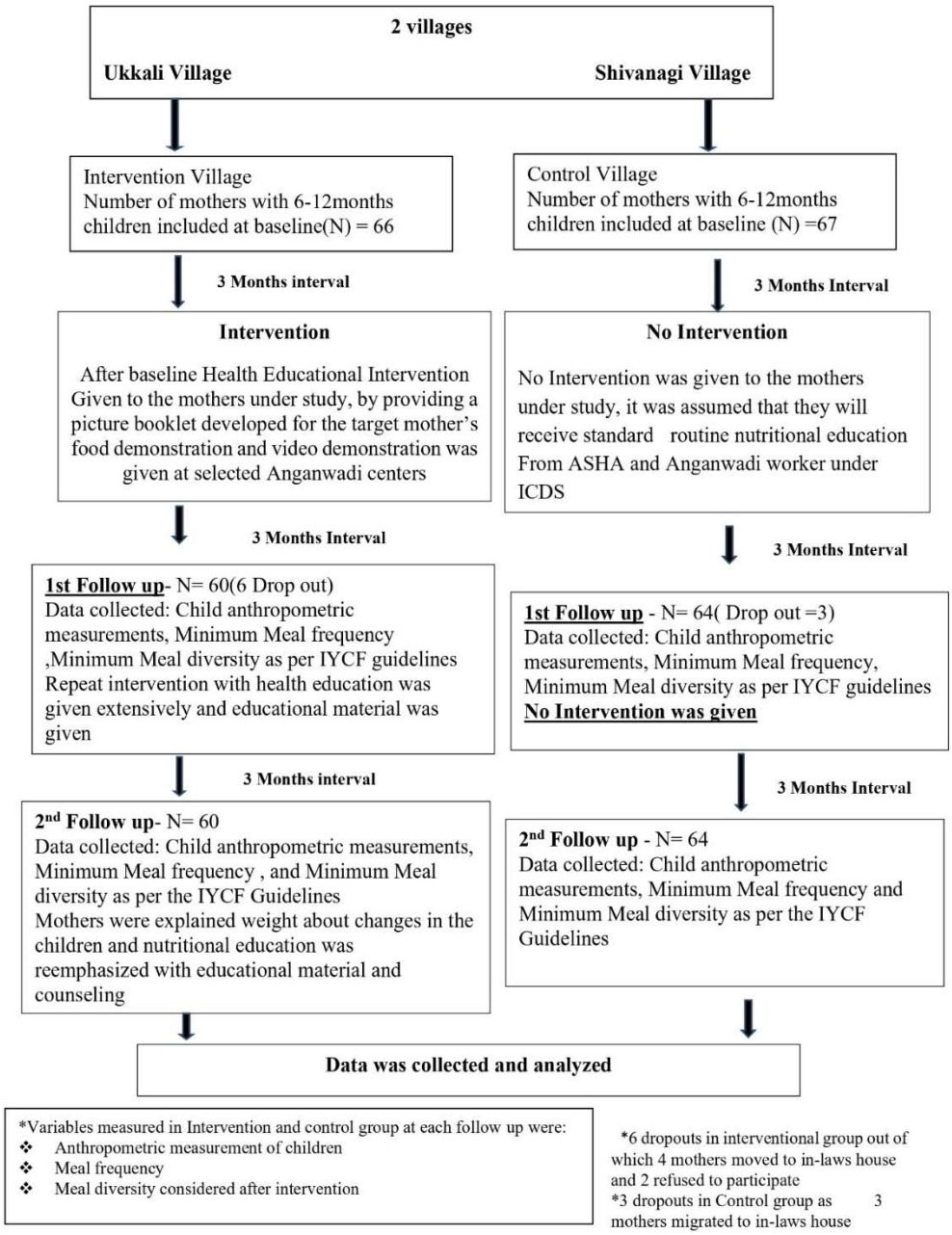
**Inclusion-Criteria:** Children between 6 to 12 months of age at the time of the baseline survey, along with their mothers were considered eligible for the study. Identification of these individuals was achieved through birth and household registers, which were obtained with the assistance of Anganwadi workers and ASHA workers from the respective villages.

**Exclusion-Criteria:** Mothers who declined to participate in the study, mothers whose children were less than 6 months or above 12 months of age, and mothers whose children suffered from any major illnesses were excluded from the study.

