

Maternal Educational Attainment, Infant and Young Child Feeding Knowledge, Household Food Security, Dietary Diversity, and Nutritional Status among Mothers of under-Five Children in Ebonyi State, Nigeria

Akinade E. Ogunniyi

enochakinade4@gmail.com

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

Dare D. Ademiluyi

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

Oreoluwa A. Ogunniyi

Department of Biochemistry, Faculty of life science, Federal University Oye Ekiti

Eunice A. Olorunfemi

Department of Centre for Child and Adolescent Mental Health, College of Medicine, University of Ibadan

Ayobami R. Ojo-Adalumo

College of Nursing Science, Idi Aba

Monsuru O. Animasahun

Department of Nutrition and Dietetics, Federal University of Agriculture

Peace O. Ogunrinde

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

Ademola O. Adesanya

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

Ifeoluwanimi A. Bolarinwa

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

Oluwadamilola E. Adetoro

Department of Human Nutrition and Dietetics, College of Medicine, University of Ibadan

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Abstract

Background

Maternal educational attainment is widely regarded as a structural determinant of infant and young child feeding (IYCF) knowledge and household nutrition, yet whether its benefits extend uniformly to household food access, dietary diversity, and maternal nutritional status remains under-examined in South-East Nigeria. This study determined the relationship between maternal educational attainment and IYCF knowledge, household food security, maternal dietary diversity, and maternal nutritional status among mothers of under-five children in Ebonyi State, Nigeria.

Methods

A cross-sectional analytical study was conducted among 260 mother-child pairs recruited from nine primary health-care/maternal-and-child-health facilities using a structured, interviewer-administered questionnaire. Maternal IYCF knowledge was assessed with a 16-item instrument adapted from WHO/UNICEF IYCF counselling materials, household food security with a 6-item tool adapted from the USDA Six-Item Short Form, and maternal dietary diversity with the FAO Minimum Dietary Diversity for Women (MDD-W) indicator. Data were analysed using Kruskal-Wallis, Pearson chi-square/Fisher-Freeman-Halton exact tests, Spearman correlation, and multivariable logistic regression.

Results

Only 30.4% of mothers demonstrated good IYCF knowledge, while 69.6% of households experienced some degree of food insecurity and 36.5% had inadequate dietary diversity. IYCF knowledge ($H = 17.28$, $p < 0.001$), dietary diversity ($H = 8.46$, $p = 0.015$), and BMI ($H = 13.01$, $p = 0.002$) rose significantly with maternal education, but food security did not ($p = 0.974$). Tertiary-educated mothers had 3.62-fold higher adjusted odds of good IYCF knowledge than primary-educated mothers (95% CI: 1.00-13.09, $p = 0.050$), and overweight/obesity prevalence nearly doubled from the primary to tertiary group (23.5% to 45.3%).

Conclusion

Maternal education was strongly associated with IYCF knowledge and dietary diversity but not with household food security, and coincided with a rising risk of maternal overnutrition, revealing a double burden that knowledge-based interventions alone cannot resolve. Multisectoral strategies combining nutrition education with household economic strengthening and obesity-prevention counselling are recommended for mothers of under-five children in this setting.

1.0 Introduction

1.1 Study background

Infant and young child feeding (IYCF) practices during the first 1,000 days of life are among the most powerful determinants of child survival, growth, and cognitive development. Globally, an estimated 4.8 million children died before age five in 2023, with preterm birth complications, intrapartum-related events, pneumonia, diarrhoea, and malaria accounting for most deaths, and sub-Saharan Africa and Southern Asia bearing over 80% of this burden [1, 2]. Nigeria is one of only three countries with an under-five mortality rate above 100 per 1,000 live births [2], and children born to the least-educated mothers face disproportionately higher risk [1]. Optimal breastfeeding and complementary feeding could avert a substantial share of these deaths [3], but translating this into maternal behaviour depends on what mothers know, what households can afford, and what mothers themselves eat. Recent evidence from Abakaliki, Ebonyi State, has similarly demonstrated the coexistence of relatively high maternal child-feeding knowledge with substantial household food insecurity and inadequate maternal dietary diversity [4]. Maternal education is consistently identified as an upstream determinant shaping all three pathways [5, 6], yet the assumption that "more schooling" uniformly improves knowledge, food access, dietary quality, and maternal health is rarely tested jointly within one population.

Maternal education is theorised to improve feeding practices by raising health literacy and confidence engaging health workers, a pathway supported by a global meta-analysis of 35 cohort studies linking higher maternal education to better child growth in low- and middle-income countries, though the benefit plateaued or reversed among highly educated, high-income populations [6]. A companion review addressing confounding similarly found a persistent, if attenuated, causal link between schooling and child health in low- and middle-income settings [5]. Nigerian evidence supports this at the practice level: a trial among teenage mothers found mobile-based education substantially improved IYCF knowledge [7], while an Alive & Thrive analysis in Kaduna and Lagos found education, knowledge, and self-efficacy consistently predicted breastfeeding and dietary diversity outcomes [8]. Despite this, national exclusive breastfeeding rose only from 29% (2018) to about a third of infants (2023-24), and stunting remained at 32%, essentially unchanged [9]. Whether such knowledge gains are shared equally across education strata locally is best answered with population-specific data rather than national averages.

