

## **Complementary Feeding, Dietary Diversity, and Nutritional Outcomes of Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria**

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### **Abstract**

**Background:** Malnutrition remains a major public health challenge in Nigeria, particularly in rural areas where food insecurity and inadequate feeding practices persist.

**Objective:** This study examines the dietary diversity, complementary feeding practices, and nutritional status of children aged 6–24 months, comparing urban and rural communities in Ebonyi State.

**Subjects/Materials:** The subjects were women of childbearing age with their children under 24 months. Structured questionnaires, anthropometric instruments were used to carry out the study.

**Methods:** A cross-sectional comparative study was conducted using multi-stage sampling. Data on sociodemographic, immunization, breastfeeding, complementary feeding, and dietary diversity were collected. Child malnutrition was assessed using the WHO Growth Standards. Chi-square tests, independent t-tests, and ANOVA were used for statistical analysis, with significance set at  $p < 0.05$ .

**Results:** A total of 385 women of childbearing age with their children under 24 months were used for the study. The mean age of the mothers and children was  $30 \pm 7.0$  and  $12.6 \pm 6.30$ . Most participants were married (91.7%), predominantly in monogamous unions (78.4%), with the majority identifying as Christians (95.6%) and having at least secondary education (57.1%). Occupations were mainly trading (30.9%) and civil service (26.2%), while 70% had 1–3 children, and household income showed that 21.6% earned ₦45,000 (\$109) or more. Exclusive breastfeeding was significantly higher in urban areas (77.2%) than rural areas ( $p < 0.001$ ), while early complementary feeding ( $< 3$  months) was more common in rural areas (25.3% vs. 10.2%,  $p < 0.05$ ). The mean dietary diversity score (DDS) was  $4.18 \pm 2.53$ , higher in urban ( $4.29 \pm 2.37$ ) than rural ( $4.04 \pm 2.74$ ,  $p < 0.05$ ). Malnutrition prevalence was 10.4% wasted, 9.9% underweight, and 9.4% stunted, with significantly higher rates among rural children ( $p < 0.05$ ).

**Conclusion:** Rural children are at higher risk of malnutrition due to lower dietary diversity, early complementary feeding, and limited healthcare access. Targeted nutrition education, improved food security, and expanded healthcare services are needed to improve child health outcomes.

**Keywords:** Malnutrition, Dietary diversity, Complementary feeding, Urban-rural disparity, Nigeria.

### **Introduction**

The first 1,000 days of life, from conception until 24 months of age, are the most critical stages of a person's life in terms of growth and brain development (1). Improved feeding of children younger than 24 months is particularly important because they experience rapid growth and development and are vulnerable to diseases. Exclusive breastfeeding for the first 6 months provides adequate nourishment for health, growth, development, and protection to the children from infection (2, 3, 4). Continuous breastfeeding beyond 6 months should be accompanied by consumption of nutritionally adequate,

safe, and appropriate complementary foods that help meet nutritional requirements when breast milk is no longer sufficient (5). The change from exclusive breastfeeding to complementary feeding is associated with great challenge and has a high impact on child nutritional status, and this increases the prevalence of malnutrition (6). Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients, encompassing undernutrition (such as wasting, stunting, and underweight), micronutrient deficiencies, and overweight or obesity, each contributing to adverse health outcomes (7).

Complementary feeding, the process of introducing solid and semi-solid foods to an infant's diet alongside breast milk, is a critical determinant of a child's growth and development, particularly within the first 24 months of life (8). Complementary feeding refers to a process that starts after the sixth month of life, when breast milk alone can no longer be sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed in addition to breast milk (9). The period of complementary feeding is generally taken to be 6 to 24 months of age, though breastfeeding may continue beyond two years (10, 11, 12). Complementary foods include infant cereal, vegetables, fruits, meats, and other protein-rich foods modified to an appropriate texture (e.g., pureed, chopped, mashed, and strained) for the infant to develop mental readiness (13).

Effective complementary feeding combines the use of good quality, locally available, and affordable foods with adequate nutrients with food supplementation and nutrition education of the mothers (14). The aim of appropriate complementary feeding practices should be to provide adequate energy, protein, and micronutrients to cover the child's energy and nutrient requirements (15). The World Health Organization highlights the importance of sustained breastfeeding throughout this period as breast milk continues to be a significant source of nutrients, contributing half of an infant's energy requirement during the first year and a third during the second year of life (16).

Poor nutritional practices during the first 24 months of life, such as an early introduction of solid foods before 6 months, can lead to lifelong health consequences such as various non-communicable diseases, including diabetes and cardiovascular disease (17). Development of childhood obesity has also been linked to very early introduction of complementary foods, inappropriate complementary feeding practices, and low dietary diversity (18-20).

HIV-positive mothers may alter infant feeding practices due to concerns about mother-to-child transmission, even when on antiretroviral therapy. This can result in delayed introduction of complementary foods or reliance on less optimal feeding methods. (21, 22). Higher maternal education is linked to better knowledge of nutrition, proper timing of introducing complementary foods, and food diversity. Educated mothers are more likely to follow recommended feeding guidelines. (23). Employed mothers may face time constraints, limiting their ability to prepare diverse, home-made complementary foods. They may rely more on commercially processed foods or caregiver-provided feeding (24). Larger families may

have limited resources, affecting the quantity and quality of complementary foods provided to each child. Competition for food and caregiver attention can influence feeding frequency and diversity (25). Pre-existing challenges in complementary feeding, including limited dietary diversity and inadequate feeding frequency, were aggravated in many low- and middle-income countries, as households faced constraints in resources and access to nutritious foods (26).

