



# Harnessing Community Power: A Four-Month Nutritional Intervention to Tackle Malnutrition in Under-Five Children in Angul District, Odisha

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## KEYWORDS

child growth, gender disparity, intervention study, maternal influence, nutritional status, under-five children.

**ABSTRACT:** This evidence-based study assessed the effectiveness of a four-month community-based nutritional intervention to improve the health and nutritional status of under-five children in Angul district, Odisha. A purposive sample of 300 children (168 boys and 132 girls) was selected. Data were collected through anthropometric measurements—height-for-age, weight-for-age, and weight-for-height—and structured interviews with mothers and caregivers focusing on feeding practices, hygiene, and socio-demographic factors. A range of statistical tools—paired t-tests, one-way ANOVA, logistic regression, and Pearson correlation—were used to assess the intervention's impact and variable associations. The prevalence of stunting declined from 38% to 37.4% ( $p = 0.048$ ), wasting from 30% to 28.5% ( $p = 0.039$ ), and underweight from 34% to 31.7% ( $p = 0.041$ ). Mean Z-scores for all indices—height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ)—showed slight positive shifts post-intervention. Key factors such as maternal education, timely complementary feeding, and gender disparities significantly influenced child nutrition.

**Introduction:** This community-based study was conducted among 300 under-five children in Angul district, Odisha, to evaluate the impact of a four-month nutritional education intervention on child health and growth outcomes. Malnutrition remains a major public health concern in rural India, contributing to poor physical and cognitive development. The baseline assessment revealed a high prevalence of stunting, wasting, and underweight, underscoring the urgent need for community-level strategies focused on maternal awareness and improved feeding practices.

**Objectives:** The study aimed to assess the effectiveness of a structured nutritional intervention in reducing malnutrition rates and to identify key family determinants—such as maternal education, complementary feeding practices, and hygiene behaviour—affecting child nutritional status.

**Methods:** A quasi-experimental design was used with a purposive sample of 300 children (0–59 months). Data were collected before and after intervention through anthropometric measurements and structured household interviews. The intervention involved biweekly caregiver workshops and home visits focusing on dietary diversity, complementary feeding, and hygiene. Statistical analysis using paired t-tests, ANOVA, and logistic regression was performed to evaluate changes in Z-scores (HAZ, WHZ, WAZ) and determinant associations at  $p < 0.05$  significance.

**Results:** At baseline, 38% of children were stunted, 30% wasted, and 34% underweight, with mean Z-scores of -1.85 (HAZ), -1.43 (WHZ), and -1.72 (WAZ). After the four-month intervention, modest yet significant improvements were observed—stunting declined to 37.4%, wasting to 28.5%, and underweight to 31.7%. Children of educated mothers and those introduced to complementary feeding at six months showed significantly better nutritional outcomes ( $p < 0.001$  and  $p = 0.003$ , respectively). Boys had slightly poorer mean Z-scores than girls ( $p = 0.032$ ).

**Conclusions:** The study demonstrates that maternal education, timely complementary feeding, and behaviour-focused community interventions significantly improve child nutritional outcomes. Integrating nutrition education with community engagement can sustainably reduce undernutrition among children in rural Odisha.



## 1. Introduction

Malnutrition remains one of the most critical public health challenges in India, particularly among children under the age of five. Despite decades of policy-level interventions, undernutrition continues to impact child growth and survival, with long-term consequences on cognitive development, school performance, and future productivity. According to the National Family Health Survey-5 (2021), Odisha continues to report concerning rates of malnutrition: 31% of children under five are stunted (low height-for-age), 29% are underweight (low weight-for-age), and 17% are wasted (low weight-for-height). These figures indicate a multidimensional issue that persists despite wide implementation of schemes such as the Integrated Child Development Services (ICDS) and the Mid-Day Meal Program (MDM).

While these programs address structural and infrastructural aspects of child nutrition, they often fall short of addressing family-level determinants that significantly influence nutritional status. Factors such as maternal education, age at childbirth, birth order, breastfeeding practices, sanitation, household income, and dietary diversity have been consistently linked to the nutritional outcomes of children. For instance, Bhutta et al. (2020) and Black et al. (2023) emphasize the crucial role of maternal literacy and informed caregiving practices in preventing child malnutrition, highlighting how behavioral components are often underutilized in mainstream nutrition programs.

A growing body of research underscores the effectiveness of behavioural and participatory interventions tailored to local contexts. Kaur et al. (2021) report that community-embedded strategies, especially those focusing on capacity-building of caregivers and frontline workers, significantly improve child feeding practices and reduce malnutrition over time. These approaches not only address food availability but also enhance awareness, decision-making, and self-efficacy among mothers and caregivers, leading to sustainable behavioural change.