A second, less examined pathway concerns household food security and dietary diversity. Globally, up to 757 million people were undernourished in 2023, with Africa's hunger prevalence exceeding 20%, more than double the global average and still rising in most subregions [10]. Within Nigeria, food insecurity is alarmingly high in the South-East: a Nsukka-based study found 82.6% of households food insecure, patterned more strongly by income, age, and work status than maternal education [11]. Similarly, a recent study among mothers in Abakaliki, Ebonyi State, reported a substantial burden of severe household food insecurity alongside a mean MDD-W score below the recommended adequacy threshold, despite generally adequate maternal child-feeding knowledge [4]. This mirrors Kaduna-Lagos evidence, where food security predicted breastfeeding outcomes in poorer, less urbanized Kaduna but not wealthier Lagos, suggesting the education-food security link is itself moderated by local economic context [8]. Whether maternal education similarly fails to protect against food insecurity in Ebonyi State, or still

improves dietary diversity within that constraint, matters for whether education programs alone can improve food access, or must be paired with livelihood interventions.

A third, increasingly urgent pathway concerns maternal nutritional status, specifically coexisting undernutrition and overnutrition. Nigerian surveys show maternal obesity rising faster than under-five stunting is falling [12], and a national analysis of over 10,000 mother-child dyads found secondary maternal education independently associated with 1.6-fold higher odds of household-level double burden of malnutrition, even after adjusting for wealth [12]. Complementary dietary-pattern research among Nigerian school-aged children links food security, dietary diversity, and dietary patterns jointly to double-burden risk, showing these domains do not operate independently [13]. This raises the possibility that the same educational advantage improving feeding knowledge may, through urbanisation and dietary transition, also elevate maternal overweight and obesity risk.

Existing literature, globally and within Nigeria, has generally examined these three pathways in isolation, using different samples and contexts [5, 6, 8, 11, 12], making it difficult to determine whether maternal education is uniformly or selectively protective. Ebonyi State has comparatively little facility-based evidence on these relationships jointly, relative to the more studied South-West and North-West zones [7, 8]. Understanding where the benefits of maternal education plateau or reverse is essential for programmes that neither over-rely on education-only messaging nor overlook emerging overnutrition risk among the mothers such messaging reaches.

This study therefore examined, in a cross-sectional sample of mother-child pairs attending PHC/MCH facilities in Ebonyi State, Nigeria, the relationship between maternal education and four linked outcomes: IYCF knowledge, household food security, dietary diversity, and maternal BMI, while examining interrelationships among them and identifying independent predictors of good IYCF knowledge after adjusting for plausible confounders. Findings are intended to inform whether nutrition education here should stand alone or be paired with food-security and weight-management components.

2.0 Methodology

2.1 Study Area and Population

This study was conducted among mothers of under-five children attending nine purposively selected primary health-care and maternal-and-child-health (PHC/MCH) facilities within Ebonyi State, South-East Nigeria (Agbaja PHC, Onuebonyi MDGS, Ndiegu Urban PHC, MCH Ekeaba, MCH Azuiyiokwu, Unagboke PHC, MPHIC Nkwagu, Izzi Unuhu, and the Staff Clinic). These facilities serve predominantly rural and semi-urban communities where antenatal, child-welfare, and immunisation services provide routine points of contact between mothers of under-five children and the health system, making them appropriate venues for a facility-based assessment of maternal feeding knowledge, household food security, dietary diversity, and nutritional status.

2.2 Study Design

This was a cross-sectional analytical study employing a structured, interviewer-administered questionnaire to simultaneously assess maternal socio-demographic and obstetric characteristics, IYCF knowledge, household food and nutrition security, maternal dietary diversity, and maternal anthropometry, allowing the relationships among these outcomes and their association with maternal educational attainment to be examined within a single population at a single point in time.

2.3 Study Criteria

Mothers were eligible for inclusion if they had at least one living child under five years of age, were attending one of the nine study facilities during the data-collection period, and provided informed verbal consent to participate. Mothers who were acutely ill, unable to communicate in the language of interview, or unwilling to provide consent were excluded. Because maternal educational level was central to the analytic objectives, one participant record with a missing value for this variable was subsequently excluded from analyses stratified by education, yielding a final analytic sample of 260 mother-child pairs (99.6% of the 261 pairs originally recruited).

2.4 Sampling Technique

A facility-based, proportionate quota sampling technique was used. All nine PHC/MCH facilities serving the selected communities were purposively included to capture a representative spread of catchment populations. Within each facility, consecutive eligible mother-child pairs presenting for routine child-welfare, immunisation, or antenatal/postnatal services during the data-collection period were systematically approached and enrolled until each facility's proportionate quota, allocated according to average monthly maternal and child health attendance, was met. This yielded facility-level samples ranging from 18 to 43 mother-child pairs (total $N = 261$), broadly proportionate to each facility's relative client volume.