Dietary diversity, the inclusion of a variety of food groups in a child's diet, is essential for adequate nutrient intake and the prevention of malnutrition. However, in many low- and middle-income countries, children's diets remain monotonous and dominated by starchy staples, resulting in poor growth and micronutrient deficiencies. In Nigeria, only about 12% of children aged 6–23 months achieve the minimum dietary diversity, while stunting and wasting remain prevalent at 31.5 % and 6.5%, respectively (27). This was a decline from the NDHS, 2018 study, where 21% of children aged 6–23 months achieved the minimum dietary diversity, while stunting and wasting reduced slightly from 37% and 7%, respectively (28).

In Ebonyi State, childhood malnutrition is a major concern: among school-age children in rural areas, stunting is reported at 42.5%, with very low consumption of fruits, eggs, and meat (<5% / <2%) in 24-hour recalls (29). In Abakaliki Metropolis, stunting in rural pupils reaches 19.3% versus 5% in urban pupils, underlining rural-urban disparities in nutritional status (30). According to National Nutrition and Health Survey (NNHS) data, only 39% of children aged 6–23 months in Ebonyi achieve minimum dietary diversity, 58% achieve minimum meal frequency, and just 17% receive a minimum acceptable diet (31). These gaps suggest that poor complementary feeding practices and inadequate dietary diversity are key contributors to the burden of malnutrition in Ebonyi.

This study aims to explore complementary feeding practices, dietary diversity, and nutritional status of children aged 6-24 months in Ebonyi State, Nigeria, comparing rural and urban communities. By identifying existing gaps and determinants, the findings will provide evidence to guide targeted interventions and nutrition education programs that can improve child health outcomes in the region.

## Materials and Methods

### Study Location



The study was conducted in Ebonyi State, Southeastern Nigeria, which is bordered by Enugu, Abia, and Cross River States. Ebonyi comprises 13 Local Government Areas (LGAs), with Abakaliki as the capital city and Afikpo South representing the rural context to capture both urban and rural settings. The state has an estimated population of 3.24 million as of 2022 (32), with females (51.1%) slightly more than males (48.9%) (33). Abakaliki accounts for about 662,000 people (34), while Afikpo South has approximately 234,700 (32). The economy is predominantly agrarian, though civil service and self-employment also contribute significantly, consistent with Nigeria's high self-employment rate of 84.7% (35). Health infrastructure in the state consists of 516 primary health care centers, 48 secondary health facilities, and 3 tertiary institutions (36).

**Study Design:** A comparative cross-sectional study was employed to assess complementary feeding practices, dietary diversity, and the nutritional status of children aged 0–24 months in urban and rural communities.

### Study and target Population

The study targeted caregivers (mothers and guardians) aged 15–59 years and their child aged 0–24 months.

### Sampling and Sample Size Determination

A **multi-stage sampling technique** was employed to select participants. First, two Local Government Areas (LGAs) were purposively selected to represent urban (Abakaliki) and rural (Afikpo South) settings. Second, within each LGA, communities and households were randomly selected using a systematic sampling approach. Finally, eligible participants within selected households were recruited consecutively until the required sample size was achieved. This approach ensured representation across both urban and rural populations while minimizing selection bias. The minimum sample size was determined using the simplified formula for proportion (37)

$$n = \frac{N}{1 + N(e)^2}$$

Where  $n$  is the sample size,  $N$  is the population size, and the level of precision, which is  $(0.05)^2$ .

Thus;  $n = 4,634 / 1 + 4,634 (0.05)^2 = 368$ .

The sample size was increased to 385 participants because of attrition.

For a target population of 4,634, the calculated minimum sample size was 368. To account for potential non-response or attrition, the sample size was increased to 385 (4.6% increase) mother-child pair was used to adjust for attrition/non-response. A total of 385 women and their children, urban (215), rural (170), between 15 to 59 years were randomly selected from different communities in the two local government areas. Abakaliki, being the state capital and the most densely populated LGA in Ebonyi State, has a larger concentration of women of reproductive age and children under 24 months compared to Afikpo South, which is predominantly rural with smaller household clusters. To ensure representativeness, 215 participants (55.8%) were drawn from the urban setting and 170 participants (44.2%) from the rural setting.

**Inclusion and Exclusion Criteria:** Mothers or caregivers of children aged 0–24 months who had lived in the selected communities for at least one year and were willing to provide informed consent were included in the study. Children with congenital abnormalities or chronic illnesses, as well as caregivers unwilling to participate, were excluded.

### Data Collection and Research Tools

The data were collected by trained students who had prior experience in conducting nutrition and health surveys. Before data collection, all enumerators underwent a structured training session on the study objectives, data collection tools, ethical considerations, and procedures for ensuring data quality and consistency. Data collection was conducted between April to September 2019.