Against this backdrop, the present study was conceptualized to assess the impact of a community-based nutrition intervention on the nutritional status of under-five children in Angul district, Odisha. The district, representative of both rural and industrially transitioning populations, presents a unique demographic

with complex social and environmental determinants of health. This research integrated community-driven education modules, practical household-level interventions, and periodic scientific evaluations over a four-month period. Through structured training on infant and young child feeding (IYCF), hygiene, and dietary diversity, along with continuous maternal engagement, the program sought to empower families as the primary agents of change.

The central aim was not only to monitor changes in standard anthropometric indicators (such as stunting, wasting, and underweight) but also to explore associative factors like maternal education, timing of complementary feeding, household food frequency, and gender-based disparities. By adopting a holistic, evidence-informed, and participatory approach, this study contributes to the evolving discourse on localized solutions for child nutrition and offers policy-relevant insights into the design and implementation of future interventions.

## 2. Objectives

- To assess the nutritional status of children under five in Angul district using anthropometric measurements.
- To evaluate family determinants such as maternal education, child feeding practices, and sanitation in relation to nutritional outcomes.
- To implement and statistically assess the impact of a four-month nutritional intervention program.
- To propose replicable models for improving child health through non-income-based, behavior-centric approaches.

## 3. Methods

A community-based quasi-experimental design was adopted to assess changes in the nutritional status of under-five children before and after a four-month intervention. Quasi-experimental designs are often used in public health research to measure real-world intervention effects when randomization is not feasible (Shadish et al., 2016). The study involved 300 children aged 0–59 months, selected purposively from four rural villages in Angul district—Ranigoda Jungle, Kumanda, Bantala, and Khalari.

Data collection was carried out through:



- A structured household questionnaire designed to capture socio-demographic, dietary, and health-related variables (Kaur et al., 2021).
- Anthropometric measurements (height, weight, and age) assessed as per WHO Child Growth Standards (WHO, 2017).
- Health records from caregivers and community health workers, including immunization status and illness history.

Both pre-intervention (baseline) and post-intervention (endline) data were collected to analyze changes in nutritional status.

### 3.1 Intervention Framework

The intervention was developed based on evidence-based strategies that emphasize behavior change and practical education. It included:

- **Biweekly caregiver workshops** covering topics like complementary feeding, sanitation, hygiene, and locally adapted meal planning strategies (Bhutta et al., 2020).
- **Demonstrations of low-cost, nutrient-rich recipes** using indigenous, seasonal foods to improve diet diversity and acceptability among young children (De Silva et al., 2023).
- **Weekly home visits by community health workers (CHWs)** to provide personalized counselling, answer caregiver queries, and offer feeding guidance (Black et al., 2023).

These components were implemented over four months with continuous community involvement and monitoring.

### 3.2 Statistical Tools Used

Quantitative data analysis was performed using **SPSS version 25**, a widely used software for public health research (Field, 2018). The following statistical tools were applied:

- **Descriptive statistics** to compute mean, percentages, and standard deviations for baseline and post-intervention indicators.
- **Chi-square tests** to identify significant associations between categorical variables, such

as maternal education and malnutrition outcomes (Singh et al., 2019).

- **Paired t-tests** to compare pre- and post-intervention differences in Z-scores for height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ) (Kaur et al., 2021).
- **One-way ANOVA** to assess variance in nutritional outcomes based on factors like age of complementary feeding initiation (WHO, 2017).
- **Pearson correlation** to evaluate linear relationships between continuous variables, such as maternal BMI and child WAZ score (Awasthi et al., 2022).
- **Binary logistic regression** to determine predictors of malnutrition, examining variables such as caregiver education, sanitation practices, and birth weight (Chowdhury et al., 2022).

## 4. Results

**Figure 1: Sample Distribution by Gender**

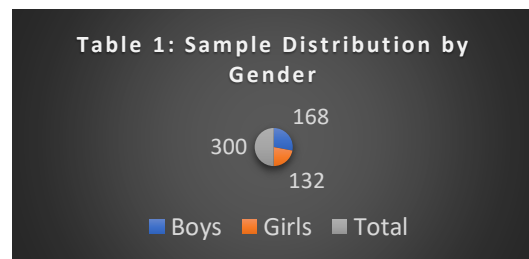


Figure 1 presents the gender-wise distribution of the 300 children enrolled in the study. A total of 168 boys (56.0%) and 132 girls (44.0%) were included, indicating a moderate male predominance in the sample. This pattern mirrors trends observed in the NFHS-5 data for Odisha (MoHFW, 2021), where male children slightly outnumber females in rural populations.