**Sample-Size:** The Sample size was calculated based on an expected mean value of meal frequency for both the intervention and control-groups, with values of 4.1 and a common standard deviation of 1.3 (based on the previous study[10]), at a 95% confidence level and 80% power. This calculation resulted in a sample size of 52 children per group/arm at a 95%significance level. Considering a 10% dropout rate, 58 participants were enrolled in each study site after applying the inclusion criteria.

The total sample size consisted of 116 mothers, with an equal number in both the intervention and control arms.

**Data Collection & Methodology:** Baseline data collection, analysis, nutritional-educational sessions, and follow-ups were carried out over the period from February 2018 to April 2019.




**Baseline survey:** Anganwadi in both educational intervention & control villages were used as the point of contact to enrol the eligible mothers of 6-12months old in their respective areas**.** House to house survey using a semi-structured questionnaire eliciting information about socio-demographic characteristics Cultural practices & knowledge-attitude & practice regarding Breast-feeding & Complementary-feeding practices were collected as baseline information. Anthropometric measurements of length, weight & MUAC of the children were collected adhering to standard procedures

**Nutritional-education-Package comprised of 5 components:**

**Educational Materials:** In this study, we developed a dedicated picture manual in the form of a booklet, drawing upon principles from Infant and Young Child Feeding (IYCF)[11], Integrated Management of Neonatal and Childhood Illness (IMNCI)[12], and World Health Organization (WHO) guidelines on complementary feeding [13]. This manual included concise, locally relevant picture-based messages, reducing reliance on written content. It covered vital information about breastfeeding techniques, when to introduce complementary foods, specific food items for a child's diet, achieving MMF, recommended food quantities by age while breastfeeding, encouraging a balanced diet, discouraging bottle-feeding, promoting hand hygiene, emphasizing continued feeding during illness, and instructions for preparing home-based oral rehydration solution (ORS). These booklets were distributed to all participating mothers as part of the study.

**Nutritional Education session:** Structured-group educational sessions were held for mothers at selected Anganwadi Centres. These sessions were carefully scheduled and communicated in advance

through Anganwadi and ASHA workers in their respective areas. Each session lasted two hours and covered comprehensive discussions on child nutrition, including the importance of sustained breastfeeding, the right time to start complementary feeding (CF), food-group selection, age-appropriate food quantity and texture, food preparation, and hygiene practices. Mothers also received information on childhood nutrition, child growth monitoring, and responsive feeding.

The Nutritional education sessions also included essential insights into common childhood illnesses, effective feeding during illness, proper utilization and preparation of ORS, recognizing signs of illness in children, and knowing when to seek medical attention. To motivate mothers to attend these sessions and inform them about their child's nutritional status, children accompanying their mothers were initially assessed based on their weight-for-age (WA) classification following IAP guidelines for malnutrition [14]. This assessment sensitized mothers to their child's current nutritional status, encouraging their active participation in the educational sessions.

**Food Demonstration at Anganwadi Centres:** As part of this research, practical food demonstrations were conducted at the Anganwadi Centres. During these demonstrations, locally sourced and cost-effective nutrient-dense food-groups were presented to the mothers. The nutritive value of each food item was elucidated, along with an emphasis on their crucial role in a child's diet. Furthermore, simple and easily replicable recipes for weaning foods were showcased. The primary objective of these demonstrations was to equip mothers with knowledge regarding the appropriate consistency and portion sizes for feeding their children.

Importantly, these sessions also discouraged the consumption of snacks and junk foods as suitable options for weaning foods, reinforcing the importance of nutritious, locally available alternatives.

**Audio-Visual Demonstration:** To enhance the educational component, an instructive audio-visual presentation affiliated with Infant and Young Child Feeding (IYCF) was showcased to the participating mothers. This presentation encompassed crucial information on correct child feeding techniques, insights into managing childhood illnesses, and the potential severity of malnutrition when not addressed promptly.

**Home Visits:** To provide personalized support and monitor progress, each mother and child enrolled in the Educational-intervention-study-group received two follow-up home visits, spaced at three-month intervals. These visits were instrumental in identifying any feeding-related challenges and offering individualized counselling. During each follow-up, comprehensive data was collected, including assessments of complementary feeding practices (MMF&MMD). Anthropometric measurements of child weights, lengths, and Mid Upper Arm Circumference were meticulously recorded following standardized procedures at each three-month interval.

