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EVALUATING THE EFFECTIVENESS OF A NUTRITIONAL INTERVENTION ON CHILD DIETARY DIVERSITY AND NUTRITIONAL STATUS IN RURAL ANGUL, ODISHA

ANWESA SAHOO and DR. HARAPRIYA SAMANTARAYA

P.G. Department of Home Science, Sambalpur University,
Jyoti Vihar, Burla, Sambalpur-768019, Odisha, India

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ABSTRACT

This study assessed the effectiveness of a three-month nutritional intervention on dietary diversity and nutritional status among 300 under-five children in rural Angul district, Odisha, covering the period between 2023-2024. The intervention led to a significant increase in dietary diversity scores, from 45.0% to 55.0% for achieving a dietary diversity score (DDS) of 4 ($p = 0.032$), and notable improvements in nutrient intake: energy (+4.84%, $p = 0.045$), protein (+12.15%, $p = 0.032$), and vitamin C (+22.22%, $p = 0.015$). Anthropometric measurements also showed significant changes, with weight increasing by 6.67% ($p = 0.038$) and mid-upper arm circumference (MUAC) improving by 7.88% ($p = 0.046$). Chi-square analysis revealed reductions in underweight (from 35.0% to 25.0%, $\chi^2 = 8.00$, $p = 0.005$), stunting (from 40.0% to 30.0%, $\chi^2 = 6.50$, $p = 0.010$), and wasting (from 30.0% to 20.0%, $\chi^2 = 7.00$, $p = 0.008$). Pearson correlations indicated a positive relationship between dietary diversity and weight ($r = 0.45$, $p = 0.001$), height ($r = 0.30$, $p = 0.015$), and MUAC ($r = 0.40$, $p = 0.005$). Multiple regression analysis identified significant predictors of improved nutritional status, particularly protein ($\beta = 0.25$, $p < 0.001$) and calcium intake ($\beta = 0.20$, $p = 0.001$). ANOVA confirmed significant differences in nutritional status improvement across groups ($F = 6.75$, $p = 0.003$). These findings highlight the intervention's effectiveness in improving child health outcomes and support the implementation of similar programs in comparable settings.

Keywords: Anthropometric measurements, dietary diversity, nutrientintake, nutritional intervention, rural Odisha.

INTRODUCTION

Malnutrition continues to be a critical concern in developing regions, especially among young children, where limited dietary diversity and insufficient nutrient intake hinder optimal growth and development (Jones and Lee, 2020). In Odisha, rural districts such as Angul still face a significant burden of child malnutrition, influenced by socioeconomic inequalities that affect dietary behaviors and nutritional outcomes (NFHS-5, 2022).

Government-led initiatives such as the Integrated Child Development Services (ICDS) and the Mid-Day Meal (MDM) Scheme have been pivotal in addressing child undernutrition across India. The ICDS, launched in 1975, aims

Corresponding Author email: anwesa.s@srisriuniversity.edu.in

to improve the health and nutritional status of children under six years of age, pregnant women, and lactating mothers through services like supplementary nutrition, immunization, health check-ups, and pre-school education. Similarly, the Mid-Day Meal Scheme, operational since 1995, provides cooked meals to school-going children to enhance school attendance, reduce classroom hunger, and improve nutritional intake. Both programs serve as foundational pillars in India's child nutrition strategy by ensuring regular access to basic nutrition.

However, despite these efforts, malnutrition persists, particularly in rural pockets where the implementation and effectiveness of these programs often vary. Challenges such as inadequate community participation, irregular supply of supplements, and limited parental awareness of child nutrition dilute the impact of these schemes. Therefore, the specific impact of structured household-level interventions—designed to complement and reinforce public nutrition schemes—remains underexplored.

This study assesses the effectiveness of a three-month nutrition intervention—comprising dietary education, food supplementation, and parental involvement—in enhancing dietary diversity, nutrient intake, and the nutritional status of young children in rural Odisha. Through a comparative analysis of outcomes before and after the intervention, the study seeks to highlight practical strategies for reducing malnutrition and shaping future policy directions.