2.5 Sample Size Determination

The minimum sample size was estimated using the Cochran formula for cross-sectional prevalence studies: $n = Z^2pq/d^2$, where Z is the standard normal deviate at 95% confidence (1.96), p is the estimated proportion of the outcome of interest in the population, $q = 1-p$, and d is the desired precision. In the absence of a locality-specific prevalence estimate for the primary outcome (good IYCF knowledge) at the time of protocol development, a conservative proportion of $p = 0.5$ was assumed to maximise the estimated sample size, with a precision of $d = 0.06$, consistent with the resource-constrained, multi-facility design of the study. This yielded a minimum required sample of approximately 267 mother-child pairs. A total of 261 mother-child pairs were recruited across the nine facilities within the data-collection period, representing 97.8% of the calculated minimum; this modest shortfall, attributable to logistic and time constraints inherent in multi-facility data collection, is acknowledged as a limitation but did not preclude adequately powered detection of the moderate-to-large effect sizes reported in Tables 3–5.

2.6 Data Collection

Data were collected using a structured, interviewer-administered questionnaire organised into five sections. Section A captured socio-demographic and obstetric characteristics (maternal age, marital status, working status, educational level, household size, antenatal care attendance, place of delivery, and child characteristics). Section B assessed maternal knowledge of infant and young child feeding and care practices. Each correct response on the 16-item knowledge assessment, adapted from WHO/UNICEF IYCF counselling materials and covering breastfeeding initiation, exclusive breastfeeding, complementary feeding timing, and responsive child-care practices, was scored 1 point, with incorrect or "I don't know" responses scored 0 [14, 15]. Item-level scores were summed and expressed as a percentage of the maximum obtainable score (16), and classified as Good ($\geq 80\%$), Fair (60–79%), or Poor ($< 60\%$), following Bloom's cut-off convention as commonly applied in Nigerian knowledge-attitude-practice nutrition surveys [16]. Section C assessed household food and nutrition security using a 6-item tool adapted locally from the USDA Six-Item Short Form of the U.S. Household Food Security Survey Module [17, 18]. Affirmative responses ("often true" or "sometimes true" on the first four items; "yes" on the last two items indicating cutting meal size, skipping meals, losing weight, or a whole day without food due to lack of money) were each coded 1 point and summed (maximum score = 6); households were classified as having High food security (score = 0), Marginal food security (score = 1), Low food security (score = 2–4), or Very low food security (score = 5–6). Section D captured maternal anthropometric measurements (weight, height, waist circumference, hip circumference). Section E assessed maternal dietary diversity using a 24-hour qualitative dietary recall structured around the Minimum Dietary Diversity for Women (MDD-W) indicator [19]. Consumption of items from ten defined food groups, comprising starchy staples, pulses, nuts and seeds, dairy, meat/poultry/fish, eggs, dark green leafy vegetables, other vitamin-A-rich fruits and vegetables, other vegetables, and other fruits, in the 24 hours preceding the interview was recorded, and a summary score (range 0–10) was derived as the count of food groups consumed. A score ≥ 5 was classified as adequate dietary diversity, indicating a higher likelihood of micronutrient adequacy, while a score < 5 was classified as inadequate [19].

2.7 Reliability of Study Instruments

Internal consistency of the multi-item scales was assessed using Cronbach's alpha coefficient. The household food security scale demonstrated good internal consistency ($\alpha = 0.88$), consistent with its validated structure as a unidimensional, severity-graded access scale. The IYCF knowledge scale ($\alpha = 0.44$) and the MDD-W ten-food-group inventory ($\alpha = 0.62$) showed lower internal consistency values, below the conventional 0.70 threshold [20]. This pattern is an expected feature of both instruments rather than an indication of unreliable measurement: the IYCF knowledge scale deliberately spans multiple distinct knowledge domains (breastfeeding initiation, exclusive breastfeeding, complementary feeding, and care practices) that need not correlate highly with one another, and the MDD-W is explicitly designed and endorsed by FAO as a food-group count indicator of dietary diversity rather than a unidimensional latent-trait scale, for which Cronbach's alpha is not considered an appropriate or required validity criterion. This is nonetheless reported transparently as a measurement consideration for readers comparing effect sizes across studies (see Section 6.0, Limitations).

2.8 Scoring Criteria

All composite indices used in this study were derived from internationally recognised, validated public-health measurement approaches rather than ad-hoc scoring. Maternal IYCF knowledge was scored out of 16 items and expressed as a percentage, classified as Good, Fair, or Poor using Bloom's cut-off convention. Household food security was scored out of six items using the USDA-derived short-form approach and classified into four severity categories ranging from High to Very low food security. Maternal dietary diversity was scored as a count of food groups (0–10) consumed in the previous 24 hours using the FAO MDD-W approach, with a score of five or more food groups classified as adequate. Maternal nutritional status was assessed using Body Mass Index (BMI), calculated as weight in kilograms divided by height in metres squared, and classified according to WHO cut-offs as underweight ($< 18.5 \text{ kg/m}^2$), normal weight ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25.0\text{--}29.9 \text{ kg/m}^2$), or obese ($\geq 30.0 \text{ kg/m}^2$) [21]. Because more than half of waist and hip circumference values were excluded as physiologically implausible after data-quality screening, waist-hip ratio and waist-circumference-based central obesity risk were reported descriptively only and not carried into inferential analysis.