It is essential to note that mothers in the control arm did not receive specialized educational sessions during follow-up visits. Data collection for this group was limited to periodic anthropometric measurements and meal assessments.

**Study-variables and Measurement-of-Outcome:**

The variables measured included the child's physical growth outcome (weight for age) as a secondary outcome and changes in complementary feeding practices (primary outcome) by mothers, assessed in terms of MMF and MMD.

**Physical growth** was assessed by, weight, length, &MAUC at baseline & during 2follow ups, the assessment was done based on the incremental increase from baseline to the final observation point (I'e at 2ndfollow-up) using standard-parameters

**Minimum-Meal-frequency [MMF]**: In our study Rate &proportion of the children who were fed were observed at each measurement point, the assessment was done based on the difference in the frequency of child feeding at baseline & after the intervention period at the end of the study.

**Minimum-Meal-diversity [MMD]**: In our study Proportions of children being fed with a minimum recommended (IYCF-guidelines) food-groups, the assessment was done based on the difference in the inclusion of a minimum 4 recommended food-groups in child feeding at baseline & final observation-point

**Statistical analysis**: The information gathered underwent meticulous documentation within a Microsoft Excel spreadsheet, with subsequent statistical scrutiny carried out utilizing SPSS (Version-17). The outcomes were visually conveyed via a combination of figures, tables, Mean ± SD, and percentages. To delve into categorical variables, the chi-square test was employed, while quantitative variables underwent evaluation through the independent t-test and Mann-Whitney-U test. For intra-group comparisons of follow-up results, the Friedman test was applied. In adherence to statistical rigor, the significance threshold for all tests was established at $p < 0.05$, and the analyses were consistently approached with a two-tailed perspective.

**Ethical-approval: Institutional Review Board-Statement:** BLDE (Deemed To Be University) Shri Bm Patil Medical College Hospital and Research Center Vijayapura Institutional-ethical-clearance-certificate-was obtained-with-reference number:142/17.

## RESULTS

**Participant Enrolment and Baseline Characteristics:** A total of 133 mothers with children aged between 6-12 months participated in our study, with 66 allotted to the educational intervention division and

67 to the control-group division at the beginning of the research. Key socio-demographic factors, including the mother's age, mean age at marriage, educational background, occupation, socioeconomic status, and child-feeding practices, were collected as baseline data for both the educational intervention and control-groups in the two selected villages. A comprehensive overview of these demographic and socio-economic profiles, along with the baseline Knowledge, Attitudes, and Practices (KAP) of mothers, is presented in [Table-1 Demographic Socio-Economic Profile & Baseline KAP of Mothers].

**Comparison of Complementary-Feeding Practices:** Out of the initial 133 children, [60 from the educational-group &65 from the control-group] were available for successive follow-up assessments. Complementary feeding practices in both-groups were compared at baseline and during follow-up intervals, with a particular focus on MMF and MMD. These comparisons are detailed in [Table 2. Comparison of Complementary-Feeding Practices between the educational-intervention and Control-Groups at Baseline, first (3 months), and Second (6 months) Follow-up Survey Points].

Notably, a significant improvement in complementary-feeding practices, including increased meal frequencies (P<0.001*) and meal diversities (p=0.029*), was observed among the educational intervention-group in comparison to the control-group. At baseline, MMF &MMD were found to be comparable between both-groups.

**Food-Group Selection and Dietary Diversity:** Following the nutritional-education sessions, a substantial proportion of children in the educational-intervention-group demonstrated the consumption of, green leafy vegetables, meats, eggs, legumes, and vitamin C-rich fruits, as illustrated in [Figure 2: Food-Groups Selection in Complementary-feeding by Mothers in the educational-Interventional-Group].

Our study highlighted a significant increase (p=0.029*) in the percentage of mothers in the educational intervention group adhering to recommended dietary diversity for feeding their children, compared to mothers in the control group (75% vs. 48%). This is further elucidated in [Figure 3: Pre-Educational-Intervention and Post-Educational Intervention Comparison of MMD Followed by Mothers in the Educational-Intervention Village].

