Complementary Feeding Indicators and Stunting in Children Under 5 Years of Age in South-Western Nigeria

***Idowu O.A., Fadahunsi M.A., and Ogunba B.O.**

[1]*Department of Human Nutrition and Dietetics, Faculty of Basic Medical Sciences, Obafemi Awolowo University, P.M.B. 13, Ile-Ife, Osun State, 220282, Nigeria*

***Corresponding author:** busayo2.idowu@gmail.com **Phone number:** 08145666684

ABSTRACT

Background: *Introducing complementary feeding is a key milestone in infant development, as it involves introducing additional sources of nutrients beyond breast milk.*

Objective: *This study assessed complementary feeding indicators and anthropometric indices in children under 5 years in Akinyele and Ibadan South East Local Government Areas of Oyo State.*

Methods: *A cross-sectional survey design was conducted among 221 mothers with children aged 6 – 23 months, selected using a multistage sampling technique. The questionnaire gathered information on socio-economic characteristics, breastfeeding, and complementary feeding practices. Version 26.0 IBM SPSS Statistics was used for analysis.*

Results: *Among the children, 49.8% were males, 50.2% were females, 61.1% were aged 6 to 12 months, and*
38.9% were 13 to 23 months. More than half (66.1%) introduced solid, semisolid, or soft foods (ISSF) at 6 months, 29% received the Minimum Dietary Diversity (consumed ≥ 5 food groups), 33% received the appropriate Minimum Meal Frequency (consumed ≥ 2 times (6 – 8 months) or ≥ 3 times (9-23 months) or ≥ 4 times (non-breastfed child), and 9% received the Minimum Adequate Diet (MDD + MMF (and ≥ 2 milk feeds if non-breastfed). Stunting was observed in 46.2% of the children, wasting in 10%, and underweight in 22.6%. A significant association was found between stunting and ISSF and MAD with p-values of 0.017 and 0.014, respectively.

Conclusion: *Few children meet complementary feeding standards; many were malnourished. Hence, educating mothers on appropriate complementary feeding practices is essential for reducing the burden of malnutrition.*

Keywords: Minimum Adequate Diet, Undernutrition, Under-five children

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INTRODUCTION

Complementary feeding, the transition from a breastmilk-only diet to one that includes additional food sources for adequate nutrition, is crucial for the development of a baby. It is recommended that infants be initiated to breastfeeding within one hour of birth, be exclusively breastfed for the first six months, be started on complementary feeding at six months, and continue breastfeeding until 2 years of age or beyond [1].

Complementary foods, when introduced at six months, ensure adequate growth and development, as breast milk alone becomes insufficient to meet energy and nutrient requirements at this stage [2]. Infants who receive a diverse diet, including breast milk, cereals, roots, tubers, legumes, nuts, seeds, dairy, meat, eggs, and a variety of vitamin A-rich fruits and vegetables daily, are more likely to meet their micronutrient needs [1].

In monitoring Infant and Young Child Feeding (IYCF) practices, WHO and UNICEF developed indicators in 2008, subsequently revising them in 2017 and 2018 [3, 4, 5]. The current IYCF indicators for complementary feeding are the Introduction of solid, semisolid, or soft foods 6–8 months, Minimum dietary diversity 6–23 months, Minimum meal frequency 6–23 months, Minimum milk feeding frequency for non-breastfed children 6–23 months, Minimum acceptable diet 6–23 months, Egg and/or flesh food consumption 6–23 months, Sweet beverage consumption 6–23 months, Unhealthy food consumption 6–23 months, Zero vegetable or fruit consumption 6–23 months [5].

Inappropriate complementary feeding (CF) during childhood is a significant cause of malnutrition [6,7]. Stunting, which is the most significant form of malnutrition, is caused by insufficient quantities and inadequate quality of complementary foods, coupled with poor feeding practices and increased infection rates [8, 9]. A child is considered stunted if the child's height is more than two standard deviations below the WHO Child Growth Standards median [10].

Globally, a significant proportion of children lack access to nutritionally adequate and safe complementary foods. In many countries, less than a quarter of infants 6 to 23 months of age meet the criteria of age-appropriate Minimum Dietary Diversity (MDD) and Minimum Feeding Frequency (MFF) [11]. While there has been an increase in introducing solid foods for children aged 6–8 months from 66% in 2010 to 72% in 2020, progress in achieving minimum meal frequency and a minimally diverse diet has been limited over the past decade [12]. Additionally, the consumption of nutritious foods among children aged 6–23 months has only marginally improved from 32% in 2010 to 36% in 2020 [12].