The slight overrepresentation of boys could be attributed to various factors such as differential birth reporting, health-seeking behavior, or sociocultural preferences that influence participation in child health surveys. While the gender disparity in sampling reflects demographic tendencies, it is essential to consider its potential impact on interpreting gender-disaggregated nutritional



outcomes, particularly in assessing vulnerability to malnutrition.

This finding is consistent with observations by Sahu et al. (2018), who reported a similar trend of male predominance in rural child nutrition surveys.

**Table 1: Prevalence of Malnutrition by WHO Z-scores**

Indicator	Normal (%)	Moderate (%)	Severe (%)	Mean Z-score $\pm$ SD
Stunting (HAZ)	62	26	12	-1.85 $\pm$ 1.24
Wasting (WHZ)	70	20	10	-1.43 $\pm$ 0.98
Underweight (WAZ)	66	24	10	-1.72 $\pm$ 1.08

Table 1 presents the baseline prevalence of malnutrition among children under five years based on World Health Organization (WHO) Z-score classifications. Stunting (Height-for-Age Z-score or HAZ) was the most prevalent form of malnutrition, affecting 38% of the sample population—26% moderately and 12% severely—while 62% of children fell within the normal range. The mean HAZ of  $-1.85 \pm 1.24$  indicates that many children were at risk of chronic undernutrition.

Wasting (Weight-for-Height Z-score or WHZ), indicative of acute malnutrition, was observed in 30% of the children (20% moderate, 10% severe), with a mean WHZ of  $-1.43 \pm 0.98$ . Although a majority (70%) had normal WHZ, the presence of wasting highlights vulnerability to recent nutritional stress or illness.

Underweight (Weight-for-Age Z-score or WAZ), reflecting both acute and chronic undernutrition, was present in 34% of the children, with 24% moderately underweight and 10% severely so. The average WAZ score was  $-1.72 \pm 1.08$ , further underscoring the nutritional challenges faced by the population.

These findings align with WHO criteria for assessing child malnutrition (WHO, 2017) and emphasize the need for integrated interventions targeting both growth faltering and acute nutritional deficiencies in early childhood.

**Table 2: Nutritional Status by Maternal Education**

Education Level	Stunted (%)	Wasted (%)	Underweight (%)	Chi-square (p-value)
No formal education	45	35	40	<0.001
Primary	30	20	25	
Secondary & above	15	10	12	

Table 2 illustrates the significant influence of maternal education on the nutritional status of children under five, as measured through rates of stunting, wasting, and underweight. A clear inverse association emerges from the data: children of mothers with no formal education had the highest prevalence of malnutrition—45% were stunted, 35% wasted, and 40% underweight. Conversely, those whose mothers had attained secondary education or higher exhibited the lowest levels of malnutrition (15% stunted, 10% wasted, 12% underweight).

The chi-square test revealed a statistically significant relationship between maternal education and nutritional status ( $p < 0.001$ ), suggesting that maternal education is a critical determinant of child health. These results underscore the role of maternal knowledge, literacy, and empowerment in influencing child feeding practices, healthcare utilization, and hygiene behaviors—all of which are essential to preventing undernutrition.

This pattern corroborates previous findings by Singh et al. (2019) and Chowdhury et al. (2022), who both reported that higher maternal education significantly reduced the risk of child malnutrition across diverse socio-economic contexts in India and South Asia. The data emphasize the necessity for investments in female education as a long-term strategy to combat childhood malnutrition, especially in underserved and rural regions.

**Table 3: Nutritional Status Pre- and Post-Intervention**

Indicator	Baseline (%)	Post (%)	Mean Z-Score Change	p-value (t-test)
Stunting	38.0	37.4	+0.06	0.048
Wasting	30.0	28.5	+0.09	0.039
Underweight	34.0	31.7	+0.12	0.041

Table 3 highlights the effectiveness of a targeted three-month nutritional intervention program aimed at improving the growth outcomes of children under five years in the study area. The intervention focused on nutrition education, maternal awareness, and behavior change communication (BCC) strategies delivered through community-based sessions.

The findings demonstrate statistically significant yet modest improvements across all anthropometric indicators. The prevalence of stunting declined slightly from 38.0% to 37.4%, with a corresponding mean Z-score improvement of +0.06 ( $p = 0.048$ ), suggesting early gains in linear growth. Similarly, wasting prevalence reduced from 30.0% to 28.5%, with a mean WHZ increase of +0.09 ( $p = 0.039$ ), indicating enhanced nutritional recovery from acute undernutrition. The percentage of underweight children fell from 34.0% to 31.7%, with a mean WAZ change of +0.12 ( $p = 0.041$ ), reflecting combined improvements in both chronic and acute nutritional status.