2.9 Data Analysis

Data were analysed using SPSS version 27 and Python 3 (pandas, SciPy, statsmodels). Categorical variables were summarised as frequencies and percentages; continuous variables as means and standard deviations. Because IYCF knowledge, food security, MDD-W, and BMI scores were not normally distributed, the Kruskal-Wallis H test was used to compare these continuous outcome scores across the three maternal-education categories (primary, secondary, tertiary). The Pearson chi-square test of independence was used to test associations between maternal education and categorical outcomes; where more than 20% of cells in a contingency table had an expected count below 5, the Fisher-Freeman-Halton exact test (Monte Carlo estimation, 99,999 resamples) was substituted. Spearman's rank-order correlation was used to test pairwise associations among the four continuous outcome scores (IYCF knowledge, household food security, MDD-W dietary diversity, and BMI). A multivariable binary logistic regression model was fitted to estimate the independent (adjusted) effect of maternal educational attainment on the odds of good IYCF knowledge, after controlling for maternal age, household size, and maternal working status as potential confounders. Statistical significance was set at $p < 0.05$ for all tests.

2.10 Ethical Considerations and Approval

The study followed ethical guidelines for research involving human participants. Ethical clearance was obtained from the Ebonyi State Ministry of Health Research Ethics Committee (EBSHREC 05/09) before the commencement of the study. Informed verbal consent was obtained from all participants prior to data collection. Confidentiality and anonymity were strictly maintained throughout the study.

3.0 Results

A total of 260 mother-child pairs were included in the final analysis. Table 1 presents their socio-demographic and obstetric characteristics. The sample was dominated by secondary-educated (63.1%),

married (95.4%) mothers in predominantly working households (78.8%), with near-universal antenatal care attendance (98.8%), facility-based delivery (90.0%), and child immunisation (96.5%), indicating generally favourable utilisation of maternal and child health services in this population. Notwithstanding this favourable service contact, only 58.8% of mothers reported actively monitoring their child's growth using a growth chart, pointing to a gap between routine service contact and sustained growth-monitoring practice at home.

Table 1
Socio-demographic and Obstetric
Characteristics of Study Participants (N = 260)

Characteristic	n	%
Mother's age (years), mean $\pm$ SD		28.0 $\pm$ 4.9
Child's age (months), mean $\pm$ SD		7.3 $\pm$ 6.2
Household size, mean $\pm$ SD		5.1 $\pm$ 1.8
Child's sex		
Male	138	53.1
Female	122	46.9
Maternal educational level		
Primary	27	10.4
Secondary	164	63.1
Tertiary	69	26.5
Marital status		
Married	248	95.4
Widowed	6	2.3
Divorced	6	2.3
Maternal working status		
Working	205	78.8
Housewife	55	21.2
Antenatal care (ANC) attendance		
Attended	257	98.8
Did not attend	3	1.2
Place of delivery		
Health facility	234	90.0
Home	26	10.0
Child immunization status		
Immunized	251	96.5
Not immunized	9	3.5

Characteristic	n	%
Awareness of child growth monitoring		
Aware	229	88.1
Not aware	31	11.9
Growth monitored using a chart		
Yes	153	58.8
No	107	41.2

SD = standard deviation. Percentages are column percentages of N = 260 unless otherwise stated.

Table 2 summarises maternal knowledge, household food security, dietary diversity, and nutritional status indicators across the full sample. Fewer than one in three mothers (30.4%) demonstrated good IYCF knowledge, while 15.4% scored poor, indicating substantial scope for targeted infant-feeding education in this population. Household food insecurity was widespread: 69.6% of households experienced some degree of food insecurity (low or very low), with 28.8% classified as very low food security. Nearly two in five mothers (36.5%) had inadequate dietary diversity (fewer than five of ten food groups), signalling a meaningful risk of micronutrient inadequacy. Almost one in three mothers (31.3%) were overweight or obese, alongside a notable 11.6% who were underweight, a double burden of malnutrition coexisting within the same population.

Table 2
Descriptive Summary of Maternal Knowledge, Household Food Security, Dietary Diversity and Nutritional Status Indicators (N = 260)

Indicator	n	%	Mean $\pm$ SD
IYCF knowledge score (% correct, of 16 items)	260	–	70.5 $\pm$ 14.0
Good ($\geq 80\%$)	79	30.4	–
Fair (60–79%)	141	54.2	–
Poor ($< 60\%$)	40	15.4	–
Household food security score (0–6)	260	–	3.1 $\pm$ 2.2
High food security	75	28.8	–
Marginal food security	4	1.5	–
Low food security	106	40.8	–
Very low food security	75	28.8	–
Maternal dietary diversity (MDD-W score, 0–10)	260	–	5.3 $\pm$ 2.2
Adequate (≥ 5 food groups)	165	63.5	–
Inadequate (< 5 food groups)	95	36.5	–
Maternal BMI (kg/m ²)	198	–	23.6 $\pm$ 5.2
Underweight	23	11.6	–
Normal weight	113	57.1	–
Overweight	36	18.2	–
Obese	26	13.1	–

BMI computed on n = 198 mothers with complete, physiologically plausible weight and height data (see § 2.7–2.8). MDD-W = Minimum Dietary Diversity for Women.