In Nigeria, only 11% of children met the MAD criteria for their age in 2018 [13], and the national prevalence of under-five stunting is 32%, with the northwestern region having a higher prevalence of 50.4% [14]. Previous studies conducted in parts of Nigeria, including Lagos [15], Ogun [16], Iseyin [17], and Cross River [18], have reported suboptimal complementary feeding practices and significant levels of undernutrition. However, few studies have specifically examined complementary feeding indicators and their relationship with nutrition outcomes like stunting, wasting, and underweight in communities within Southwestern Nigeria, particularly in Ibadan, Oyo State.

Determining the prevalence of stunting and assessing complementary feeding indicators in this region will provide valuable insights for improving complementary feeding practices and locally targeted nutrition interventions. Improving these practices is crucial for promoting sustainable and prosperous societies and is vital for achieving the 2030 Sustainable Development Goals (SDGs), particularly Goal 2, which aims to improve nutrition and end malnutrition in all its forms. This study aimed to assess complementary feeding indicators and determine the prevalence of stunting, wasting, and underweight. It also showed the determinants of stunting.

METHODS

A cross-sectional study was conducted among mothers or caregivers of children aged 6-23 months in Akinyele and Ibadan South-East Local Government Areas of Oyo State, Nigeria. A multi-stage sampling technique was employed to ensure a representative sample. In the first stage, two local governments, Ibadan South-East (urban) and Akinyele (semi-urban), were purposively selected. These local governments were chosen to reflect variations in socioeconomic and environmental contexts. In the second stage, a combination of random and convenient sampling was used to recruit participants who met the inclusion criteria. Within each LGA, specific communities were identified, and mothers or caregivers with children aged 6 to 23 months were approached in households, shops, and health centres. This approach ensured access to diverse respondents across informal and formal settings. A total of 221 mother-child pairs were included were selected from Ibadan South-East Local Government and 110 pairs from Akinyele Local Government Area.

Data collection methods

Data were collected using a structured, interviewer-administered questionnaire consisting of information on the sociodemographic and socioeconomic characteristics of the mothers, breastfeeding practices, complementary feeding practices, and a 24-hour dietary recall assessment questionnaire. The anthropometric measurements of the children were also taken and recorded. The weight of the children was measured using a digital bathroom weighing scale to the nearest 0.1 kg. The scale was placed on a flat surface to reduce errors. The child, whose heavy clothing had been removed, was placed on the scale with feet slightly apart until their weight steadied and was recorded. For children who were not able to stand still, an indirect method was used. The adult was first weighed and then measured again while holding the child. The child's weight was calculated by manually subtracting the adult's weight from the combined weight. The height of the children was measured to the nearest 0.1 cm using a graduated rod. To

measure the height, the child stood upright against the rod, and a ruler was placed horizontally on the top of the child's head to ensure it was level. The height was then read at the point where the ruler touched the graduated rod. In terms of nutritional status, stunting, wasting, and underweight were defined as height-for-age, weight-for-height, and weight-for-age, respectively, that are less than -2 standard deviations (SD) below the mean (standard mean developed by WHO). Children at exactly -2 standard deviation (SD) are considered within the normal range. This was calculated using the WHO Anthro 2021 v.3.2.2 software.

Complementary feeding practice was assessed based on indicators defined by the WHO namely: the Introduction of solid, semisolid or soft foods (ISSSF), Minimum dietary diversity (MDD), Minimum meal frequency (MMF), Minimum milk feeding frequency for non-breastfed children (MMFF), Minimum acceptable diet (MAD), Egg and/or flesh food consumption (EFF), Sweet beverage consumption (SwB), Unhealthy food consumption (UFC), Zero vegetable or fruit consumption (ZvF) and Bottle feeding (BoF) [5]. This was assessed based on all foods, drinks, and snacks consumed by the child 24 hours preceding the interview.