**Child-Growth-Outcomes:** The results of child growth assessments, including changes in weight and length, are presented in [Table 3. Comparison of Growth between educational-Intervention and Control-Group at Each Follow-Up].

During both the baseline and the initial follow-up, there were no significant differences found in the mean WAZ and HAZ between the 2 comparison groups (p=0.48 and p=0.241, respectively). However, at the second follow-up, noteworthy disparities emerged, indicating significant changes in mean WAZ (p<0.017* **Mann-whitney/t test was applied U= 1442.0**) and HAZ (p<0.00078* **Mann-whitney/t test was applied U= 1.38**) between the two comparison groups.

**Table 1: Demographic Socio-Economic Profile & baselines KAP of Mothers**

| Variables | No. of Mothers | | P value* |
|---|---|---|---|
| | Intervention Group (n=66) (%) | Control group (n=67)(%) | |
| **Age of Mother (Years)** | | | |
| <18 | 2 (3) | 2 (2.9) | 0.170 |
| 18-20 | 25 (37.8) | 24 (35.8) | |
| 20-25 | 32 (48.4) | 40 (59.7) | |
| 25-30 | 7 (10.6) | 1 (1.4) | |
| 30-35 | 1 (1.5) | - (-) | |
| **Education of Mother** | | | |
| Illiterate | 17 (25.7) | 17 (25.3) | 0.087 |
| Up to primary@ | 31 (46.9) | 35 (52.2) | |
| Up to Secondary | 12 (18.1) | 15 (22.3) | |
| Graduate | 6 (9) | - (-) | |
| **Occupation Of Mother** | | | |
| Home-maker | 46 (69.6) | 41 (61.1) | 0.616 |
| Agricultural-labors | 11 (16.6) | 9 (13.4) | |
| Daily-wage-labors | 7 (10.6) | 4 (5.9) | |
| Govt-worker | 1 (1.5) | 3 (4.4) | |
| Business | 1 (1.51) | - (-) | |
| **Religion** | | | |
| Hindu | 35 (53) | 38 (56.72) | 0.669 |
| Muslim | 31 (46.9) | 29 (43.28) | |
| **Socio-Economic-Classification** | | | |
| Class I-class II | - (-) | 2 (2.9) | 0.791 |
| Class III | 16 (24.2) | 20 (29.8) | |
| Class IV | 39 (59) | 35 (52.2) | |
| Class V | 11 (16.6) | 10 (14.9) | |
| **Initiation of BF#** | N=61 (%) | N=61 (%) | |
| Within-hour | 23 (37.7) | 13 (21.31) | 0.138 |
| 1-6 hours | 32 (52.46) | 40 (65.57) | |
| 7-24 hours | 6 (9.84) | 8 (13.11) | |
| **Colostrum-given** | | | |
| Yes | 37 (60.66) | 33 (54.1) | 0.4054 |
| No | 24 (39.34) | 29 (47.54) | |
| **Exclusively-breast-feeding** | | | |
| Yes | 19 (31.15) | 21 (34.43) | 0.699 |
| No | 42 (68.85) | 40 (65.57) | |
| **Breast-feeding child during sickness** | | | |
| Yes | 28 (45.9) | 31 (50.82) | 0.586 |
| No | 33 (54.1) | 30 (49.18) | |
| **Initiation of complementary-foods** | | | |
| Less than 6months | 2 (3.03) | 6 (8.96) | 0.372 |
| 6months | 9 (13.63) | 9 (13.43) | |
| 7-12months | 39 (60.61) | 32 (47.76) | |
| Not yet started | 16 (25.75) | 20 (29.85) | |
| **Minimum-meal-frequency** | | | |
| Correct | 10 (15.15) | 8 (11.94) | 0.588 |
| Not-correct | 56 (87.88) | 5 (88.06) | |
| **Minimum-Meal-diversity** | | | |
| Four-food-groups | 28 (42.42) | 25 (37.31) | 0.547 |
| Not-included-4food groups | 38 (57.58) | 42 (62.69) | |

*Chi-square test applied to calculate statistical significance
@1 to 10th standard
#Time of initiation of breast-feeding (Excluded Non-Breastfed-Mothers)