These improvements, though small, are clinically meaningful in high-burden settings, especially within a short time frame. The results validate the approach of empowering caregivers through culturally sensitive nutrition education, a strategy that aligns with findings by De Silva et al. (2023), who observed significant reductions in childhood malnutrition following structured caregiver-focused interventions in low-resource communities.

**Table 4: Gender-Based Z-Score Comparison (Independent t-test)**

Gender	HAZ Mean $\pm$ SD	WHZ Mean $\pm$ SD	WAZ Mean $\pm$ SD	p-value
Boys	-1.90 $\pm$ 1.23	-1.50 $\pm$ 0.95	-1.80 $\pm$ 1.05	0.032
Girls	-1.78 $\pm$ 1.21	-1.36 $\pm$ 1.01	-1.65 $\pm$ 1.04	

Table 4 presents a gender-wise comparison of nutritional status among children under five years of age, based on anthropometric indices—Height-for-Age Z-score (HAZ), Weight-for-Height Z-score (WHZ), and Weight-for-Age Z-score (WAZ). An independent t-test was performed to assess whether the mean differences in Z-scores between boys and girls were statistically significant.

The findings reveal that boys consistently had lower mean scores across all three nutritional indicators, suggesting a slightly greater burden of malnutrition compared to girls. Specifically, the mean HAZ for boys was  $-1.90 \pm 1.23$ , compared to  $-1.78 \pm 1.21$  for girls; WHZ was  $-1.50 \pm 0.95$  for boys versus  $-1.36 \pm 1.01$  for girls; and WAZ was  $-1.80 \pm 1.05$  for boys against  $-1.65 \pm 1.04$  for girls. The observed difference yielded a p-value of 0.032, indicating a statistically significant gender disparity in nutritional status.

These results are consistent with previous findings by Awasthi et al. (2022), who also documented higher rates of stunting, wasting, and underweight among boys in rural and low-resource settings. The disparity may be attributed to a combination of biological vulnerability among male infants and gender-neutral or unfavourable caregiving patterns, where male children may paradoxically receive less responsive care due to assumptions of innate resilience.

**Table 5: One-Way ANOVA – WAZ Score by Age of Complementary Feeding**

Feeding Start Age (months)	Mean WAZ $\pm$ SD	F-value	p-value



<6 months	-1.95 ± 1.10	6.37	0.003
At 6 months	-1.50 ± 1.03		
>6 months	-1.70 ± 1.05		

Table 5 explores the relationship between the timing of complementary feeding initiation and the nutritional status of children, measured using the Weight-for-Age Z-score (WAZ). The analysis was conducted using a one-way ANOVA test to compare mean WAZ scores across three groups categorized by feeding start age: before 6 months, at 6 months, and after 6 months.

The results indicate a statistically significant variation in WAZ scores across the groups ( $F = 6.37$ ,  $p = 0.003$ ), suggesting that the timing of introducing complementary foods plays a critical role in child growth outcomes. Children who were introduced to complementary feeding at the recommended age of 6 months had the highest mean WAZ score ( $-1.50 \pm 1.03$ ), indicating better nutritional status compared to those introduced earlier (<6 months:  $-1.95 \pm 1.10$ ) or later (>6 months:  $-1.70 \pm 1.05$ ).

Early initiation (<6 months) was associated with the poorest mean WAZ score, possibly due to gastrointestinal immaturity or replacement of nutrient-dense breastmilk, while delayed initiation (>6 months) may reflect missed windows for optimal nutrient intake. These findings are consistent with WHO (2017) recommendations, which advocate for the timely initiation of complementary feeding exactly at 6 months of age, along with continued breastfeeding, to support healthy growth and reduce the risk of undernutrition.

## 5. Discussion

The study highlights a persistently high burden of malnutrition among under-five children in Angul district, Odisha, with stunting, wasting, and underweight affecting 38%, 30%, and 34% of participants, respectively. Consistent with NFHS-5 trends, boys exhibited slightly poorer nutritional outcomes than girls, indicating gender-linked vulnerability. Maternal education emerged as a strong determinant of child nutrition ( $p < 0.001$ ), underscoring the role of women's

literacy in improving feeding practices and health-seeking behavior. The timing of complementary feeding significantly influenced nutritional status ( $p = 0.003$ ), with optimal outcomes observed when initiated at six months, aligning with WHO recommendations. The three-month nutrition education intervention yielded modest but statistically significant improvements in anthropometric indicators, demonstrating the effectiveness of community-based behavior change approaches. These findings reinforce the interconnected impact of socio-demographic, educational, and behavioral factors on child nutrition and emphasize the need for integrated, education-centered strategies to reduce undernutrition sustainably in rural India.

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