Introduction of solid, semi-solid, or soft foods (ISSF) was defined as the proportion of infants (6 – 23 months) who started complementary foods at 6-8 months. Minimum Dietary Diversity (MDD) was assumed when a child was fed from at least five out of the eight food groups for breastfed children and four food groups with at least two milk feedings for non-breastfed children. The food groups include (1) breastmilk; (2) grains, roots and plantains; (3) pulses (beans, peas, lentils), nuts and seeds; (4) dairy products (milk, infant formula, yoghurt, cheese); (5) flesh foods (meat, fish, poultry, organ meats); (6) eggs; (7) vitamin-A-rich fruits and vegetables and (8) any other fruits and vegetables food groups. A breastfed child was assumed to meet Minimum Meal Frequency (MMF) if, in the past 24 hours, he or she ate solid, semi-solid or soft foods about 2-3 times per day for age 6-8 months and 3-4 times for age 9-23 months while a non-breastfed child was assumed to meet MMF if he or she ate at least 4 times for age 6-23months. The Minimum Acceptable Diet (MAD) was assessed as a composite indicator of MDD and MMF and defined as met when breastfed children aged 6-23 months attained the MDD and MMF during the previous day, or non-breastfed children aged 6-23 months consumed two milk feedings and, attained MMF and MDD. Minimum Milk Feeding Frequency (MMFF) was assumed when a non-breastfed child aged 6 to 23 months received at least two milk feeds during the previous day, Egg and/or Flesh Food Consumption (EFF) was assumed when a child aged 6-23 months consumes egg and/or flesh food during the previous day, Sweet Beverage Consumption (SwB) was assumed when child aged 6 to 23 months consumes a sweet beverage during the previous day, Unhealthy Food Consumption (UFC) was assumed when a child aged 6 to 23 months who consumes unhealthy food during the previous day and Zero Vegetable or Fruit Consumption (ZVF) was assumed when a child aged 6 to 23 months did not consume any fruit or vegetable during the previous day while BoF was assumed when a child aged 6 to 23 months consumes any food or drink from a bottle with a nipple/ teat (including breast milk) and/or were force-fed.

Version 26 of IBM SPSS Statistics was used to carry out the data analysis. Descriptive statistical analysis was used. Frequencies and percentages were applied for categorical variables, while means and standard deviations were used for continuous variables. Binary multivariable logistic regression was used to assess the relationship between complementary feeding indicators and stunting. The model controlled multiple variables, and adjusted odds ratios (AORs) with 95% confidence intervals were reported.

Ethical Consideration

Informed consent was obtained from all the participating mothers after the objectives and procedures of the study were explained. Participation was voluntary, and confidentiality was assured. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. This study was approved by the Department of Planning, Research, and Statistics of the Ministry of Health, Oyo State, with approval number: NHREC/OYOSHRIEC/10/11/22.

RESULTS

Socio-economic characteristics of mothers

The socio-economic characteristics of mothers are shown in Table 1. The mean age of the mothers was 29.83 ± 5.97 years, 97.3% were married, and 67.4% were into trading/business. About half (50.2%) had secondary school education, most (65.6%) of the mothers earned between N10,000 to N50,000 in a month, and the mean household size was 5.35 ± 3.51.

Table 1: Socio-economic characteristics of mothers

Characteristics	Frequency (221)	Percentage (%)
Mother's age (years)		
≤ 20	12	5.4
21 – 30	117	52.9
31 – 40	85	38.5
41 – 50	6	2.7
> 50	1	0.5
Mean ± SD = 29.83 ± 5.97		
Marital status		
Single/Separated	6	2.7
Married	215	97.3
Occupation of the mother		
Civil Servant	20	9.0
Farming	10	4.5
Trading/Business	149	67.4
Artisan	26	11.8
Unemployed	6	2.7
Others	10	4.5
Mother's monthly income (₦)		
Less than 10,000	36	16.3
10,000 - 50,000	145	65.6
60,000 - 100,000	34	15.4
110,000 - 150,00	6	2.7
Years of formal education		
< 6		
7 - 12	8	3.6
13 - 18	111	50.2
19 - 23	99	44.8
Mean ± SD = 13.36 ± 2.57	3	1.4
Household size		
≤ 5	149	67.4
6 – 10	64	29.0
11 – 15	4	1.8
16 – 20	2	0.9
> 20	2	0.9
Mean ± SD = 5.35 ± 3.51		

Source: Field survey, 2023

Characteristics of children

The socio-economic characteristics of children are shown in Table 2. The mean age of children was 12.75 ± 5.29 months, 61.1% of the children were aged 6 to 12 months, and 38.9% were aged 13 to 23 months. About half (50.2%) were females, and 49.8% were males. The mean birth weight of the children was 3.23 ± 0.65.

