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# DIETARY DIVERSITY AND NUTRITIONAL STATUS AMONG CHILDREN AGED 6–60 MONTHS IN RURAL LUCKNOW: A CROSS-SECTIONAL STUDY

Community Medicine

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## ABSTRACT

**Background:** Undernutrition continues to be a significant public health concern among children under five in rural India, with dietary diversity recognized as a key determinant of nutritional adequacy. The period between 6 to 60 months is critical for growth and development, yet inadequate diversification of diet remains prevalent. **Objectives:** To assess the dietary diversity and its association with nutritional status—using anthropometric and biochemical indicators—among children aged 6–60 months in rural Lucknow. **Methods:** This community-based cross-sectional study was conducted among 370 children using multistage random sampling. Dietary intake was assessed using a Food Frequency Questionnaire, and Dietary Diversity Score (DDS) was calculated. Nutritional status was evaluated through anthropometric measures (WAZ, HAZ, WHZ, MUAC) and biochemical parameters (hemoglobin, serum iron, MCV, TSIL). Data analysis was performed using SPSS v29. **Results:** Only 20.3% of children had high DDS (≥5), while 55.4% had low or very low diversity. Prevalence of underweight, stunting, and wasting were 32.4%, 35.1%, and 24.3% respectively. A significant inverse association was found between DDS and all three undernutrition indicators ($p < 0.001$). **Conclusion:** Low dietary diversity is strongly associated with poor nutritional outcomes. Community-based nutritional education and dietary diversification strategies are essential to reduce undernutrition in rural children.

## KEYWORDS

Dietary diversity; Nutritional status; Malnutrition; Rural health; Anthropometry; Preschool children.

## INTRODUCTION

Child undernutrition remains a major public health burden in India, particularly in rural areas where food insecurity, inadequate maternal awareness, and poor dietary practices contribute to suboptimal growth outcomes.[1] According to global estimates, undernutrition accounts for approximately 45% of deaths among children under five years of age.[2] Ensuring dietary adequacy during the crucial developmental window of 6–60 months is essential for physical growth, immune function, and cognitive development.[1]

Dietary diversity—defined as the number of distinct food groups consumed over a reference period—is widely recognized as a reliable proxy for dietary quality and micronutrient sufficiency.[3,4] The WHO recommends that young children consume foods from at least four of seven essential food groups to ensure adequate nutrition [4]. While this is emphasized for ages 6–23 months[5-8], children aged 6 to 59 or 60 months also require a diverse diet to meet their growing developmental needs.[9] However, dietary monitoring often declines after infancy, leading to persistent nutritional gaps. In rural Indian settings, particularly in districts like Lucknow, children's diets are typically dominated by cereal-based staples, with minimal inclusion of animal protein, dairy, fruits, and vegetables—leading to micronutrient deficiencies and growth retardation.[10]

Low dietary diversity has been closely associated with poor anthropometric outcomes such as stunting, wasting, and underweight, and these conditions are linked with long-term deficits in cognitive and motor development.[1,11] While national nutrition surveys provide broad overviews, there is limited localized data addressing dietary diversity and its impact on growth in Tier II rural regions. This cross-sectional study aims to assess dietary diversity and its association with the nutritional status of children aged 6–60 months in rural Lucknow. By correlating Dietary Diversity Scores (DDS) with anthropometric indices—weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ)—the study seeks to provide actionable insights for targeted nutritional interventions at the community level.

## MATERIAL AND METHODS

This study was designed as a community-based cross-sectional observational investigation to assess dietary diversity and its association with the nutritional status of children aged 6 to 60 months residing in rural areas of Lucknow district, Uttar Pradesh. A multistage random sampling method was employed for the selection of study areas. Out of the eight rural blocks in the district, two blocks were randomly selected using the chit-draw method. From each selected block, two sub-centres were further chosen through random sampling. All villages under the jurisdiction of these sub-centres were included in the study. Children meeting the eligibility criteria and residing in the selected villages were approached for participation, and written informed consent was obtained from parents or legal guardians prior to data collection.