A semi-structured interviewer-administered questionnaire was designed and pre-tested to collect information used for this study. The questionnaire had four sections, which included

### Section 1: Respondent Profile and Household Composition.

This was used to collect personal information, which included the respondent's name, address, age, location, number of children in the household, and type of family. Information on respondents and household composition was collected to understand sociodemographic characteristics, including age, location, number of children, and family type. To ensure ethical compliance and protect participants' identities, personally identifying information (such as names and specific addresses) was coded immediately. Each respondent was assigned a

unique identification number, which was used for data entry and analysis.

All data were stored securely in password-protected electronic databases accessible only to authorized research team members. Hard copies of questionnaires were kept in locked cabinets, and any published results were presented in aggregate form to prevent identification of individual respondents. These measures ensured that confidentiality and privacy were strictly maintained throughout the study.

**Section 2: Socio-Economic characteristics of the household.** This section contains information on the socio-economic characteristics of the households. Such information includes: income, level of education of parents, designated household income, primary occupation of parents, religion, among other information

**Section 3:** Children's age, immunization, breastfeeding records, and introduction/complementary feeding pattern/practices, twenty-four-hour individual dietary recall for the Child on foods and drinks consumed by the child the previous day before the time the data was obtained. Trained interviewers conducted a 24-hour dietary recall with a pre-tested questionnaire to obtain information on the subjects' food intake. Subjects were asked to recall all foods and beverages given to the child in the previous twenty-four hours prior to the interview.

**a. Food groups classification for children 6-24 months (9 food groups).**

The twenty-four-hour dietary recall data were analyzed using 8 food groups for determining dietary diversity in children 6-24 months according to (38, 39). However, fats and oils were added specifically due to the large amount of consumption of fatty foods in Nigeria, making it 9 food groups. The 9 food groups used were breastmilk, Grains, roots and tubers, Legumes and nuts, Dairy products (milk, yogurt, cheese), Flesh foods (meat, fish, poultry, and liver/organ meats), Eggs, Vitamin A-rich fruits and vegetables, other fruits and vegetables, and fat and oils

**b. Measurement of dietary diversity scores:** For each of the 9 food groups, a point was added if any food in the group was consumed, and zero (0) was marked for food groups not consumed. The sum of all the food groups the individual had consumed was calculated and was recorded as their dietary diversity score. For a child to meet Minimum Dietary Diversity (MDD), they must consume foods from at least five of these nine food groups within the last 24 hours (40).

**Section 4: Anthropometric Measurements**

**a. Weight:** The weights of the children were measured to the nearest 0.1kg using a portable bathroom scale (Hana bathroom scale Model). The children who could stand were guided on how to stand on the scale, upright with

minimum movement. For the ones that could not stand, the scale was zeroed, and they were measured with their mother; the calculated difference between the weight of the mother and child, and the weight of the mother alone, is the weight of the child.

**b. Height:** In assessing their height, those who can stand were guided to stand straight, knees and heels straight, buttocks and shoulders in contact with the measuring stand, and the measurement of height was taken. For the ones that cannot stand, they were laid straight on a table with the assistance of their mother, and their length was measured.

**c. Assessment of wasting, stunting, and underweight in Children**

The Z score of children was determined using WHO Anthro (41), anthropometric data that were provided through the measurement of children's length and weight in relation to their age. Three indices of undernutrition were used to quantify the nutritional status of children in the study area. This was done by calculating their Z score with the WHO Anthro calculator (41) method, and it was compared with the Nigerian National Center for Health Statistics (NHCHS) reference population international standard Z score, where less than -2 SD indicates malnutrition in a child. Children were classified as follows:

- (i) Wasting: low weight for height with Z score <-2SD
- (ii) Underweight: low weight for age with Z score <-2SD
- (iii) Stunted: low height for age with Z score <-2SD

$$Z \text{ score} = \frac{\text{Observed Value} - \text{Median of reference population}}{\text{Standard deviation of the reference population}}$$

**Section 4: Data Management and Statistical Analysis**

Data collected using structured questionnaires were reviewed daily for completeness and consistency. Personal identifiers, such as names and exact addresses, were replaced with unique participant codes to ensure anonymity. Trained data entry personnel entered the data into SPSS version 20.0, with double-entry verification and range checks to minimize errors. Hard copies were securely stored in locked cabinets, and electronic files were password-protected and accessible only to authorized team members. Data cleaning involved checking for missing values, coding categorical variables, and verifying outliers.

Anthropometric indices—weight-for-age, height-for-age, and weight-for-height were converted to Z-scores using the WHO 2006 Child Growth Standards. The statistical package for social sciences (SPSS version 20.0) was used. Chi-square tests, descriptive statistics (frequency tables), independent t-tests, and ANOVA were used for statistical analysis, with significance set at  $p < 0.05$ .

## RESULTS

A total of 385 mother–child pairs participated in the study, comprising 215 (55.8%) from the urban area (Abakaliki) and 170 (44.2%) from the rural area (Afikpo South). The children were aged 6–24 months, with 181 (47.0%) males and 204 (53.0%) females, yielding a female-to-male ratio of approximately 1: 1.13

## Anthropometric and Demographic Characteristics of Mothers and Their Children

Table 1 presents the anthropometric and sociodemographic characteristics of the mothers and their children. The mean age of the children was  $12.6 \pm 6.3$  months, while their mean weight and height were  $9.0 \pm 1.79$  kg and  $73.5 \pm 8.13$  cm, respectively. The mothers' ages ranged from 17 to 49 years, with a mean of  $30.0 \pm 7.0$  years. The mean maternal height and weight were  $164.1 \pm 11.7$  cm and  $61.8 \pm 11.8$  kg, respectively, and the mean body mass index (BMI) was  $23.1 \pm 4.4$  kg/m<sup>2</sup>. Family size varied from 1 to 8 members, with a mean of  $3.0 \pm 1.5$ , indicating predominantly small to medium-sized households.