Food group consumption among children by age

Figure 1 shows the food group consumption among children by age. The figure revealed that 97.7% of the children aged 6 to 23 months consumed grains, roots, and tubers. Dairy products were consumed by 64.7% of the children, while 50.2% consumed flesh foods. Pulses, nuts, and seeds were consumed by 34.4% of the children, and 32.1% had eggs included in their diet. Additionally, 21.7% of the children consumed vitamin A-rich fruits and vegetables, and 7.7% included other fruits and vegetables in their diet.

Notably, there was a generally high percentage of consumers of grains, roots, and tubers across all age groups, with the highest (100%) among children aged 12 – 23 months. Starting with 95.5% for those aged 6-8 months, the percentage reached 100% for children aged 12-23 months. Conversely, the percentage of those who consumed dairy products declined with age, dropping from 86.4% in the 6-8 months age group to 53.8% in the 12-23 months age group. Consumption of flesh foods increased across age groups, with only 18.2% of 6-8 months consuming them, rising to 62.4% for those aged 12- 23 months. Consumption of pulses, nuts, and seeds also increased across age groups, starting at 9.1% for 6-8 months and reaching 43.6% for 12-23 months. Consumption of eggs follows a similar pattern, with consumption increasing from 11.4% in the 6-8 months age group to

43.6% for children aged 12-23 months. It is notable that the percentage of infants who consumed vitamin A-rich fruits and vegetables, as well as other fruits and vegetables, generally increased with age, albeit at lower percentages compared to some other food categories.

Table 2: Socio-economic characteristics of children

Characteristics	Child Frequency (221)	Percentage (%)
Sex of child		
Male	110	49.8
Female	111	50.2
Age of child (months)		
6 – 12	135	61.1
13 - 23	86	38.9
Mean ± SD = 12.75 ± 5.29		
Birth weight (kg)		
< 2.5	11	5.0
2.5 - 4.5	150	67.9
> 4.5	3	1.4
Cannot recall	57	25.8

Mean ± SD = 3.23 ± 0.65

Complementary Feeding Indicators among age groups

Figure 2 illustrates the complementary feeding indicators among age groups. Complementary feeding indicators across age groups show distinct patterns. Among children aged 6 – 8 months, 52.3% were introduced to solid, semisolid, or soft foods at the right time (at 6 months). Among children aged 9 – 11 months, 81. 7 % were introduced to complementary foods at 6 months, and among those aged 12 – 23 months, 63.2% had a timely introduction to solid, semisolid, or soft foods. Bottle-fed children consistently rose from 56.8% at 6-8 months to 74.4% at 12-23 months. Egg and/or flesh food consumption (EFF) also showed a steady rise, from 22.7% at 6-8 months to 81.2% at 12-23 months. Conversely, the percentage of children who consumed sweet beverages decreased with age, from 88.6% among those aged 6-8 months to 41.9% among those aged 12-23 months. Minimum milk feeding frequency (MMF) shows a sharp decline from 72.7% at 6-8 months to 20% at 9-11 months, slightly increasing to 24.8% at 12-23 months. Unhealthy food consumption (UFC) decreased from 61.4% at 6-8 months to 10.3% at 12 - 23 months. Zero vegetable and fruit consumption (ZVF) increased with age, from 6.8% at 6-8 months to 36.8% at 12-23 months. More children aged 12 – 23 months (35.9%) achieved the Minimum Dietary Diversity (MDD) than 9.1% and 30.0% observed among children aged 6 – 8 months and 9 – 11 months, respectively. The percentage of children who met the Minimum Acceptable Diet (MAD) was low across all groups, with minor variations: 9.1% at 6-8 months, 8.3% at 9-11 months, and 9.4% at 12-23 months.

Nutritional status of children

The nutritional status of the children is shown in Table 3. The overall level of stunting was 46.1 among the children, with a prevalence of 9.5% among those aged 6 – 8 months, 11.3% among those aged 9 – 11 months, and 25.3% among those aged 12 – 23 months. The p-value of 0.905 indicates that there is no significant difference in the prevalence of stunting between males and females. The total prevalence of wasting is 10% and it is slightly higher in males, with 5.88% being wasted, compared to 4.07% of females. The p-value of 0.357 shows that there is no significant difference in the prevalence of wasting between males and females, indicating that wasting is similarly distributed among boys and girls. Less than half (22.6%) of the children are underweight. The proportion of underweight males was higher, with 15.4% of males being underweight, compared to 7.2% of females. The p-value of 0.003 indicates a significant difference in the prevalence of underweight between males and females.