**Table 2: Comparison of Complementary-feeding-practices between intervention & control-group at Baseline, first (3 months) & 2nd (6 months) follow-up survey points.**

| Variables | No. of Mothers (%) | | | Diff bet 1st follow up & Baseline (%) | Diff bet 2nd follow up & Baseline (%) | Cochran Test P value |
|---|---|---|---|---|---|---|
| | Baseline | First follow up | Second follow-up | | | |
| **Intervention group** | | | | | | |
| Correct Food-frequency | 13.3 | 60 | 71.7 | 46.7 | 58.4 | Q=52.76 |
| Incorrect Food-frequency | 86.7 | 40 | 28.3 | | | P<0.0001 |
| **Control group** | | | | | | |
| Correct Food-frequency | 12.5 | 13.5 | 17.2 | 1 | 4.7 | Q=6.000 |
| Incorrect Food-frequency | 87.5 | 86.5 | 82.8 | | | P=0.063 |
| Intervention vs Control-group@ | P=0.8900 | P<0.0001* | P<0.0001* | | | |
| **Intervention-group** | | | | | | |
| Four-food-groups | 40 | 73.3 | 75 | 33.3 | 35 | Q=24.76 |
| Not-included 4 food-items | 60 | 26.7 | 25 | | | P<0.0001 |
| **Control-group** | | | | | | |
| Four-food-groups | 35.9 | 39.1 | 48.4 | 3.2 | 12.5 | Q=13.0 |
| Not-included4 food-items | 41(64.1) | 39(60.9) | 33(51.6) | | | P=0.002* |
| Intervention vs Control group@ | P=0.6412 | P=0.001* | P=0.029* | | | |

Statistically significant*; @Chi-square test applied
Note: Excluded loss of follow-up respondents

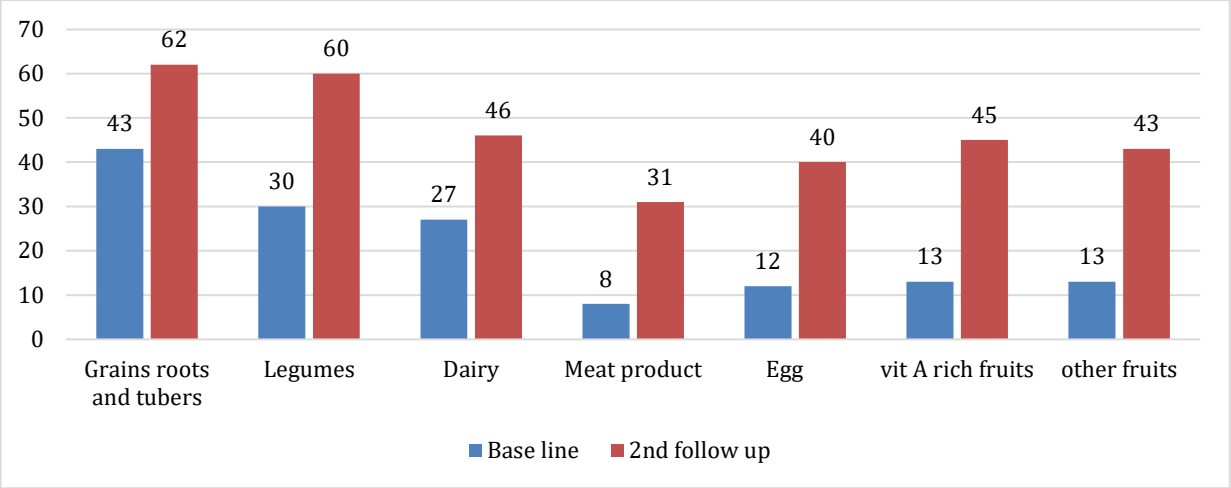



**Figure 2: Pre-intervention and Post-intervention Comparison of food-group selection by mothers in interventional-Group**