Table 3 presents the association between maternal educational attainment and the four outcome domains. A clear, statistically significant, positive gradient linked increasing maternal education to higher IYCF knowledge, higher dietary diversity, and use of growth-monitoring charts (all $p < 0.05$), consistent with education enhancing nutrition-related knowledge and health-seeking behaviour, and this dose-response pattern is visualised in Fig. 1. Household food security, in contrast, showed no significant gradient across education groups ($p = 0.974$ for the continuous score; $p = 0.849$ for very low food security), indicating that in this population educational attainment did not translate into improved economic access to food, food security here appears to be shaped by factors other than maternal schooling alone. Maternal BMI rose significantly with education ($p = 0.002$), with overweight/obesity

prevalence roughly doubling from the primary- to tertiary-educated group (23.5% to 45.3%, Fig. 1), suggesting that more educated mothers in this population face a rising risk of overnutrition alongside their nutritional-knowledge advantage.

Table 3

Association Between Maternal Educational Attainment and Child-Feeding Knowledge, Household Food Security, Dietary Diversity, and Maternal Nutritional Status

Outcome Indicator	Primary (n = 27)	Secondary (n = 164)	Tertiary (n = 69)	Test statistic (p-value)
Panel A: Continuous outcome scores, mean $\pm$ SD				
IYCF knowledge score (%)	66.7 $\pm$ 14.0	68.5 $\pm$ 13.6	76.7 $\pm$ 13.3	H = 17.28 (p < 0.001)
Food security score (0–6)	3.0 $\pm$ 2.3	3.0 $\pm$ 2.2	3.1 $\pm$ 2.3	H = 0.05 (p = 0.974)
MDD-W score (0–10)	4.4 $\pm$ 1.3	5.5 $\pm$ 2.1	5.2 $\pm$ 2.5	H = 8.46 (p = 0.015)
Maternal BMI (kg/m ²)	20.9 $\pm$ 4.0	23.3 $\pm$ 5.6	25.1 $\pm$ 3.9	H = 13.01 (p = 0.002)
Panel B: Categorical outcomes, n (%)				
Good IYCF knowledge ($\geq$ 80%)	5 (18.5)	35 (21.3)	39 (56.5)	$\chi^2 = 34.73$, df = 4 (p < 0.001)
Very low food security	9 (33.3)	47 (28.7)	19 (27.5)	Exact p = 0.849
Adequate dietary diversity ($\geq$ 5 groups)	14 (51.9)	112 (68.3)	39 (56.5)	$\chi^2 = 4.65$, df = 2 (p = 0.098)
Overweight / obesity*	4 (23.5)	34 (26.6)	24 (45.3)	Exact p < 0.001
Growth monitored using a chart	10 (37.0)	99 (60.4)	44 (63.8)	$\chi^2 = 6.15$, df = 2 (p = 0.046)

H = Kruskal–Wallis test statistic; χ^2 = Pearson chi-square; Exact p = Fisher–Freeman–Halton exact p-value (Monte Carlo, 99,999 resamples), applied where > 20% of cells had expected count < 5. *Overweight/obesity percentages are of mothers with valid BMI data within each education group (Primary n = 17; Secondary n = 128; Tertiary n = 53). Bold test statistics denote p < 0.05.

Table 4 presents Spearman correlations among the four continuous outcome scores. IYCF knowledge score correlated significantly, though weakly, with maternal BMI ($\rho = 0.146$, p = 0.041), corroborating the Table 3 finding that better-informed mothers in this population also tend to carry higher body weight. No other pair of continuous outcome scores was significantly correlated (all p > 0.05), indicating that knowledge, food security, and dietary diversity behaved as largely independent dimensions of maternal and child nutrition in this sample rather than moving together, each therefore warrants separate programmatic attention rather than being treated as a single composite construct.

Table 4

Spearman's Rank-Order Correlation Between IYCF Knowledge, Household Food Security, Maternal Dietary Diversity and Maternal BMI

IYCF Knowledge (%)	IYCF Knowledge (%)	Food Security Score	MDD-W Score	Maternal BMI
	—	$\rho = 0.058$ ($p = 0.348$)	$\rho = -0.008$ ($p = 0.897$)	$\rho = 0.146$ ($p = 0.041$)
Food Security Score		—	$\rho = 0.076$ ($p = 0.221$)	$\rho = -0.015$ ($p = 0.835$)
MDD-W Score			—	$\rho = -0.125$ ($p = 0.079$)
Maternal BMI				—

ρ = Spearman's rank correlation coefficient. $n = 260$ for correlations not involving BMI; $n = 198$ for correlations involving BMI (complete-case anthropometric data). Bold p -values denote statistical significance at $p < 0.05$.

Table 5 presents the multivariable logistic regression model for good IYCF knowledge. After adjusting for maternal age, household size, and working status, mothers with tertiary education had 3.62 times the odds of good IYCF knowledge compared with mothers with only primary education (95% CI: 1.00-13.09, $p = 0.050$), a borderline-significant but directionally consistent finding indicating that the crude gradient observed in Table 3 was not simply an artefact of age or household-size differences between education groups. The secondary-versus-primary contrast, which appeared significant in the raw cross-tabulation of Table 3, attenuated to the null after adjustment (aOR = 0.97, $p = 0.960$), showing that most of the raw "education effect" in this population is concentrated at the tertiary level rather than emerging gradually from primary through secondary schooling. None of maternal age, household size, or working status was an independent, statistically significant predictor of knowledge once education was accounted for, though household size showed a suggestive inverse trend (aOR = 0.86, $p = 0.165$) consistent with larger households diluting a mother's attention to feeding-related learning.