Relationship between complementary feeding indicators and stunting

The result of the multivariable binary logistic regression analysis showing the relationship between complementary feeding indicators and stunting is shown in Table 4. The 10.9% change in the complementary feeding indicators can be accounted for in the total variation in the dependent variable (Stunting) as shown by the Nagelkerke R-squared value (0.109). From Table 4, it is observed that the adjusted odds ratio of 2.384 indicates that those who do not start complementary foods at 6-8 months are 2.38 times more likely to be stunted compared to those who started complementary at that age, after controlling for other variables in the model. Similarly, the adjusted odds ratio of 4.273 indicates that those who did not achieve the Minimum Adequate Diet (MAD) are 4.27 times more likely to be stunted than those who achieved the Minimum Adequate Diet, adjusting for other variables in the model.

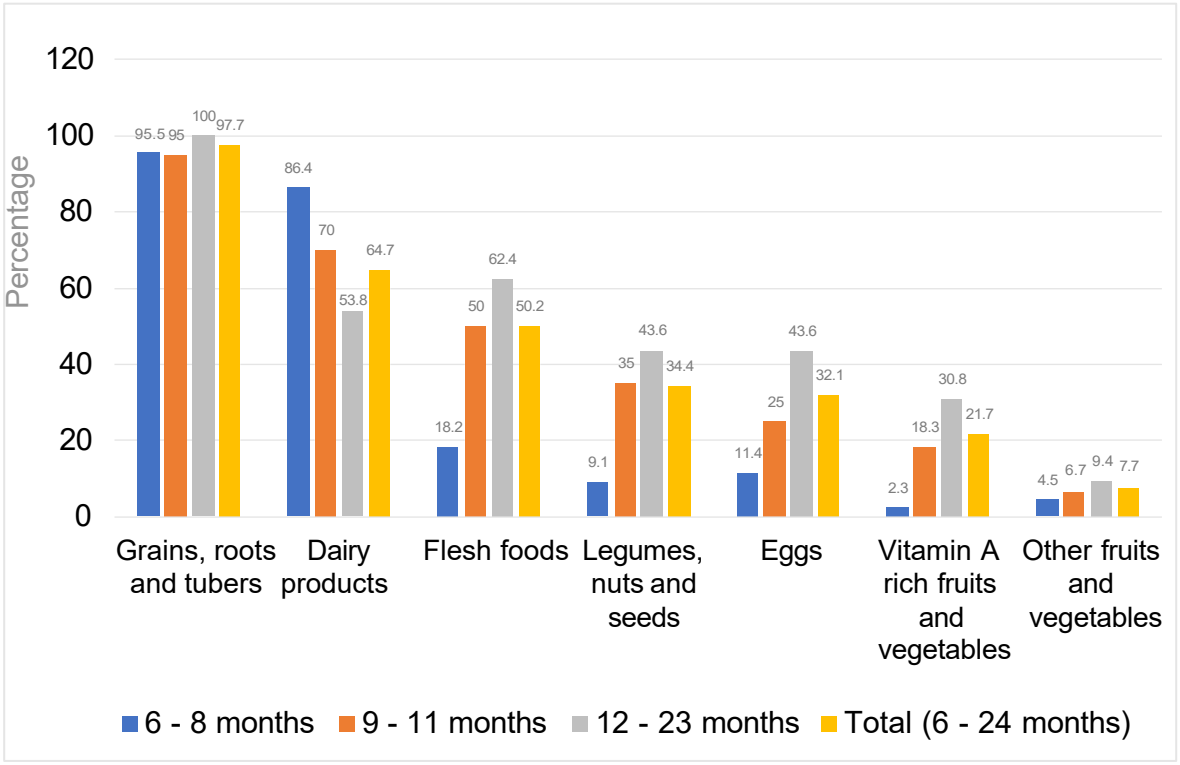

Figure 1: Food group consumption among children by age

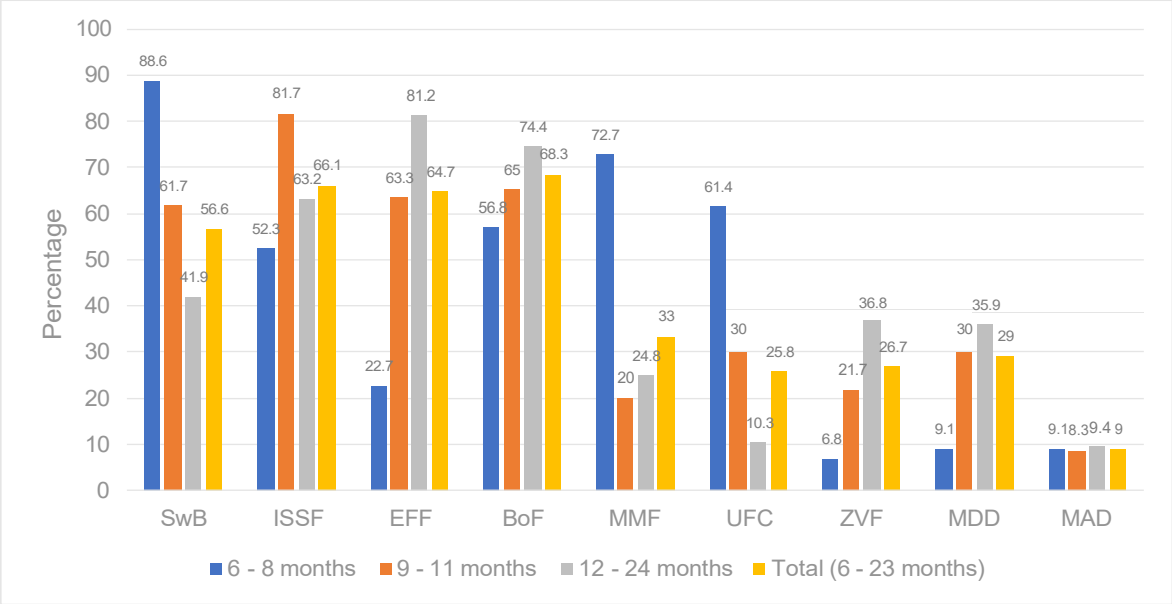

Figure 2: Complementary feeding indicators among age groups

KEY

SwB – Sweet Beverage Consumption. ISSF – Introduction of solid, semisolid or soft foods. EFF - Egg and/or Flesh Food Consumption. BoF – Bottle Feeding. MMF – Minimum Meal Frequency. UFC – Unhealthy Food Consumption. ZVF – Zero Vegetable and Fruit Consumption. MDD – Minimum Dietary Diversity. MAD – Minimum Adequate Diet

Table 3: Nutritional status of children

Nutritional status	Male (110) Frequency (%)	Female (111) Frequency (%)	p-value
Stunting			
Stunted	51 (23.1)	51 (23.1)	0.905