**Table 1: Anthropometric and Demographic Characteristics of Mothers and Their Children**

| Variable                 | Minimum | Maximum | Mean  | SD   |
|--------------------------|---------|---------|-------|------|
| Age of Child (Months)    | 2       | 24.0    | 12.6  | 6.30 |
| Weight (kg)              | 3.90    | 12.1    | 9.0   | 1.79 |
| Height (cm)              | 50.0    | 90.0    | 73.5  | 8.13 |
| Age of Mother (years)    | 17      | 49      | 30    | 7.0  |
| Height (cm)              | 139.0   | 196.0   | 164.1 | 11.7 |
| Weight (kg)              | 30.0    | 93.0    | 61.8  | 11.8 |
| BMI (kg/m <sup>2</sup> ) | 8.96    | 37.4    | 23.1  | 4.4  |
| Family Size              | 1       | 8       | 3.0   | 1.5  |

## Family Structure, Socio-economic Characteristics, and Household Composition of Mothers in Urban and Rural Communities

Table 2 shows family structure, socio-economic characteristics, and household composition of mothers in urban and rural communities. The majority of caregivers were married (91.7%), but significantly higher among urban mothers (95.8%) compared with rural mothers (86.4%) ( $p=0.002$ ). Urban households were predominantly monogamous (96.7%) and nuclear in structure (93.5%), while rural households showed higher proportions of polygamy (31.2%), other family systems (13.5%), and extended families (48.2%) ( $p<0.001$ ). Christianity was the major religion in both communities, though rural mothers recorded a nearly universal Christian affiliation (98.8%) ( $p=0.012$ ). A strong educational disparity was observed: 27.9% of urban mothers had university education, compared to only 2.4% of rural mothers. Rural mothers had O'level education (70.5%) or no formal education (4.1%) ( $p<0.001$ ). Occupation and income also varied significantly across communities ( $p<0.001$ ). Urban mothers were mainly civil servants (37.2%) and traders (36.7%), whereas rural mothers were mainly farmers (24.7%) or unemployed (30.0%). Monthly incomes of ₦35,000 and above were mostly reported by urban mothers, while rural mothers clustered in the low-income categories or reported no income. Household size varied noticeably: 60.9% of urban families had 1–2 children, while rural communities had more larger households, with 20.0% having five or more children ( $p<0.001$ ).

**Table 2: Family Structure, Socio-Economic Characteristics, and Household Composition of Mothers in Urban and Rural Communities of Ebonyi State, Nigeria**

| Variable                                    | Category            | Urban (N=215) | Rural (N=170) | Total (N=385) | p-value |
|---------------------------------------------|---------------------|---------------|---------------|---------------|---------|
| <b>Family system</b>                        | Monogamy            | 208 (96.7)    | 94 (55.3)     | 302 (78.4)    | <0.001* |
|                                             | Polygamy            | 7 (3.3)       | 53 (31.2)     | 60 (15.6)     |         |
|                                             | Others              | 0 (0.0)       | 23 (13.5)     | 23 (6.0)      |         |
| <b>Family type</b>                          | Nuclear             | 201 (93.5)    | 88 (51.8)     | 289 (75.1)    | <0.001* |
|                                             | Extended            | 14 (6.5)      | 82 (48.2)     | 96 (24.9)     |         |
| <b>Marital status</b>                       | Married             | 206 (95.8)    | 147 (86.4)    | 353 (91.7)    | 0.002*  |
|                                             | Divorced            | 1 (0.5)       | 2 (1.2)       | 3 (0.8)       |         |
|                                             | Separated           | 8 (3.7)       | 21 (12.4)     | 29 (7.5)      |         |
| <b>Religion</b>                             | Christianity        | 200 (93.0)    | 168 (98.8)    | 368 (95.6)    | 0.012*  |
|                                             | Islam               | 15 (7.0)      | 0 (0.0)       | 15 (3.9)      |         |
|                                             | Traditional         | 0 (0.0)       | 2 (1.2)       | 2 (0.5)       |         |
| <b>Highest educational level of Mothers</b> | University degree   | 60 (27.9)     | 4 (2.4)       | 64 (16.6)     | <0.001* |
|                                             | Polytechnic         | 48 (22.3)     | 21 (12.3)     | 69 (17.9)     |         |
|                                             | O'level             | 100 (46.5)    | 120 (70.5)    | 220 (57.1)    |         |
|                                             | Primary education   | 5 (2.3)       | 18 (10.6)     | 23 (6.0)      |         |
|                                             | No formal education | 2 (0.9)       | 7 (4.1)       | 9 (2.4)       |         |
| <b>primary occupation of Mother</b>         | Trader              | 79 (36.7)     | 40 (23.5)     | 119 (30.9)    | <0.001* |
|                                             | Farmer              | 18 (8.4)      | 42 (24.7)     | 60 (15.6)     |         |
|                                             | Civil servant       | 80 (37.2)     | 21 (12.4)     | 101 (26.2)    |         |
|                                             | Artisan             | 29 (13.5)     | 16 (9.4)      | 45 (11.7)     |         |
|                                             | Unemployed          | 9 (4.2)       | 51 (30.0)     | 60 (15.6)     |         |
| <b>Estimated monthly income (₦)</b>         | 5,000–14,999        | 18 (8.4)      | 32 (18.8)     | 50 (13.0)     | <0.001* |
|                                             | 15,000–24,999       | 23 (10.7)     | 45 (26.5)     | 68 (17.7)     |         |
|                                             | 25,000–34,999       | 25 (11.6)     | 29 (17.1)     | 54 (14.0)     |         |
|                                             | 35,000–45,999       | 62 (28.8)     | 10 (5.9)      | 72 (18.7)     |         |
|                                             | 45,000–55,000       | 52 (24.2)     | 2 (1.2)       | 54 (14.0)     |         |
|                                             | ≥55,000             | 28 (13.0)     | 1 (0.6)       | 29 (7.6)      |         |
|                                             | No income/housewife | 5 (2.3)       | 51 (30.0)     | 56 (14.5)     |         |
|                                             | Don't know          | 2 (1.0)       | 0 (0.0)       | 2 (0.5)       |         |
| <b>Number of children in household</b>      | 1–2                 | 131 (60.9)    | 58 (34.1)     | 189 (49.1)    | <0.001* |
|                                             | 3–4                 | 72 (33.5)     | 78 (45.9)     | 150 (38.8)    |         |
|                                             | ≥5                  | 12 (5.7)      | 34 (20.0)     | 46 (12.0)     |         |