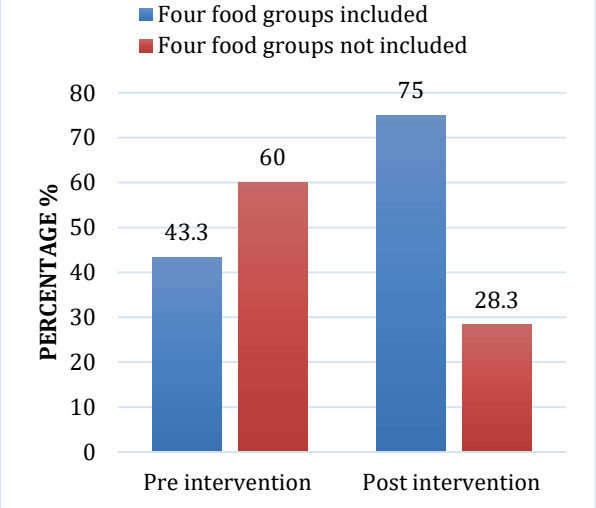



**Figure 3: Pre-Educational-Intervention and Post-Educational Intervention Comparison of MMD Followed by Mothers in the Educational Intervention Village**

It was observed that children in the educational intervention group exhibited a more substantial mean weight gain compared to the control group (-0.48± 0.78 vs. -0.84±1.48), with this difference being statistically significant (p<0.001*). Gender differences were evident in mean WAZ within both the educational intervention group Friedman test was applied (males Fr=40.26, P<0.001*; females Fr=42.71, P<0.001*) and the control group (Friedman test was applied: males Fr=62.52, P<0.001*; females Fr=6.866, P=0.033). Similar gender differences were observed in mean HAZ among both groups. Between the educational intervention and control groups, detailed gender-sensible differences in weight and height Z-scores at three points of the study were summarized in [Table-4: Gender-Wise Comparison of Weight and Height Z-Scores between Educational-Intervention and Control Group at 3 Points of Study].

Our study also highlighted significant gender differences in weight-for-age Z-scores (WAZ) and height-for-age Z-scores (HAZ) at baseline between male and

female children in both the intervention and control groups and these differences persisted during subsequent follow-up visits. While weight and height gains were observed among both male and female children in the intervention group, male children exhibited more significant gains in both mean WAZ and mean HAZ compared to their female counterparts. [Table-4 Gender-Wise Comparison of Weight and Height Z-Scores between Educational-Intervention and Control Group at 3 Points of Study].

**Table 3: Comparison of growth between intervention & control-groups each follow-up**

| Z score | Baseline (Mean ± SD) | First, follow-up (Mean ± SD) | Second, follow-up (Mean ± SD) | Mean diff bet 1st follow-up & Baseline | Mean diff bet 2nd follow-up & Baseline | Friedman test |
|---|---|---|---|---|---|---|
| **Weight-for-Age** | | | | | | |
| Interventional-Group | -1.84 ± 0.99 | -1.18 ± 0.73 | -0.48 ± 0.73 | 0.66 | 1.36 | F=57.83 p<0.0001* |
| Control-group | -1.85 ± 1.08 | -1.38 ± 1.41 | -0.85 ± 1.44 | 0.47 | 1 | F=24.05 p<0.001* |
| Mann-whitney/t test | U=1868.2 | t=0.6994 | U=1442.0 | | | |
| P value | P=0.3190 | P=0.4880 | P<0.017* | | | |
| **Length-for-Age** | | | | | | |
| Interventional-Group | -2.06 ± 0.59 | -1.86 ± 0.95 | -1.76 ± 1.2 | 0.20 | 0.30 | F=19.64 p<0.0001* |
| Control-group | -2.17 ± 0.43 | -1.927 ± 0.49 | -1.836 ± 0.44 | 0.243 | 0.334 | F=2.289 p=0.318 |
| Mann Whitney U test | U=1.763 | U=0.241 | U=1.387 | | | |
| P value | P=0.4338 | P=0.2417 | P<0.00078* | | | |

**Table 4: Gender-Wise Comparison of Weight and Height Z-Scores between Educational-Intervention and Control Group at 3 Points of Study**