Not stunted	59 (26.7)	60 (27.1)	
Wasting			
Wasted	13 (5.9)	9 (4.01)	0.357
Not wasted	97 (43.9)	102 (46.1)	
Underweight			
Underweight	34 (15.4)	16 (7.2)	0.003*
Not underweight	76 (34.4)	95 (43.0)	

*p-values were calculated using the Chi-square test of independence. A p-value <0.05 was considered statistically significant

Table 4: Relationship between complementary feeding indicators and stunting

Variable	p - value	AOR Exp (B)	95% C.I. for EXP (B)
ISSF (1)	0.005*	2.384	1.29 – 4.39
MDD (1)	0.365	.685	0.30 – 1.55
MMF (1)	0.329	1.416	0.70 – 2.85
MAD (1)	0.048*	4.273	1.01 – 18.05
EFF (1)	0.619	.843	0.43 – 1.66
SwB (1)	0.188	.665	0.36 – 1.22
Ufc (1)	0.926	.968	0.49 – 1.91
ZVF (1)	0.246	1.533	0.75 – 3.15
BoF (1)	0.610	1.175	0.63 – 2.18

ISSF – Introduction of solid, semisolid or soft foods. MDD – Minimum Dietary Diversity. MMF – Minimum Meal Frequency. MAD – Minimum Adequate Diet. EFF - Egg and/or Flesh Food Consumption. SwB – Sweet Beverage Consumption. UFC – Unhealthy Food Consumption. ZVF – Zero Vegetable and Fruit Consumption. BoF – Bottle Feeding. AOR – Adjusted Odds Ratio. CI – Confidence Interval.
* $p < 0.05$ (statistically significant)

DISCUSSION

Complementary feeding indicators facilitate strategic implementation and monitoring of Infant and Young Child Feeding (IYCF) practices [5]. This study assessed the complementary feeding indicators and anthropometric indices in children between 6 to 23 months. Previous studies examined complementary feeding among a broader age range of under-five children [15,19], while a study in Cross-Rivers State in Nigeria focused on children between 6 and 11 months [18].