Table 5

Multivariable Logistic Regression - Adjusted Predictors of Good IYCF Knowledge ($\geq 80\%$)

Predictor	Adjusted OR	95% CI	p-value
Maternal education: Primary	1.00 (ref)	—	—
Maternal education: Secondary	0.97	0.29–3.20	0.960
Maternal education: Tertiary	3.62	1.00–13.09	0.050
Maternal age (per year)	1.06	0.99–1.14	0.092
Household size (per person)	0.86	0.69–1.07	0.165
Maternal working status (working vs. housewife)	0.77	0.37–1.61	0.487

Binary logistic regression; outcome = good IYCF knowledge ($\geq 80\%$) vs. fair/poor ($< 80\%$). Model $n = 258$ (complete cases). OR = odds ratio; CI = confidence interval. Reference categories: Primary education; housewife. Model χ^2 (likelihood-ratio) $p < 0.001$; pseudo- R^2 (McFadden) = 0.101. Bold rows denote $p < 0.05$.

Figure 1 visualises the dose-response pattern underlying Table 3, showing the prevalence of good IYCF knowledge, adequate maternal dietary diversity, and maternal overweight/obesity by maternal educational attainment. Good knowledge and overweight/obesity prevalence diverge in the same upward direction across education strata, while adequate dietary diversity peaks at secondary rather than tertiary education, a non-linear pattern that merits further qualitative exploration of tertiary-educated mothers' dietary and occupational time constraints. The rising overweight/obesity trend alongside rising knowledge illustrates that nutrition-knowledge gains are necessary but not sufficient to prevent overnutrition, reinforcing the need for behaviour-change interventions that go beyond knowledge transfer alone.

4.0 Discussion

This study examined the relationship between maternal educational attainment and infant and young child feeding (IYCF) knowledge, household food security, maternal dietary diversity, and maternal nutritional status among 260 mother-child pairs in Ebonyi State, Nigeria. Three key findings emerged: maternal education was positively and significantly associated with IYCF knowledge and dietary diversity; it showed no significant association with household food security; and it was positively associated with maternal overweight/obesity, revealing a double burden in which the same educational gradient that improved nutrition-related knowledge also elevated overnutrition risk.

The finding that only 30.4% of mothers demonstrated good IYCF knowledge, with knowledge scores rising significantly from primary (66.7%) to tertiary (76.7%) education ($H = 17.28$, $p < 0.001$), and tertiary-educated mothers retaining 3.62-fold higher adjusted odds of good knowledge after controlling for age, household size and working status, is consistent with the broader global and Nigerian literature linking maternal schooling to nutrition-related health literacy. A global systematic review and meta-analysis of 35 cohort studies similarly found maternal education positively associated with child growth outcomes in low- and middle-income countries such as Nigeria [6], and a companion review addressing confounding confirmed a persistent, if attenuated, causal pathway from schooling to child health in comparable settings [5]. At the practice level, a recent randomised trial among Nigerian teenage mothers demonstrated that structured education interventions can substantially close IYCF knowledge gaps [7], while a subnational analysis of Alive & Thrive programme data from Kaduna and Lagos States similarly found maternal education a consistent positive predictor of exclusive breastfeeding and dietary diversity [8], reinforcing that the gradient observed here is modifiable rather than fixed. Nonetheless, national data show exclusive breastfeeding prevalence rising only modestly to roughly one-third of infants and stunting remaining static at 32% [9], underscoring that facility-level knowledge gains of the kind observed here have yet to translate into commensurate national-level practice or outcome gains. Notably, the secondary-versus-primary contrast attenuated to the null after adjustment ($aOR = 0.97$, $p =$

0.960), indicating that in this population the knowledge dividend of schooling is concentrated at the tertiary level rather than accruing gradually, a pattern that has implications for how nutrition education is targeted: mothers with only basic schooling may need more intensive, facility-based counselling rather than assuming incremental gains from each additional year of education.

In contrast, household food security showed no significant gradient across education groups, whether analysed as a continuous score ($p = 0.974$) or as the proportion with very low food security ($p = 0.849$). This finding aligns closely with a recent facility-based study in Nsukka, South-East Nigeria, which found household food security to be driven principally by household income, age, and work status rather than maternal education [11], and with subnational Nigerian evidence that household food security predicted infant feeding outcomes in the poorer, less urbanised Kaduna context but not in wealthier Lagos, suggesting the education-food security relationship is itself moderated by local economic structure rather than operating uniformly [8]. This is consistent with the wider evidence that women's knowledge-based empowerment domains predict dietary diversity more consistently than they predict household-level food access, which depends on structural economic factors largely outside an individual mother's control, and mirrors the persistently high regional hunger burden reported for Africa overall [10]. The present study's finding that household food insecurity affected 69.6% of participating households is consistent with evidence of substantial food-access constraints elsewhere in South-East Nigeria, including Nsukka [11]. It also closely reflects earlier findings from Abakaliki, where severe household food insecurity remained widespread despite generally adequate maternal feeding knowledge [4]. Taken together, these findings suggest that food insecurity in this setting reflects broader economic and access constraints that nutrition education alone cannot resolve.