The study population comprised children aged between 6 and 60 months who were permanent residents of the selected rural areas and presented to the pediatric outpatient department during the study period. Children were included if they were within the specified age group, free from any acute or chronic illness likely to influence nutritional status, and if their guardians provided informed consent and agreed to comply with study requirements. Children with congenital anomalies, severe illness, or those not residing in the local area were excluded from the study.

The sample size was determined using the formula

$$n = z^2 \times p(1-p)/e^2$$

with $z = 1.96$ for 95% confidence, $p = 0.404$ (based on expected prevalence), and $e = 0.05$ for precision. The calculation yielded a required sample of 369.9, which was rounded to 370 participants. A total of 370 eligible children were thus included in the final study sample.

Data collection began with demographic profiling, including age, gender, socioeconomic status, religion, parental education, and occupation. A detailed medical history was recorded to account for any confounding conditions. Dietary practices were assessed using a validated Food Frequency Questionnaire (FFQ), and Dietary Diversity Scores (DDS) were calculated based on the number of WHO-recommended food groups consumed over a reference period. Anthropometric measurements included weight, height, Body Mass Index (BMI), and Mid-Upper Arm Circumference (MUAC). Nutritional status was interpreted using WHO growth standards to derive Z-scores for weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ). Biochemical parameters such as hemoglobin, blood indices, serum iron, and total serum iron levels were also measured to assess micronutrient status. All data were entered into Microsoft Excel and analyzed using IBM SPSS version 29. Descriptive statistics were applied to summarize demographic and clinical data, while chi-square tests were used to evaluate associations between categorical variables. A p-value of less than 0.05 was considered statistically significant for all inferential analyses.

## RESULTS

**Table 1: Sociodemographic Characteristics of Study Participants (n = 370)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age Group (months)** | 6–12 | 60 | 16.2 |
| | 13–24 | 75 | 20.3 |
| | 25–36 | 85 | 23.0 |
| | 37–48 | 80 | 21.6 |
| | 49–60 | 70 | 18.9 |
| **Gender** | Male | 180 | 48.6 |
| | Female | 190 | 51.4 |
| **Socioeconomic Status** | Upper | 55 | 14.9 |
| | Middle | 70 | 18.9 |
| | Lower Middle | 245 | 66.2 |
| **Occupation** | Unskilled | 160 | 43.2 |
| | Semi-skilled | 135 | 36.5 |
| | Skilled/Professional | 75 | 20.3 |

**Table 2: Dietary Diversity Score Distribution (n = 370)**

| DDS Score (Food Groups) | Diversity Level | Frequency (n) | Percentage (%) |
|---|---|---|---|
| 0–2 | Very Low Diversity | 85 | 23.0 |
| 3 | Low Diversity | 120 | 32.4 |
| 4 | Minimum Acceptable DDS | 90 | 24.3 |
| ≥5 | High Dietary Diversity | 75 | 20.3 |

**Table 3: Anthropometric Profile of Children (n = 370)**

| Indicator | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Weight-for-Age (WAZ)** | Normal | 250 | 67.6 |
| | Underweight | 120 | 32.4 |
| **Height-for-Age (HAZ)** | Normal | 240 | 64.9 |
| | Stunted | 130 | 35.1 |
| **Weight-for-Height (WHZ)** | Normal | 280 | 75.7 |
| | Wasted | 90 | 24.3 |
| **MUAC** | ≥13.5 cm (Normal) | 295 | 79.7 |
| | <13.5 cm (Low) | 75 | 20.3 |

**Table 4: Biochemical Indicators**

| Parameter | Normal Range | Mean ± SD | Below Normal (%) |
|---|---|---|---|
| Hemoglobin (g/dL) | 11–13 | 10.6 ± 1.4 | 62.7 |
| Serum Iron (µg/dL) | 50–120 | 48.2 ± 11.3 | 55.4 |
| MCV (fL) | 80–96 | 77.4 ± 5.9 | 47.0 |
| TSIL (µg/dL) | 50–120 | 45.8 ± 10.2 | 58.1 |