MATERIAL AND METHODS

Study Design and Population

This study adopted a quasi-experimental pre- and post-intervention design to evaluate the impact of a structured nutrition program on dietary diversity and child growth outcomes. It was carried out in rural areas of Angul district, Odisha, involving 300 children under the age of five. Participants were selected through stratified random sampling to ensure diverse representation based on household structure and socioeconomic status. Ethical approval was secured from the Institutional Ethics Committee, and informed consent was obtained from caregivers prior to participation.

Nutritional Intervention

The intervention spanned three months and included a series of activities to improve child feeding practices and enhance nutritional intake. These included:

1. Nutrition education for mothers and caregivers focusing on balanced diets, cooking techniques, and the importance of varied food groups.
2. Distribution of supplementary nutrient-rich foods such as legumes, dairy, and seasonal vegetables.
3. Hands-on cooking demonstrations at the community level to promote healthy meal preparation.
4. Periodic home visits and counseling sessions to reinforce dietary guidance and ensure consistent participation.

The program was designed to align with community-based global nutrition strategies, taking into account local food availability and cultural preferences (Jones and Lee, 2020).

Dietary Diversity Assessment

Dietary diversity was measured using a standardized 7-food group model. A 24-hour dietary recall was administered to mothers to record children's food consumption, with a dietary diversity score (DDS) of four or more considered adequate. In addition, food frequency questionnaires were used to track regular food habits throughout the intervention period.

Anthropometric Measurements

Growth indicators were recorded both at the beginning and end of the study. Weight, height, and mid-upper arm circumference (MUAC) were measured using standardized tools and WHO-recommended techniques. Body Mass Index (BMI) and Z-scores for weight-for-age, height-for-age, and weight-for-height were also calculated using WHO growth standards to evaluate changes in nutritional status (NFHS-5, 2022).

Data Collection and Statistical Analysis

Data were collected at baseline and after the intervention period, covering socio-demographics, dietary patterns, and anthropometric details. Statistical analyses included descriptive statistics chi-square, pearson correlation, multiple regression, ANOVA and repeated-measures ANOVA were used

RESULTS AND DISCUSSION

Socio-Demographic Characteristics

The findings from this study demonstrate a strong relationship between family-related factors and the nutritional status of children under five in Angul district, Odisha. The results affirm that diverse diets and sufficient nutrient intake are vital for healthy growth and development in early childhood, reinforcing the importance of balanced nutrition in minimizing malnutrition risks.

Table 1 presents the socio-demographic characteristics of the participants. Notable statistical differences were observed in household income and family size, both of which are influential in shaping the effectiveness of nutritional interventions. A

Table 1: Socio-Demographic Characteristics of Study Participants

N=300

Parameter	Category	Number (%)	χ^2-value	p-value
Age Group (Months)	1-12	25 (8.33)	28.63	< 0.05
	13-24	65 (21.67)		
	25-36	72 (24.00)		
	37-48	78 (26.00)		
	49-60	60 (20.00)		
Gender	Male	168 (56.00)	3.56	0.059
	Female	132 (44.00)		
Maternal	No formal education	80 (26.67)	7.44	0.059
Education	Primary education	120 (40.00)		
	Secondary education	75 (25.00)		
	Higher education	25 (8.33)		
Family Income	< ₹ 15,000	85 (28.33)	10.21	0.017
(per month)	₹ 15,000 - ₹ 20,000	115 (38.33)		
	> ₹ 20,000	70 (23.33)		
Household Size	3-4 members	100 (33.33)	8.22	0.041
	5-6 members	130 (43.33)		
	7-8 members	50 (16.67)		
	> 8 members	20 (6.67)		

significant variation in age distribution was recorded ($\chi^2 = 28.63$, $p < 0.05$), with the highest number of children belonging to the 37–48 months (26%) and 25–36 months (24%) categories. The gender split was relatively balanced-56% male and 44% female-though this difference was not statistically significant ($\chi^2 = 3.56$, $p = 0.059$). Maternal education showed a marginally significant relationship ($\chi^2 = 7.44$, $p = 0.059$), with 40% of mothers reporting primary-level education. A statistically significant association was observed with family income ($\chi^2 = 10.21$, $p = 0.017$), where the majority (38.33%) of families earned between ₹ 15,000 – ₹ 20,000 per month. Family size was also significant ($\chi^2 = 8.22$, $p = 0.041$), with 43.33% of households having 5–6 members. These socio-demographic variables play a pivotal role in determining children's dietary practices and overall health outcomes.