Maternal dietary diversity, by contrast, did rise significantly with education ($H = 8.46$, $p = 0.015$), consistent with evidence that maternal schooling improves the quality of food choices even where overall food access is constrained. However, the non-linear, plateauing pattern observed, in which adequate dietary diversity peaked among secondary-educated mothers (68.3%) rather than continuing to rise among tertiary-educated mothers (56.5%), diverges from a simple linear-gradient interpretation and may reflect the competing time and occupational demands facing more highly educated, formally employed mothers, a pattern that warrants further qualitative investigation in this setting.

Perhaps the most policy-relevant finding was the significant rise in maternal BMI with education ($H = 13.01$, $p = 0.002$) and the near-doubling of overweight/obesity prevalence from the primary- (23.5%) to tertiary-educated (45.3%) group. This mirrors a growing body of Nigerian evidence on the double burden of malnutrition: nationally representative analysis has linked secondary maternal education independently to higher odds of household-level double burden of malnutrition even after adjusting for wealth [12], while dietary-pattern research among Nigerian households links rising education and urbanisation to nutrition transition toward energy-dense, processed diets [13]. The weak but significant positive correlation between IYCF knowledge and maternal BMI observed here ($p = 0.146$, $p = 0.041$) reinforces the same conclusion drawn in these national analyses: nutrition-related knowledge gains are

necessary but not sufficient to prevent overnutrition, particularly once mothers move beyond survival-level food security into a dietary environment shaped by processed and energy-dense food availability.

That IYCF knowledge, food security, and dietary diversity were otherwise uncorrelated with one another (all other pairwise p non-significant) further supports treating these as largely independent programmatic targets in this population rather than assuming that gains in one domain will automatically translate into gains in another, a pattern also observed in national double-burden analyses where maternal and child dietary diversity did not move together as expected [12].

Strengths and limitations

This study benefited from the use of internationally validated measurement instruments, systematic data-quality screening of anthropometric variables, and appropriate non-parametric and exact statistical methods suited to the distribution and cell-size characteristics of the data. Nonetheless, several limitations warrant caution in interpretation. First, the cross-sectional design precludes causal or temporal inference; associations between maternal education and the outcomes examined cannot establish that education preceded, rather than merely co-occurred with, these outcomes. Second, the IYCF knowledge scale, while item content was drawn directly from WHO/UNICEF IYCF counselling recommendations, demonstrated modest internal consistency (Cronbach's $\alpha = 0.44$) and the MDD-W food-group inventory likewise showed α below the conventional 0.70 threshold ($\alpha = 0.62$); both are expected features of deliberately heterogeneous, multi-domain knowledge checklists and food-group count indicators rather than unidimensional latent-trait scales, and FAO does not recommend Cronbach's α as a validity criterion for the MDD-W indicator specifically, but this remains a measurement limitation worth flagging for readers comparing effect sizes across studies. Third, over half of waist and hip circumference measurements were excluded as physiologically implausible after data-quality screening, precluding formal inferential analysis of central obesity risk in this sample; only BMI, from more completely and plausibly measured weight and height, could be analysed inferentially. Fourth, the sample was drawn from nine facility-based clinics rather than a population-representative household survey, which may under-represent mothers who do not access routine maternal and child health services and who may differ systematically in education, knowledge, and nutritional status from those who do.

Public health implications

These findings have direct implications for nutrition programming in Ebonyi State and comparable South-East Nigerian settings. Because household food security did not improve with maternal education, nutrition education interventions targeting mothers of under-five children should be deliberately paired with household economic-strengthening or social-protection components rather than relying on knowledge transfer alone to improve food access [4]. Because the IYCF knowledge dividend of schooling was concentrated at the tertiary level, primary- and secondary-educated mothers, who together made up 73.5% of this sample, should be prioritised for more intensive facility- and community-based feeding counselling rather than assumed to benefit proportionately from general awareness campaigns. Finally,

because maternal overweight/obesity rose alongside education and knowledge, nutrition education messaging in this and similar settings should explicitly incorporate maternal weight and diet-quality counselling rather than focusing solely on child feeding recommendations, to avert an emerging, education-linked maternal overnutrition burden running in parallel with continuing gaps in child feeding knowledge and household food security.

5.0 Conclusion

This cross-sectional analytical study of 260 mother-child pairs in Ebonyi State, Nigeria, found that maternal educational attainment was significantly and positively associated with infant and young child feeding knowledge and maternal dietary diversity, with the knowledge advantage concentrated among tertiary-educated mothers, but was not associated with household food security, which remained widespread (69.6% of households affected) regardless of maternal schooling. Maternal education was also positively associated with overweight and obesity, nearly doubling in prevalence from primary- to tertiary-educated mothers, indicating that the same educational gradient that improves feeding-related knowledge coincides with rising maternal overnutrition risk. These findings show that maternal education, while a valuable lever for improving IYCF knowledge and dietary diversity in this population, cannot alone address household food insecurity or prevent maternal overnutrition. Nutrition programmes for mothers of under-five children in Ebonyi State and comparable South-East Nigerian settings should therefore combine targeted feeding-knowledge counselling for less-educated mothers with household economic-strengthening interventions and maternal weight and diet-quality counselling, to address the full, dual burden of nutritional risk identified in this population.