### **Infant Feeding Practices and Immunization Records of Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria**

Table 3 shows Infant Feeding Practices and Immunization Records of Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria. The proportions of children with complete immunization were similar in urban (45.1%) and rural areas (44.7%), and most children were still taking vaccines (urban 47.4%, rural 47.1%), indicating no significant difference between locations ( $p = 0.941$ ). Exclusive breastfeeding (EBF) differed significantly between urban and rural areas. A higher proportion of urban children (77.2%) were exclusively breastfed compared to rural children (57.1%,  $p < 0.001$ ). Conversely, non-exclusive breastfeeding was more

common in rural areas (42.9%) than urban areas (22.8%). The time of initiation of complementary feeding also varied significantly by location ( $p < 0.001$ ). Most urban children (62.8%) started complementary feeding at 6 months, compared to 32.4% of rural children. Rural children were introduced to complementary foods earlier, at 3–4 months (urban 18.6% vs rural 37.6%). The proportion of children not yet eating complementary foods was higher in rural areas (22.9%) than urban areas (13.0%). More urban mothers (61.4%) prepared homemade foods compared to rural mothers (52.4%), though this difference was not statistically significant ( $p > 0.05$ ). Feeding frequency per day differed significantly between urban and rural children ( $p < 0.01$ ). Majority of urban children (76.9%) were fed 3–4 times per day, while rural children were more evenly distributed, with 52.4% fed 3–4 times and 20.6% fed only twice per day. A higher proportion of rural children (27.0%) received 3–4 meals plus 1–2 snacks, compared to urban children (13.9%)

**Table 3: Infant Feeding Practices and Immunization Records of Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria**

| Variable                                    | Characteristics        | Urban (N=215) | Rural (N=170) | Total (N=385) | p-value |
|---------------------------------------------|------------------------|---------------|---------------|---------------|---------|
| Immunization records                        | Complete               | 97 (45.1)     | 76 (44.7)     | 173 (44.9)    | 0.941   |
|                                             | Not complete           | 16 (7.4)      | 14 (8.2)      | 30 (7.8)      |         |
|                                             | Still taking           | 102 (47.4)    | 80 (47.1)     | 182 (47.3)    |         |
| Exclusive breastfeeding                     | Yes                    | 166 (77.2)    | 97 (57.1)     | 263 (68.3)    | <0.001* |
|                                             | No                     | 49 (22.8)     | 73 (42.9)     | 122 (31.7)    |         |
| Time of initiation of complementary feeding | 1–2 months             | 3 (1.4)       | 9 (5.3)       | 12 (3.1)      | <0.001* |
|                                             | 3–4 months             | 40 (18.6)     | 64 (37.6)     | 104 (27.0)    |         |
|                                             | 5–6 months             | 143 (66.5)    | 58 (34.1)     | 201 (52.2)    |         |
|                                             | Not yet eating         | 28 (13.0)     | 39 (22.9)     | 67 (17.4)     |         |
| Homemade complementary food                 | Yes                    | 132 (61.4)    | 89 (52.4)     | 221 (57.4)    | 0.071   |
|                                             | No                     | 83 (38.6)     | 81 (47.6)     | 164 (42.6)    |         |
| Feeding frequency/day                       | 2 times                | 39 (9.2)      | 35 (20.6)     | 74 (19.2)     | 0.002*  |
|                                             | 3–4 times              | 117 (76.9)    | 89 (52.4)     | 206 (53.5)    |         |
|                                             | 3–4 times + 1–2 snacks | 59 (13.9)     | 46 (27.0)     | 105 (27.3)    |         |