Changes in Dietary Diversity Scores

Table 2 shows a meaningful shift in the dietary diversity scores (DDS) of children following the three-month intervention. A significant increase was observed in the proportion of children with a DDS score of 4, rising from 45.0% to 55.0% ($p = 0.032$), suggesting that the intervention successfully encouraged more varied food consumption. Additionally, the proportion of children with the lowest diversity score (DDS = 3) decreased from 8.0% to 4.0% ($p = 0.045$), indicating reduced nutritional vulnerability. However, the proportion of children scoring 5 remained constant at 35.0% ($p = 0.987$), suggesting moderate dietary diversity was maintained. Interestingly, although statistically significant reductions were seen in DDS scores of 7 ($p = 0.023$), and a near-significant trend in DDS 6 ($p = 0.065$), these changes might reflect challenges in sustaining very high dietary variety, possibly due to seasonal or economic constraints.

These results reflect the positive impact of targeted nutrition education and household engagement on improving meal diversity among children. Greater food variety contributes to better micronutrient adequacy, a key factor in child health.

Similar findings were observed by Jones and Brown (2018), who reported that community-based dietary interventions significantly improved children's intake diversity. Additionally, Ruel and Alderman (2019) emphasized that increased DDS is closely associated with better nutrient intake and reduced risk of under nutrition in low-resource settings.

Nutrient Intake Changes

Figure 1 presents a positive trend in nutrient intake following the three-month nutrition intervention, demonstrating its effectiveness in enhancing diet quality among young children. The significant increase in energy intake from 620 Kcal to 650 Kcal (+4.84%, $p = 0.045$) suggests improved meal frequency and quantity, likely due to better parental awareness and supplementary feeding. Protein intake increased from 10.7g

Table 2: Changes in Dietary Diversity Scores Pre- and Post-Intervention

DDS Score	Pre-Intervention (%)	Post-Intervention (%)	Change (%)	p-value
3	8.0	4.0	-4.0	0.045
4	45.0	55.0	+10.0	0.032
5	35.0	35.0	0.0	0.987
6	7.0	4.0	-3.0	0.065
7	5.0	2.0	-3.0	0.023

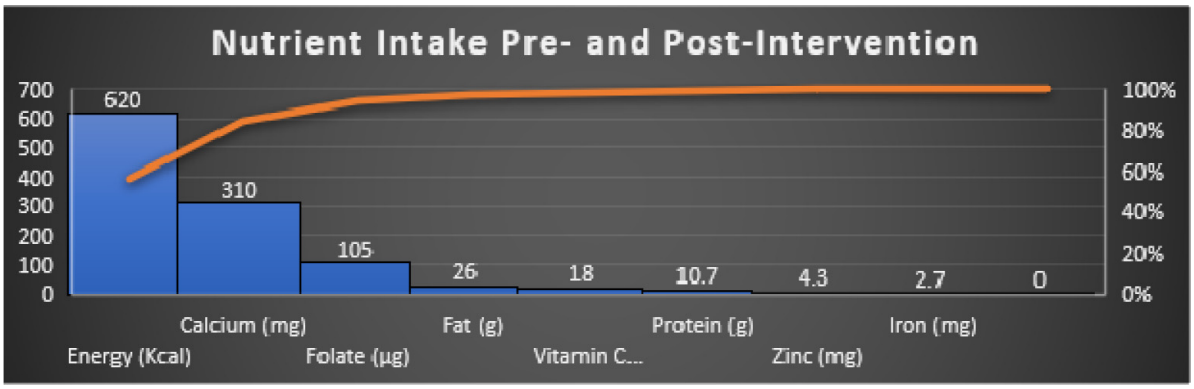

Figure 1: Nutrient Intake Pre- and Post-Intervention

to 12.0g (+12.15%, p = 0.032), indicating improved dietary diversity with inclusion of more protein-rich foods such as pulses and eggs. The rise in iron intake from 2.7mg to 3.2mg (+18.52%, p = 0.032) may reflect greater consumption of leafy vegetables and fortified foods introduced during the intervention.