| Z-score | Baseline Mean ± SD | First follow-up Mean ± SD | Second follow-up Mean ± SD | Mean diff bet 1st follow-up & baseline | Mean diff bet 2nd follow-up & baseline | Friedman test |
|---|---|---|---|---|---|---|
| **Weight for Age** | | | | | | |
| **Intervention-group** | | | | | | |
| Male | -1.83 ± 0.86 | -1.48 ± 0.27 | -0.94 ± 0.34 | 0.35 | 0.89 | Fr=40.26, P<0.001* |
| Female | -1.90 ± 0.48 | -1.52 ± 0.87 | -1.21 ± 0.70 | 0.38 | 0.69 | Fr=42.71, P<0.001* |
| **Control-Group** | | | | | | |
| Male | -1.82 ± 0.75 | -1.42 ± 0.38 | -1.01 ± 0.70 | 0.4 | 0.81 | Fr=62.52, P<0.001* |
| Female | -1.85 ± 1.31 | -1.54 ± 1.5 | -1.2 ± 1.16 | 0.31 | 0.65 | Fr=6.866, P=0.033 |
| **Height-for-Age** | | | | | | |
| **Intervention-group** | | | | | | |
| Male | -2.06 ± 0.46 | -1.86 ± 0.44 | -1.71 ± 0.42 | 0.2 | 0.35 | Fr=42.38, P<0.001* |
| Female | -2.11 ± 0.85 | -1.91 ± 0.80 | -1.78 ± 0.51 | 0.2 | 0.33 | Fr=56.29, P<0.001* |
| **Control-Group** | | | | | | |
| Male | -1.96 ± 0.9 | -1.85 ± 0.44 | -1.80 ± 0.37 | 0.11 | 0.16 | Fr=37.35, P<0.001 |
| Female | -2.15 ± 0.53 | -1.91 ± 0.38 | -1.85 ± 0.50 | 0.24 | 0.3 | Fr=49.98, P<0.001 |

## DISCUSSION

At six months of age, a child's energy and nutrient requirements increase significantly, necessitating the introduction of complementary foods to meet these demands and support optimal growth.[15] Failure to introduce complementary foods at this critical juncture can lead to stunted growth in infants.[16] In our educational intervention study, at the baseline assessment, it was observed that 52% of children aged 7-12 months in both the educational intervention and control villages had initiated complementary feeding. These rates align with the findings of the Breastfeeding and Infant and Young Child Feeding (BF & IYCF) 2019 report card. However, approximately 30%of mothers in our study had delayed the introduction of complementary foods to their children. The primary reasons for this delay included concerns about the child's ability to digest complementary feeds, a lack of knowledge regarding the appropriate timing for introducing complementary foods, prevalent misconceptions, and community beliefs. A study conducted by Aggarwal A. et al. in Delhi also identified poor maternal knowledge, cultural customs, and false beliefs as contributors to delayed complementary feeding practices.[16]

To promote correct breastfeeding and complementary feeding practices, health education sessions targeting mothers were conducted regularly. A module was developed to provide mothers with guidance and practical training on correct feeding methods. International guidelines from the World Health Organization (WHO) recommend the use of seven food groups for calculating Minimum-Dietary-Diversity and the number of food groups consumed by children. However, before the educational sessions, our study revealed that only 39.5% of mothers were incorporating more than four food groups into their children. Similar findings (42.6%) were reported in a study conducted by Ahmad et al. in Uttar Pradesh.[17] Additionally, at the baseline assessment, only 13.3% of

mothers were adhering to MMF guidelines, whereas a study by Deepti Dabar et al. in Delhi reported a higher MMF rate (50.7%).[18] This disparity may be attributed to regional differences, as our study was conducted in a rural setting with lower maternal education levels, lower socioeconomic status, and the inclusion of children aged 6-12 months, who typically breastfeed more frequently in comparison to younger infants.

**Effect of Nutritional Educational Sessions:** In our study, a targeted educational intervention comprising five components was provided to mothers in the educational intervention group (6-12 months), and the results were compared with those of the control group. This educational package included group education sessions, educational materials in the local language (picture booklets), video demonstrations on childhood illnesses, and demonstrations of complementary food preparation. A review article by Shi & Zhang underscored that nutritional education, when combined with other strategies, not only promotes child growth but also reduces malnutrition in developing countries.[19] Several randomized controlled trials (Aboud FE et al. 2009, Shi L et al. 2010, Kulwa KB et al. 2014) adopted a similar study design to ours, based on formative research outcomes and the integration of nutritional education delivered in locally accepted languages and through cooking demonstrations using locally available foods.[20,19,21] In our study, we integrated all these educational modes to deliver nutritional education.