#### **Daily Consumption of Food Groups among Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria**

Table 4 presents the daily consumption of different food groups among children in urban and rural areas. Consumption of grains, roots, and tubers was significantly higher among urban children (87.0%) compared to rural children (78.2%) ( $p = 0.024$ ). A significantly higher proportion of rural children (75.9%) consumed legumes and nuts compared to their urban counterparts (50.7%) ( $p < 0.001$ ). Dairy product consumption was significantly higher among urban children (82.3%) than rural children (61.2%) ( $p < 0.001$ ). Egg consumption was also higher in urban areas (40.0%) compared to rural areas (26.5%) ( $p = 0.007$ ). Conversely, the intake of vitamin A-rich fruits and vegetables was significantly higher among rural children (99.4%) than urban children (39.5%) ( $p < 0.001$ ). There were no statistically significant differences between urban and rural children in the consumption of flesh foods ( $p = 0.297$ ), other fruits and vegetables ( $p = 0.322$ ), and fats and oils ( $p = 0.645$ ).

**Table 4: Daily Consumption of Food Groups among Children Aged 6–24 Months in Urban and Rural Areas of Ebonyi State, Nigeria**

| Food groups fed to children        | Urban (N=215) | Rural (N=170) | Total (N=385) | $\chi^2$ | p-value |
|------------------------------------|---------------|---------------|---------------|----------|---------|
| Grains, Roots & Tubers             | 87.0          | 78.2          | 83.1          | 5.12     | 0.024*  |
| Legumes & Nuts                     | 50.7          | 75.9          | 61.8          | 25.61    | <0.001* |
| Dairy Products                     | 82.3          | 61.2          | 73.0          | 20.15    | <0.001* |
| Flesh Foods                        | 37.7          | 32.4          | 35.3          | 1.09     | 0.297   |
| Eggs                               | 40.0          | 26.5          | 34.0          | 7.36     | 0.007*  |
| Vitamin A-rich Fruits & Vegetables | 39.5          | 99.4          | 66.0          | 161.24   | <0.001* |
| Other Fruits & Vegetables          | 44.7          | 39.4          | 42.3          | 0.98     | 0.322   |
| Fats & Oils                        | 47.4          | 50.0          | 48.6          | 0.21     | 0.645   |

**World Health Organization 2010**

**Dietary diversity scores (DDS), Mean Dietary diversity score (MDDS) in the two local Government areas.**

Table 5 shows that the DDS of children in Ebonyi State ranged from 1 to 9, with a mean of  $4.18 \pm 2.53$ . When classified into terciles, 40.3% of the children had low dietary diversity (1–4 food groups), 39.8% had medium dietary diversity (5–7 food groups), and 19.9% had high dietary diversity (8–9 food groups). The mean DDS was significantly higher in urban areas ( $4.29 \pm 2.37$ ) compared to rural areas ( $4.04 \pm 2.74$ ) ( $p < 0.043$ ).

**Table 5: Dietary Diversity Scores (DDS) and Mean Dietary Diversity Scores (MDDS) among Children in Urban and Rural Communities of Ebonyi State, Nigeria.**

| DDS Category (No. of Food Groups) | Urban (N = 215)                   | Rural (N = 170)                   | Total (N = 385)                   | p-value       | Method             |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------|--------------------|
| 1–4 (Low)                         | 33.5%                             | 42.4%                             | 40.3%                             |               |                    |
| 5–7 (Medium)                      | 29.3%                             | 37.0%                             | 39.8%                             |               |                    |
| 8–9 (High)                        | 16.3%                             | 20.5%                             | 19.9%                             |               |                    |
| <b>Total</b>                      | <b>100%</b>                       | <b>100%</b>                       | <b>100%</b>                       |               |                    |
| <b>Mean DDS (MDDS)</b>            | <b><math>4.29 \pm 2.37</math></b> | <b><math>4.04 \pm 2.74</math></b> | <b><math>4.18 \pm 2.53</math></b> | <b>0.043*</b> | Independent t-test |

Sample size for urban was 215, rural 170 and Total 385, N= Number, % = percentage

**Table 6: Table: Nutritional Status of Children (6–24 months) by Sex and Location Using Z-Scores (WAZ, HAZ, WHZ)**

Table 6 shows the nutritional status of children (6–24 months). Overall, the prevalence of malnutrition was 10.4% wasted, 9.9% underweight, and 9.4% stunted, respectively, with no significant difference between urban and rural children ( $p > 0.05$ ). About 70.3% of children had a normal nutritional status, with a significantly higher proportion in urban areas (77.2%) compared to rural areas (61.7%,  $p = 0.003$ ). Underweight prevalence ( $WAZ < -2$  SD) was higher among rural children (15.9%) than urban children (5.1%,  $p = 0.001$ ). Sex-specific analysis revealed that in rural communities, normal nutritional status was slightly higher among girls (67.4%) than boys (55.6%), but the difference was not significant ( $p = 0.145$ ). In urban areas, girls significantly had a normal nutritional status (85.1%) compared to boys (68.3%,  $p = 0.007$ ). Underweight, stunting, and wasting did not differ significantly between boys and girls in either rural or urban settings ( $p > 0.05$ ). Overall, children in urban areas had better nutritional status than those in rural areas, with girls in urban communities showing the highest proportion of normal nutritional status.