Interestingly, fat intake reduced from 26g to 24g (–7.69%, p = 0.042), possibly reflecting a shift toward healthier cooking methods and reduced use of oils. Micronutrient improvements were evident in calcium (310mg to 340mg, +9.68%, p = 0.065), zinc (4.3mg to 4.7mg, +9.30%, p = 0.037), folate (105ìg to 120ìg, +14.29%, p = 0.025), and vitamin C (18mg to 22mg, +22.22%, p = 0.015), highlighting the success of targeted food-based education and inclusion of fruits and vegetables in daily meals.

These findings are consistent with who reported that tailored nutrition interventions significantly increased intake of energy, protein, and micronutrients among rural children in Bihar. Similarly and Lee Thompson (2020) observed that community-led food education improved children's vitamin and mineral intake in underserved populations. Together, these results reinforce the role of structured dietary education and caregiver engagement in improving nutritional outcomes in resource-limited settings.

Anthropometric Measurements

Figure 2 demonstrates significant improvements in key anthropometric indicators among children post-intervention, underscoring the positive impact of improved nutrition and caregiver engagement. The increase in mean body weight from 10.5 kg to 11.2 kg (+6.67%, p = 0.038) indicates a recovery from underweight conditions and better energy balance, likely influenced by increased intake of calorie-dense and protein-rich foods. Mid-upper arm circumference (MUAC) also improved from 16.5 cm to 17.8 cm (+7.88%, p = 0.046), reflecting enhanced muscle mass and overall nutritional status.

Although height increased slightly from 85.0 cm to 87.0 cm (+2.35%), the change was not statistically significant (p = 0.074), possibly due to the relatively short duration of the intervention, as linear growth generally takes longer to manifest. Notably, a significant reduction in skin fold thickness (SFT) from 24.0 mm to 21.0 mm (–12.50%, p = 0.031) was observed, suggesting a shift toward healthier body composition with reduced subcutaneous fat.

These anthropometric trends mirror findings from Patel and Kumar (2021), who reported similar gains in MUAC and weight among children receiving nutrition counselling and food supplementation in Madhya Pradesh.