**Table 5: Association Between Dietary Diversity and Nutritional Status**

| DDS Category | Underweight (%) | Stunting (%) | Wasting (%) | p-value |
|---|---|---|---|---|
| Very Low (0–2) | 54.1 | 50.6 | 40.0 | <0.001 |
| Low (3) | 35.8 | 33.3 | 26.7 | |
| Minimum (4) | 18.2 | 21.1 | 16.7 | |
| High (≥5) | 11.5 | 14.3 | 10.2 | |

## DISCUSSION

In this study involving 370 children aged 6–60 months from rural Lucknow, the sociodemographic profile reflected a vulnerable population with 66.2% of children belonging to lower middle and lower socioeconomic groups. Maternal education was limited—only 16.2% were graduates—while 25.7% were illiterate. These trends are consistent with Ahmad et al.[12] and Aggarwal et al.[13], who observed that lower maternal education and poor socioeconomic status were significantly linked to undernutrition. Chatterjee et al.[14] similarly found limited maternal nutrition knowledge, and Malhotra et al.[15] demonstrated better health outcomes in children of more educated mothers.

Dietary diversity was suboptimal, with 55.4% of children having either very low or low DDS. Only 20.3% reached a high DDS. These findings mirror George et al.[16], who found only 42% of caregivers followed age-appropriate dietary diversity. Singh A et al.[17] reported that traditional weaning foods were carbohydrate-heavy and lacked essential nutrients, leading to undernutrition. Jain et al.[18] showed similar dietary limitations in the Jain community of Lucknow, with poor fruit and vegetable intake contributing to deficiencies. Wijndaele et al.[19] emphasized the dangers of early cow's milk use and inadequate complementary feeding, further supporting our findings.

Anthropometric results showed underweight (32.4%), stunting (35.1%), and wasting (24.3%), in line with Das et al.[20] and Ahmad et al.[12], who reported similar prevalence rates. Aggarwal et al.[13] found even higher rates of stunting in slum populations. Our study uniquely included MUAC, with 20.3% of children showing low arm circumference—an important indicator of acute malnutrition. While Sahu et al.[21] highlighted emerging overnutrition concerns, our findings confirm persistent undernutrition in rural populations.

Biochemical assessments revealed high rates of anemia and micronutrient deficiencies. Hemoglobin was subnormal in 62.7%, serum iron in 55.4%, TSIL in 58.1%, and MCV in 47%. These results align with Jain et al.[18], Ahmad et al.[12], and Sachdeva et al.[22], who all reported high levels of nutrient deficiencies. Singh A et al.[1] and George et al.[16] noted that poor feeding practices and food taboos further contribute to such deficiencies.

A strong inverse relationship between DDS and nutritional status ($p < 0.001$) was observed—children with DDS 0–2 had the highest rates of undernutrition. This is consistent with findings from Chatterjee et al.[14], Ahmad et al.[12], Singh A et al.[17], and George et al.[16], reinforcing the critical role of dietary diversity in preventing malnutrition.

## CONCLUSION

We concluded that dietary diversity is a crucial determinant of nutritional status among children aged 6–60 months in rural Lucknow. A strong inverse association between low DDS and undernutrition emphasizes the need for early dietary interventions. Empowering mothers through nutrition education and improving access to diverse, nutrient-rich foods are essential strategies to combat malnutrition in resource-limited rural settings.

### Strengths

The study's strength lies in its holistic approach—integrating dietary assessment with anthropometric and biochemical evaluations—to provide a comprehensive profile of child nutrition. A robust sample size and the inclusion of WHO-standardized growth indicators enhance the study's credibility. Additionally, its focus on a rural Indian population fills an important gap in localized data for policymaking and targeted nutritional interventions.

### Limitations

As a cross-sectional study, causal relationships between dietary diversity and nutritional outcomes could not be established. The reliance on caregiver-reported dietary information may introduce recall bias. Furthermore, the wide age range (6–60 months) was not stratified in analysis for age-specific needs. Lastly, the exclusion of other key micronutrients like vitamin A and zinc may limit biochemical assessment completeness.

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**Ethical Approval:** Obtained.
**Consent:** Written consent secured.

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