**Table 6: Nutritional Status of Children (6–24 months) by Sex and Location Using Z-Scores (WAZ, HAZ, WHZ)**

| Nutritional Indicator    | Rural Girls (%) | Rural Boys (%) | Rural Total (%) | Urban Girls (%) | Urban Boys (%) | Urban Total (%) | Grand Total (%) | p-value |
|--------------------------|-----------------|----------------|-----------------|-----------------|----------------|-----------------|-----------------|---------|
| <b>Normal</b>            | 67.4            | 55.6           | 61.7            | 85.1            | 68.3           | 77.2            | 70.3            | 0.001*  |
| <b>WAZ (Underweight)</b> | 11.2            | 21.0           | 15.9            | 2.6             | 7.9            | 5.1             | 9.9             | 0.489   |
| <b>HAZ (Stunted)</b>     | 11.2            | 9.8            | 10.6            | 7.0             | 9.9            | 8.4             | 9.4             | 0.435   |
| <b>WHZ (Wasted)</b>      | 10.1            | 13.6           | 11.8            | 5.3             | 13.9           | 9.3             | 10.4            | —       |

### Discussion

Dietary quality in early childhood is crucial for optimal growth, cognitive development, and long-term health outcomes (42–44). The mean DDS of  $4.18 \pm 2.53$  observed in this study reflects moderate dietary diversity, but urban children showed slightly higher scores than rural children, likely due to better access to markets, higher household income, and greater parental education in urban settings. Similar urban–rural gaps in dietary diversity linked to socioeconomic conditions have been documented in Ethiopia and Nigeria (45, 46, 47). Evidence from Bangladesh and Sub-Saharan Africa further emphasizes that differences in complementary feeding practices significantly affect children’s nutrition and growth (48–49).

Despite moderate diversity, dietary patterns showed heavy reliance on cereals (83.1%), with low intake of animal-source foods such as meat (35.3%) and eggs (34.0%). The heavy reliance on cereals may be because cereals are staple foods that are more affordable and widely available in both rural and urban areas, leading to their dominance in diets. This reflects affordability constraints and aligns with findings that low-income households prioritize cheaper staples, contributing to micronutrient deficiencies particularly in iron, zinc, and vitamin B<sub>12</sub>, which are primarily obtained from animal sources (50–51). Low protein intake is particularly not good for early childhood growth and cognitive development. Studies have shown that animal-source foods significantly improve child growth and reduce stunting (52). In rural areas, affordability and cultural factors may limit protein consumption, as many households prioritize cheaper staple foods (53). Seasonal price fluctuations and limited food availability may further restrict dietary choices, particularly in rural communities. In Nigeria, food prices fluctuate due to seasonal variations, poor infrastructure, and post-harvest losses, making certain food groups inaccessible at times (54). Interventions like home gardening, small-scale poultry farming, and fortified food programs are often recommended to improve access to nutrient-rich foods in low-income households (50).

Malnutrition prevalence of 10.4% wasted, 9.9% underweight, and 9.4% stunted, indicates moderate but persistent nutritional challenges in Ebonyi State. Although stunting was lower than the national average, wasting and underweight remain comparable to national figures (55). This may be because both urban and rural areas in Ebonyi State are currently experiencing economic hardships in Nigeria, thus limiting household food security. Also, limited access to healthcare, poor sanitation, and hygiene practices contribute to malnutrition, particularly in rural areas. Overall, these findings suggest that dietary diversity is suboptimal in both communities, with only a minority of children achieving high DDS. Although urban children showed a marginal nutritional advantage, the widespread low-to-medium diversity highlights a potential concern for micronutrient deficiencies among children aged 6–24 months in Ebonyi State.

### Malnutrition by Location

Rural children experienced more wasting (11.8%) than urban (10.4%), and boys were more affected than girls, consistent with studies showing that male children may be more nutritionally vulnerable due to higher metabolic needs and illness susceptibility (55–56). Conversely, slightly higher stunting among rural girls may reflect gender-based disparities in food access and care practices observed in Sub-Saharan Africa (57–58).

A notable finding was that wasting was more common in rural areas (11.8%) than urban areas (10.4%), and more boys than girls were affected (13.6% rural vs. 13.9% urban). This may be because rural communities often face seasonal food shortages, contributing to acute malnutrition (wasting) and limited access to healthcare in rural areas which delays treatment for conditions like diarrhea and infections, exacerbating wasting rates. More boys being affected may be because boys may have higher metabolic rates and nutritional demands, making them more susceptible to weight loss during illness or food scarcity. In some cultural settings, boys may be more active, requiring more energy, or may receive less attention in feeding practices. This aligns with studies such as (59, 55), which found that male

children in Nigeria tend to have higher rates of malnutrition due to gender-based dietary and care practices. Some cultural norms prioritize feeding male children's larger portions, but these portions may still lack the necessary micronutrients, leading to acute malnutrition.