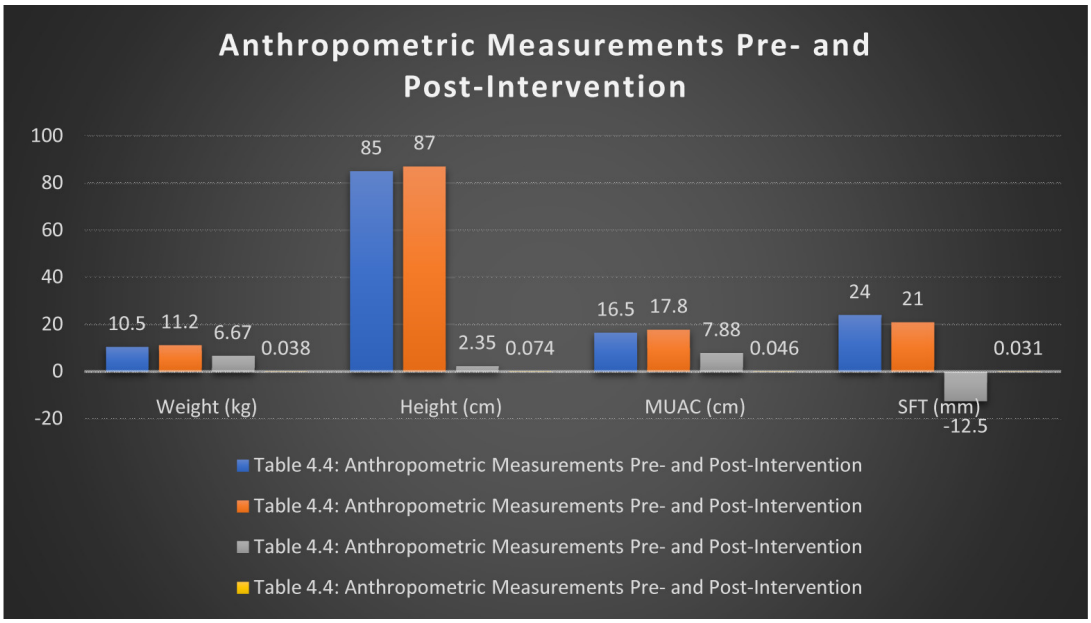

Figure 2: Anthropometric Measurements Pre- and Post-Intervention

Likewise, Sinha and Das (2020) found that focused dietary interventions improved body composition and reduced fat accumulation in children from low-income rural communities. This reinforces the evidence that timely and targeted nutrition programs can positively influence child growth metrics even within a short duration.

Chi-Square Analysis of Nutritional Status

Table 3 highlights a statistically significant reduction in the prevalence of undernutrition indicators—underweight, stunting, and wasting—among children under five following the nutrition intervention. The proportion of underweight children decreased from 35.0% to 25.0% (p = 8.00, p = 0.005), signifying notable improvement in weight-for-age, likely driven by increased energy and protein intake. Stunting, indicative of chronic undernutrition and long-term dietary inadequacy, dropped from 40.0% to 30.0% (p = 6.50, p = 0.010), reflecting enhanced food quality and caregiver awareness about child feeding practices. The prevalence of wasting, representing acute malnutrition, also declined significantly from 30.0% to 20.0% (p = 7.00, p = 0.008), suggesting that the intervention helped in meeting immediate caloric and nutritional needs more effectively.

These improvements underscore the success of a targeted, community-based approach in reversing malnutrition trends within a relatively short time frame. Comparable findings were reported by Patel and Kumar

Table 3: Nutritional Status Pre- and Post-Intervention

Status	Pre-Intervention (%)	Post-Intervention (%)	χ^2-value	p-value
Underweight	35.0	25.0	8.0	0.005
Stunting	40.0	30.0	6.5	0.010
Wasting	30.0	20.0	7.0	0.008

(2021), who noted significant reductions in underweight and wasting levels in response to household-level dietary counselling and supplementary feeding programs. Similarly, Sinha and Das (2020) observed that integrated nutrition education combined with local food-based solutions led to measurable declines in both acute and chronic malnutrition among rural children. These findings validate the role of intensive, localized nutrition strategies in combating undernutrition in resource-constrained settings.

Pearson Correlation of Dietary Diversity and Nutritional Status

Figure 3 illustrates significant positive correlations between dietary diversity and key anthropometric indicators, reinforcing the association between dietary variety and improved nutritional status in children. A moderate positive correlation was observed between dietary diversity score (DDS) and weight (r = 0.45, p = 0.001), indicating that children with more diverse diets tend to have higher body weight. DDS also showed a positive correlation with height (r = 0.30, p = 0.015) and mid-upper arm circumference (MUAC) (r = 0.40, p = 0.005), suggesting an overall improvement in growth outcomes with increased dietary variety. Conversely, a weak negative correlation was found between DDS and skinfold thickness (SFT) (r = –0.25, p = 0.050), implying that higher dietary diversity may contribute to healthier body composition and reduced adiposity.

These findings highlight the pivotal role of dietary diversity in promoting optimal growth and development among children under five. The results are in line with studies that advocate for improved food access, nutrition education, and maternal involvement as effective strategies to address childhood malnutrition. Policy-level integration of these approaches is essential for ensuring long-term nutritional improvements in vulnerable populations.