More than half of the children in this study were introduced to solid, semi-solid, and soft food at 6-8 months. This proportion is higher than the average prevalence in a similar study conducted in Ijebu Ode, Ogun state [16]. The difference in prevalence may be attributed to variations in socio-cultural factors between the two regions. According to the World Health Organization [5], for a child to achieve minimum dietary diversity, they should consume at least five out of the eight recommended food groups daily. However, the present study found that only a few of the children met this requirement, which is higher than a lower percentage in a previous study conducted in Iseyin, Oyo state [17]. In terms of minimum meal frequency, which is recommended to ensure adequate energy and nutrient intake, less than half of the children met the recommended frequency in this study. The concept of a minimum acceptable diet combines minimum dietary diversity, minimum meal frequency, and minimum milk feeding frequency [5]. In this study, very few children met the criteria for a minimum acceptable diet, which is consistent with that of the Nigerian study of the trends of complementary feeding indicators from 2003 to 2013 [20]. Generally, across various study areas, the percentages for the Minimum Adequate Diet (MAD), Minimum Meal Frequency (MMF), and Minimum Dietary Diversity (MDD) have consistently been low. This trend highlights the alarming prevalence of inappropriate complementary feeding practices and reinforces the widespread challenge of inadequate complementary feeding practices across Nigeria. The analysis of the twenty-four-hour dietary recall data revealed that the majority of mothers provided grains, roots, and

tubers to their children, which is consistent with the prevalence observed in Ijebu-ode and Iseyin [16,17]. However, these findings differ from a study conducted among children in Northern Uganda, where only 35.2% provided cereals and 0.9% provided tubers [21]. It appears that mothers in this study place significant emphasis on grains, roots, and tubers in their children's diets, and this is also reflected in the low dietary diversity in the study area. The prevalence of stunting in this study was higher than the prevalence observed in a similar study in Iseyin and the national prevalence of 32% [17, 22]. The prevalence of wasting was lower than the prevalence in the study at Iseyin but higher than the national prevalence of 6.5% [17,23]. Lastly, the prevalence of underweight (which is below average) was similar to the prevalence in the Iseyin study but higher than the national prevalence of 18.4% [17,23]. These results showed that there is an alarming rate of stunting, wasting, and underweight in the study area. Hence, targeted interventions to address both chronic and acute malnutrition are needed. To address these gaps, locally tailored interventions are essential. Nutrition education programmes targeting mothers and caregivers should be intensified at the community level through primary health care centers and community health workers. These programmes should focus on practical demonstrations of diverse, affordable, and locally available food combinations.

This present study found a significant association between Introduction to solids, semi-solids, and soft foods (ISSF) and stunting, which aligns with a study conducted in India [24]. Also, this study indicated a significant association between minimum adequate diet and stunting, which is consistent with the findings of the study in Cross River State, Nigeria [18]. According to the study, those who did not start complementary foods at 6 months were 2.38 times more likely to be stunted compared to those who started complementary foods at that age, and those who did not achieve the Minimum Adequate Diet (MAD) were 4.27 times more likely to be stunted than those who achieved the Minimum Adequate Diet. This strong association between stunting and both the timing of complementary food introduction and Minimum Acceptable Diet (MAD) underscores the importance of timely and appropriate complementary feeding. Improving infant and young child feeding (IYCF) practices can significantly reduce the burden of stunting in this population. Therefore, it is recommended that intensified efforts be made to promote optimal infant and young child feeding practices to effectively combat stunting.

CONCLUSION

It was concluded that 2 out of 5 children are stunted in this study area, 3 out of 5 children start complementary feeding at the appropriate age, and 9 out of every 10 children did not meet up with the Minimum Acceptable Diet. The significant association between stunting and key feeding indicators – ISSF and MAD – highlights the need for strategic interventions. Promoting timely and adequate complementary feeding should be prioritized as a cost-effective strategy to combat undernutrition and promote healthy growth in Nigerian children.

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