Underweight was also more prevalent among boys in both rural (21.0%) and urban (7.9%) areas, further supporting the evidence that boys in resource-limited settings may be more vulnerable to malnutrition (56). The stunting rate was 11.2% for girls in rural areas and 9.9% for boys in urban areas, suggesting that chronic malnutrition may be slightly more prevalent among girls, particularly in rural communities. This trend is consistent with findings from (57) and (58), who reported that rural girls in sub-Saharan Africa face greater nutritional risks/challenges due to cultural and socioeconomic disparities that limit their access to nutritious foods. Several factors contribute to these disparities. Maternal education plays a crucial role in child nutrition. Studies have shown that children of educated mothers are less likely to be malnourished due to better health knowledge, improved feeding practices, and access to healthcare (59,60). In this study, only 34.5% of mothers attended tertiary institutions, which may limit awareness of optimal child nutrition.

Income level and employment also influence malnutrition. Only 21.6% of respondents earned ₦45,000 (\$109) or more, meaning the majority had limited financial resources to purchase diverse and nutritious foods. This corroborates with (61) findings that low-income households in Nigeria spend up to 60% of their income on food, often prioritizing staple grains over nutrient-rich foods.

Additionally, large family sizes can contribute to malnutrition. Households in this study had an average of  $3.0 \pm 1.5$  members, with some having up to 7 children. Larger families may struggle with food security, as resources are divided among more dependents (62).

### **Comparison with National and Global Trends**

Compared to national data, the malnutrition rates observed in this study are slightly lower than the Nigerian average. However, they remain a concern given the global targets set by the Sustainable Development Goals (SDGs) to reduce malnutrition by 2030 (63). Nigeria has made some progress in improving child nutrition through initiatives such as the National Home-Grown School Feeding Programme (NHGSFP), yet rural communities continue to face significant food insecurity, which directly affects child nutritional outcomes (64). A contrasting study by FAO,

IFAD, UNICEF, WFP, and WHO (65) indicates that interventions such as biofortification, school feeding programmes, and maternal education have contributed to reductions in stunting rates in several African countries. Nevertheless, persistent rates of wasting and being underweight suggest that acute malnutrition remains a major challenge, likely driven by seasonal food shortages, infectious diseases, and economic constraints.

### **Exclusive Breastfeeding and Complementary Feeding Practices**

This study found that 16.1% of children were still on breast milk and had not been introduced to complementary feeding. About 68% practiced exclusive breastfeeding (urban 77.2%, rural 57.1%). The exclusive breastfeeding rate was significantly higher in urban areas (77.2%) compared to rural areas (57.1%). Rural mothers were found to introduce complementary foods early (25.3% before 3 months vs. 10.2% in urban areas). This disparity may be due to better access to healthcare facilities and breastfeeding education among urban mothers, while rural areas often face limited healthcare access and persistent traditional practices that discourage exclusive breastfeeding (66, 67). These findings are consistent with national patterns reported in the State of Food Security and Nutrition in the World 2022 (68), which highlighted that urban mothers generally have better access to skilled health providers and are more likely to receive breastfeeding counselling. In contrast, rural mothers face greater economic barriers and sociocultural influences that contribute to suboptimal breastfeeding practices.

Early introduction of solid foods has been linked to increased risk of infections, gastrointestinal problems, and undernutrition (69). While prolonged breastfeeding is beneficial, delaying the introduction of complementary foods beyond six months can lead to inadequate energy and micronutrient intake. According to WHO recommendations, complementary feeding should begin at six months of age, as breast milk alone becomes insufficient to meet the infant's nutritional needs (69). This is supported by Mekonnen et al. (70), who found that delayed complementary feeding significantly increased the risk of stunting and underweight among Ethiopian infants.

Only 57.5% of mothers prepared homemade complementary foods, meaning that nearly 43% relied on commercially processed foods, which may be less nutrient-dense and more expensive. Feeding frequency also differed by location: urban mothers were found to feed children 3–4 times daily (76.9%) than rural mothers (52.4%), a disparity that may influence child growth and overall nutritional status. Strengthening

community-led nutrition programmes, especially those focused on maternal education, exclusive breastfeeding, and appropriate complementary feeding, could help reduce malnutrition and improve dietary practices (67;68).

### Conclusion

The findings of this study highlight the persistent challenges of dietary diversity and child malnutrition with significant urban-rural disparities in child nutrition, dietary diversity, and feeding practices in Ebonyi State. While dietary diversity was relatively moderate, consumption of nutrient-dense foods such as meat and eggs remained low. Malnutrition, particularly wasting and underweight, was more prevalent in rural areas and higher among boys. Limited maternal education, low-income levels, and poor dietary diversity contribute to these challenges.

The observed differences between urban and rural areas in Ebonyi State highlight disparities in food access, healthcare services, and socio-economic conditions. Addressing these issues requires multisectoral approaches, including enhanced nutrition education, improved agricultural support/ food accessibility in rural areas, enhanced breastfeeding support, and better and increased access to healthcare services. Policymakers, healthcare providers, and community organizations must work together to implement targeted nutrition interventions to improve child health outcomes in Ebonyi State

**Ethical Approval/Informed Consent:** Ethical clearance with reference number FUNAI/21/05/2019 was given by Alex Ekwueme Federal University Ndufu Alike Ethics Committee. The purpose of the study was explained to mothers and caregivers who gave their consent and also duly filled out the informed consent forms. Participants were informed of their freedom to withdraw or refuse to take part in the study without prejudice.

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