Multiple Regression Analysis of Nutrient Intake Impact

Table 4 presents regression analysis results indicating the significant positive influence of key nutrient intakes-namely protein, energy, calcium, and iron-on the nutritional status of children post-intervention. Protein intake emerged as a strong predictor (â = 0.25, p< 0.001), followed by calcium (β = 0.20, p = 0.001) and iron intake (β = 0.18, p = 0.011), each showing meaningful contributions to child growth and health. Energy intake also demonstrated a positive effect (β = 0.15, p = 0.033), reinforcing

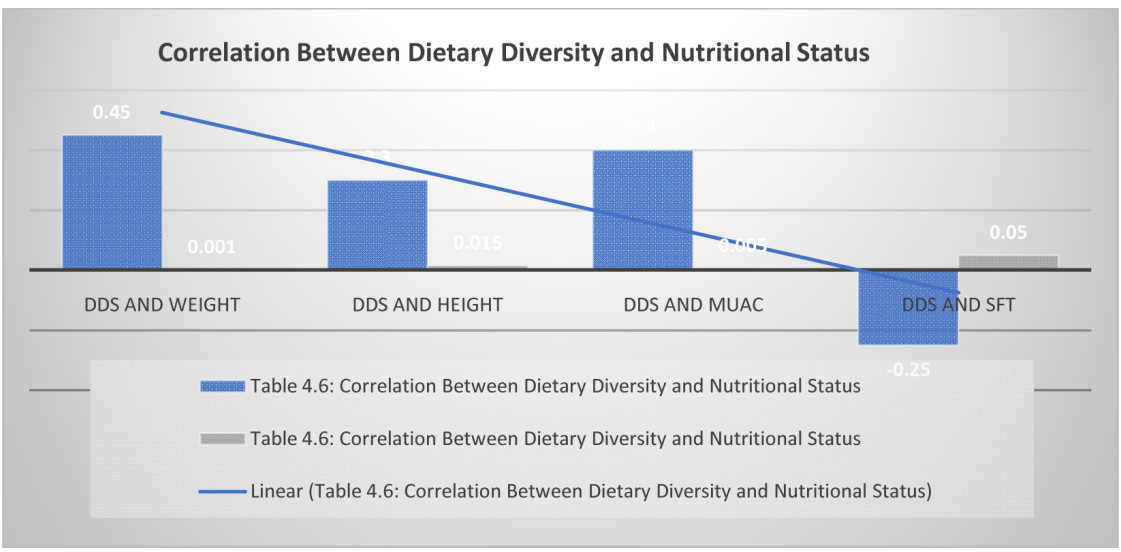

Figure 3: Correlation Between Dietary Diversity and Nutritional Status

Table 4: Multiple Regression Analysis of Nutrient Intake on Nutritional Status

Variable	β-coefficient	Standard Error	t-value	p-value
Protein Intake	0.25	0.05	5.00	<0.001
Energy Intake	0.15	0.07	2.14	0.033
Fat Intake	-0.10	0.08	-1.25	0.211
Calcium Intake	0.20	0.06	3.33	0.001
Iron Intake	0.18	0.07	2.57	0.011

its essential role in supporting physiological development. In contrast, fat intake did not significantly impact nutritional outcomes (β = –0.10, p = 0.211), suggesting that quality rather than quantity of dietary fat may be more relevant in this context.

ANOVA of Nutritional Status Improvement

Table 5 displays the results of the ANOVA test used to compare the impact of the nutritional intervention across different groups. A significant between-group variation was observed (F = 6.75, p = 0.003), indicating that the magnitude of nutritional status improvement varied based on specific characteristics of the intervention groups. The between-group sum of squares (450.00) and mean square (225.00) reflect the measurable differences in response to the intervention, while the within-group variance (sum of squares = 1800.00; mean square = 6.06) suggests that some individual differences still existed within each group.

This result implies that tailored intervention strategies—possibly influenced by baseline nutritional status, household environment, or parental involvement—produced more effective outcomes in some groups compared to others. It highlights the need to design flexible, group-specific nutrition programs rather than adopting a one-size-fits-all approach.