The findings of our study demonstrated that regular nutritional education sessions significantly improved the child's nutritional status in the educational intervention group, leading to weight gain compared to the control group. Significant variations in Weight-for-Age Z-scores (WAZ) and Height-for-Age Z-scores (HAZ) were evident between the intervention and control groups (U=1442, P<0.017*; U=1.387, P<0.001). Additionally, statistically significant distinctions were observed in the implementation of MMF and MMD between the intervention and control groups (X2=37.38, P<0.0001*; X2=9.209, P=0.029*).

A similar educational-interventional study conducted in China by Jingxu et al. also reported significant increases in WAZ and HAZ in the intervention group compared to the control group.[19] In another study in Bangladesh, which implemented both nutrition education and nutritional supplementation, the intervention group exhibited higher WAZ scores than the control group (Roy et al. 2005).[22] Penny et al. conducted a study in Peru using a similar educational strategy, demonstrating higher WAZ and HAZ scores in the intervention group.[23] These findings suggest that educating mothers during the critical window of introducing complementary feeding and providing support through follow-up visits is crucial for achieving optimal child-feeding practices and preventing future malnutrition.

In our study, it was observed that the educational messages in pictorial booklets were well-received by mothers in the intervention group, resulting in a significant increase (p=0.029*) in the adoption of recommended dietary diversity in their child's diet, from 13.3% to 71.7%. Additionally, there was an improvement in recommended food-group selection, from 40% to 75% inclusion of various food groups in complementary feeding by mothers in the educational intervention group. Similar results were found in a study conducted by Shi L et al. in 2010, where a higher number of mothers in the intervention group than in the control group had incorporated animal-sourced foods into complementary foods.[19] Numerous studies worldwide have highlighted increased intake of recommended food groups, such as vegetables, eggs, meat, fish, chicken, and fruits, by children in intervention groups.[10,24] Due to variations in food resources and cultural beliefs across different regions, it is challenging to emphasize the intake of specific food groups consistently in various studies.

Our study also revealed significant gender differences in WAZ and HAZ at baseline between male and female children in both the educational intervention and control groups and these differences persisted during subsequent follow-up visits. Although weight and height gain were observed among both male and female children in the educational intervention group, male children exhibited more significant gains in both mean WAZ and mean HAZ compared to their female counterparts. This pattern was also evident in the control group. Recent data from the National-Family-Health-Survey 5 (NFHS 5) in India highlight malnutrition as a major contributing factor to under-five mortality, particularly among girls, with a mortality rate 8.3% higher than that of boys. Specifically, women and girls face greater vulnerability due to prevailing inequalities and discrimination, which begin even before conception and persist throughout their lives. Some studies in India have shown that the breastfeeding duration for female children is shorter than that for male children, ultimately compromising their nutritional needs.[25,26,27]

## Strength and Limitations

Our study offers insight into the impact of educational intervention on both complementary feeding practices and the physical growth of children Health-Education, educational-material & counseling at frequent-intervals were imparted to see the change in complementary-feeding-practice and child growth, in our study educational intervention was directly administered by healthcare providers (doctors), whom mothers recognize and prefer as trustworthy information on child feeding Practice. Thus, this strategy was well accepted by the mothers and resulted in improved Minimum Meal frequency and Minimum Meal diversity practices. There are only a few studies in Indian literature that have explored health education as an intervention and our study demonstrates positive outcomes in this regard.

There are some limitations in our study which include that our study was a non-randomized comparative study & 2-follow-ups in duration due to feasibility & constraints to finish the study. In our study during the follow-up assessments, data collection focused solely on child anthropometry, minimum meal frequency, and dietary diversity. Direct inquiries regarding the enhancement of mothers' knowledge were not included. However, the observed increase in minimum meal frequency and dietary diversity in the child's diet indirectly suggests an improvement in mothers' understanding of child feeding practices.

## Conclusion and Recommendations

In summary, the cumulative positive findings from our study, alongside other research, provide compelling evidence regarding the effectiveness of nutritional education in improving complementary feeding practices and child growth. To address the persistent issue of malnutrition and enhance child growth in India, there is a pressing need for further large-scale interventional studies. Therefore, we recommend the implementation of consistent educational sessions at regular intervals, particularly targeting mothers while their children are still breastfeeding. This approach is expected to significantly reduce childhood malnutrition in regions with similar socio-economic conditions.

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