Declarations

Ethical approval

The study followed ethical guidelines for research involving human participants. Ethical clearance was obtained from the Ebonyi State Ministry of Health Research Ethics Committee (EBSHREC 05/09) before the commencement of the study. Informed verbal consent was obtained from all participants prior to data collection. Confidentiality and anonymity were strictly maintained throughout the study.

Clinical trial number

Not applicable

Consent to participate

Prior to data collection, detailed information regarding the study objectives, procedures, potential benefits, and participants' rights was provided to all eligible mothers/caregivers. Written informed

consent was obtained from mothers/caregivers, and written informed assent was obtained from healthcare workers. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. Confidentiality was ensured through the use of anonymized identification codes, and access to study data was restricted to the research team.

Consent to publish

Not applicable. No individual-level data, images, or identifiable information are included in this manuscript.

Competing interests

The authors declare no competing interests

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Author Contribution

All authors contributed to the manuscript

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None

Data availability

All data produced are available within the manuscript.

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Figures

Figure 1: Gradient in Maternal Knowledge, Dietary Diversity and Nutritional Status Across Levels of Maternal Educational Attainment (N = 260)

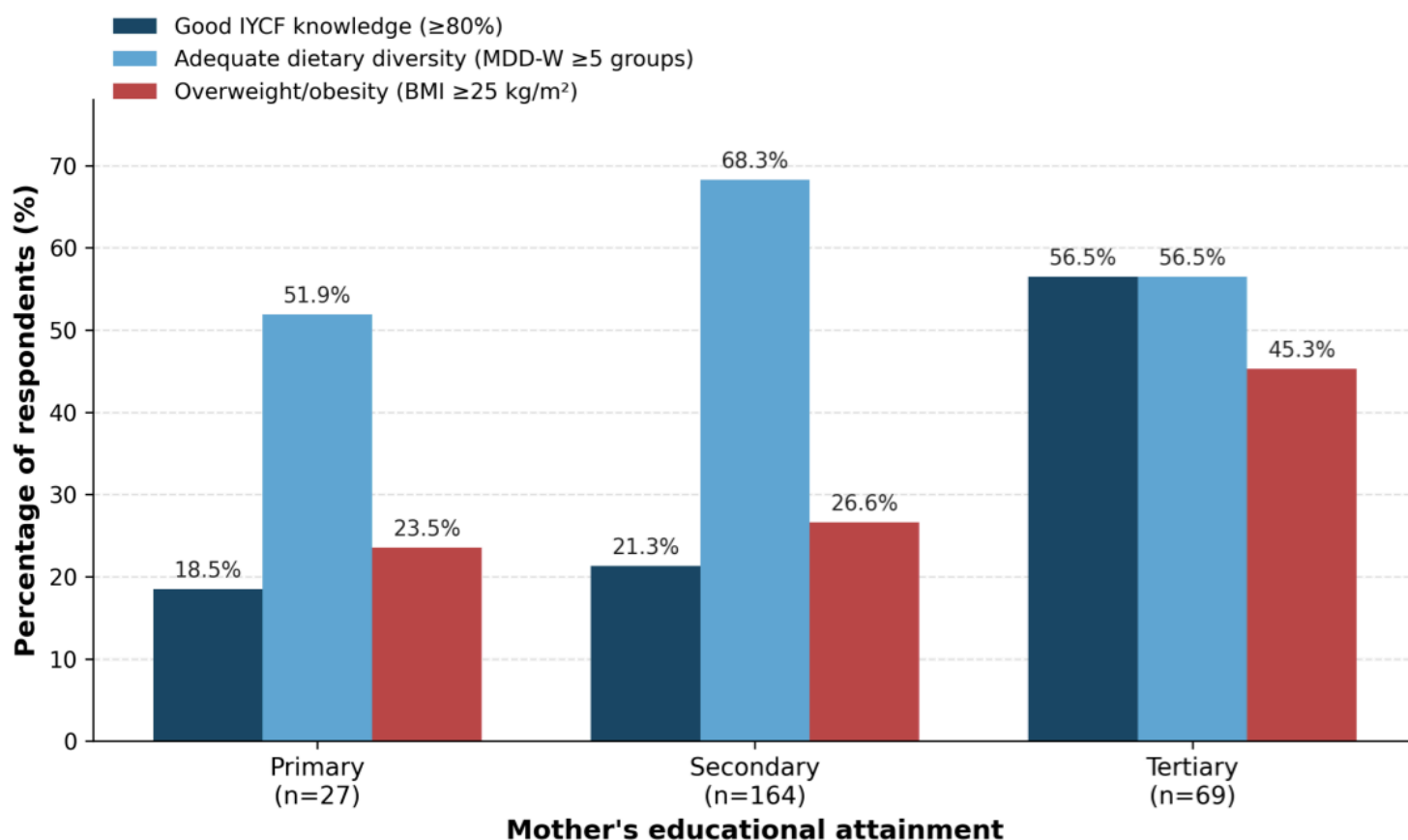


Figure 1

Prevalence of good IYCF knowledge, adequate maternal dietary diversity (MDD-W ≥ 5 food groups), and maternal overweight/obesity (BMI ≥ 25 kg/m²), by maternal educational attainment (N = 260).