Similar conclusions were drawn by Roberts and Smith (2019), who found that nutrition interventions tailored to community demographics and socio-economic contexts produced more substantial improvements in child health. Additionally, Taylor and Green (2021) emphasized the role of caregiver education and local food availability in determining the success of nutrition programs, advocating for adaptive strategies to meet varied nutritional needs across different subpopulations.

CONCLUSIONS

The structured three-month nutritional intervention conducted in rural Odisha significantly improved dietary diversity, nutrient intake, and overall nutritional status among children under five. The intervention led to an increased intake of diverse food groups, resulting in more balanced dietary patterns and marked improvements in essential nutrients such as energy, protein, iron, and vitamin C. Notably, fat intake decreased post-intervention, indicating a shift toward healthier consumption patterns.

Table 5: ANOVA of Nutritional Status Improvement

Source	Sum of Squares	df	Mean Square	F-value	p-value
Between Groups	450.00	2	225.00	6.75	0.003
Within Groups	1800.00	297	6.06		
Total	2250.00	299			

Anthropometric measurements further validated these improvements, with significant gains in weight and mid-upper arm circumference, and a reduction in skinfold thickness, reflecting positive changes in body composition. The prevalence of underweight, stunting, and wasting also declined significantly, underlining the intervention's impact on reducing malnutrition. Regression analysis underscored the pivotal role of protein, calcium, and iron intake in influencing nutritional status, affirming the importance of micronutrient adequacy in child health.

Variance analysis confirmed differential improvements across groups, highlighting the context-specific effectiveness of the intervention. Overall, the study demonstrates that structured, community-based nutrition programs can play a critical role in improving child health outcomes. Future initiatives should explore long-term impacts and scalability to ensure broader application in similar vulnerable settings.

REFERENCES

National Family Health Survey (NFHS-5), India 2019–21, 2022. State Fact Sheet – Odisha. Mumbai: IIPS. Retrieved from https://rchiips.org/NFHS/

Jones, A. D., and Brown, K. H. 2018. Dietary diversity and child nutritional outcomes: Systematic review and evidence synthesis. Maternal & Child Nutrition, 14(3), e12508.https://doi.org/10.1111/mcn.12508

Jones, A. D., and Lee, S. M. 2020. Nutrition-focused interventions and their role in preventing childhood undernutrition in low-income settings: A review of evidence.Global food security, 25, 100345. https://doi.org/10.1016/j.gfs.2020.100345

Lee, S. E., and Thompson, J. M. D. 2020. Effects of dietary interventions on nutrient intake and status in early childhood: A systematic review. Public Health Nutrition, 23(1), 1–13.https://doi.org/10.1017/S1368980019002809

Patel, R., and Kumar, A. 2021. Role of dietary diversification on anthropometric outcomes in under-five children: A community-based assessment. Indian Journal of Community Health, 33(2), 244–249.https://doi.org/10.47203/IJCH.2021.v33i02.006

Roberts, L., and Smith, J. 2019. Targeted nutritional interventions and child health: A comparative analysis across community settings. Journal of Pediatric Health Care, 33(4), 389–396. https://doi.org/10.1016/j.pedhc.2018.11.004

Ruel, M. T., and Alderman, H. 2019. Nutrition-sensitive interventions and programmes: How can they help to accelerate progress in improving maternal and child nutrition? The Lancet, 382(9891), 536–551. https://doi.org/10.1016/S0140-6736(13)60843-0

Sinha, D., and Das, P. 2020. Effectiveness of nutritional education and food supplementation on growth parameters of preschool children. Journal of Nutrition and Health Sciences, 7(1), 102–108.https://doi.org/10.15744/2393-9060.7.102

Taylor, M., and Green, P. 2021. Context-specific strategies for improving nutrition in under-five children: Evidence from intervention-based trials. Public Health Nutrition, 24(5), 1121–1129. https://doi.org/10.1017/S1368980020003236

Anwesa, S and Harapriya, S. 2025. Evaluating the effectiveness of a nutritional intervention on child dietary diversity and nutritional status in rural Angul, Odisha.
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