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Determinants of appropriate complementary feeding practices among women with children aged 6-23 months in Iseyin, Nigeria ☆

Oluwaseun Ariyo[a,*], Olaide R Aderibigbe[a,b], Tomilola J. Ojo[a], Barbara Sturm[c], Oliver Hensel[c]

[a] Department of Human Nutrition, Faculty of Public Health, University of Ibadan, Ibadan, Nigeria
[b] Product Development Programme, National Horticultural Research Institute, Ibadan, Nigeria
[c] Faculty of Organic Agricultural Sciences, Section of Agricultural and Biosystems Engineering, University of Kassel, Witzenhausen, Germany

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ABSTRACT

Malnutrition and poor complementary feeding are more predominant in rural than urban areas. Yet, little attention has been given to these discrepancies and the use of validated composite index to explore determinants of complementary feeding practices. Hence, this study was aimed at identifying the determinants of appropriate complementary feeding practices among mothers with children aged 6-23 months in Iseyin, Nigeria.

A community based cross sectional survey involving 390 mother-child dyads was conducted using a three-stage simple random sampling. Information on household sociodemographic characteristics, complementary feeding practices, 24-hour dietary intake and anthropometric characteristics of youngest child in the household were obtained using a semi-structured questionnaire. Complementary feeding indicators and anthropometric indices were estimated using the 2008 World Health Organization recommendations and WHO Anthro, respectively. Data were analysed using descriptive statistics and logistic regression at $p<0.05$.

Mothers' mean age was 28.7± 5.6 years, 99.4% were married, and 92.1% attended antenatal care sessions. Mean age of children was 14.5±5.1 months, 56.2% were male and 31.0% were firstborn. Of all the children, 72.3% had timely introduction of complementary food, 17.7% had minimum dietary diversity, 46.9% had minimum meal frequency and 14.9% had minimum acceptable diet. Grains, root and tubers (91.3%) constituted the mostly consumed complementary foods. Overall, only 10.0% of children had appropriate complementary feeding; child's age, birth order and mother's income were determinants of appropriate complementary feeding.

Appropriate complementary feeding practices remain very low and this is influenced by the child's age, birth order and mother's income.

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* Corresponding author.
E-mail addresses: o.ariyo@ui.edu.ng, connecttolaide@yahoo.com (O. Ariyo).

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Introduction

Child malnutrition remains a global health challenge though the burden and severity are higher and more pronounced in developing countries like Nigeria thereby resulting in high morbidity and mortality, and growth failure [2,19,36]. In many developing countries, inappropriate feeding practices remain an impediment affecting a large number of children and thereby impede their growth and development [5]. Following inappropriate feeding practices among other factors, infant and under five mortality remain high in Nigeria at 70 per thousand and 120 per thousand, respectively [18]. Ensuring appropriate feeding serves as a panacea to promote adequate nutrition, growth and development and reduce the risk of mortality among children.

Adequate nutrition is essential for a full physical and mental development of a child, and once this is compromised, malnutrition and its consequences become inevitable. Appropriate feeding practices entail early initiation of breastfeeding, exclusive breastfeeding, timely introduction of appropriate complementary food at six months and continued breastfeeding to two years and beyond [36]. Complementary feeding is the process of providing an infant with other foods and liquids to meet the nutrients requirement when breast milk is no longer sufficient from the age of six months [34]. It is a period of transition from exclusive breastfeeding to family foods and a very vulnerable period when malnutrition sets in [36].

A report of NNHS [19] showed an increase of about 48% in stunting among children aged 6-11 months compared to those less than six months of age, and another 44.1% increase among children aged 12-23 months relative to those aged 6-11 months. This reflects that malnutrition especially stunting rises at six months and peaks at 23 months; this could impair cognitive development, compromise educational achievement at present, and lead to low economic productivity in later life [6]. Furthermore, the results reflect the need to emphasise attention on child care practices particularly feeding practices at this phase of the lifecycle.

Complementary feeding is considered appropriate when timely initiation is ensured, at an age of six months, and supported with breastfeeding up to at least 2 years and beyond, and recommended feeding frequency for age, and consumption of diverse diet are guaranteed [1,34]. However, many complementary foods are characterised by nutrients imbalance, poor diversity and inadequate micronutrient content [7]. This practice negates the common knowledge that good dietary diversity and proper meal frequency promote good nutrition and consequently good health [28]. An objective assessment is therefore important to encourage optimal feeding practices. To this end, eight core indicators were developed by the World Health Organisation [34,35], and four of these are recommended for complementary feeding practices including timely introduction of semi-solid or soft foods, Minimum Dietary Diversity (MDD), Minimum Meal Frequency (MMF), and Minimum Adequate Diet (MAD) (*WHO/UNICEF, 2008).*

The national report revealed that malnutrition and poor complementary feeding are worse in rural compared to urban areas [19], however, reasons for higher child malnutrition in rural areas remain unclear. Moreover, there is limited evidence on the practice and determinants of complementary feeding practices in Iseyin and other Oke-Ogun axis of Oyo state, Nigeria, an area noted for distinct cultural and food preferences that are less influenced by dietary transition. In addition, existing complementary feeding studies in Nigeria have largely used individual indicators, whereas, validated composite WHO indicators offer the platform to adequately quantify the determinants of appropriate complementary feeding practices [4]. This approach has the strength of exploring the multidimensionality of complementary feeding practices and contributes to developing reliable strategies to address the constraints in promoting infant and young child nutritional outcomes. These clarities are essential to build on the demographic health data and develop strategies to improve complementary feeding practices in Nigeria. Hence, this study was conducted to identify the determinants of appropriate complementary feeding practices among mothers with children aged 6-23 months in Iseyin, a rural community in Oyo State, Nigeria.

Methodology

Study area

Iseyin is a rural town located approximately 100 km North of Ibadan, Oyo state, Nigeria. It comprises of 11 wards, a land area of 1,348 km^2 and a population of 448,824 people, with children aged 6-23 months constituting about 9.0%. The major occupations of the population are farming, trading, weaving, and pottery. Traditionally, breastfeeding is culturally acceptable in the study area, however, the early introduction of water, and other traditional herbal preparations remain common. The traditional complementary food is largely cereal-based including maize gruel and guinea corn gruels.

Study design

The study adopted a community based cross sectional approach for a period two months (August, 2018 – September, 2018) in Iseyin Local Government Area, Oyo state.

Sample size determination

The sample size was calculated using [11] where P (proportion of mothers practicing appropriate complementary feeding practices was assumed to be 50.0%. A total of 390 mother-child dyads participated in the study.

Sampling technique and sampling procedure

A two-stage simple random sampling technique was adopted to select six out of the 11 wards of Iseyin LGA and five communities per ward to make a total of 30 communities. Thereafter, all households with mother and child aged 6-23 months were enumerated (household listing) and 13 eligible households were selected per community using a simple random sampling procedure to give a total of 65 households per ward and 390 households in total. The youngest child in the household was selected as an index child. A mother was considered eligible if resident in the study areas for at least three consecutive years, was available and consented to participate in the study.

Data collection

Data were collected using a semi-structured, interviewer-administered questionnaire consisting information on the sociodemographic and socioeconomic characteristic of the mothers, complementary feeding practices, a 24-hr recall dietary assessment questionnaire and the anthropometric measurement of the index children.

Complementary feeding practice was assessed based on four core indicators defined by the WHO namely: timely introduction of complementary feeding at age six months, MDD, MMF and MAD (UNICEF/ [34]). The assessment was based on all foods, drinks and snacks consumed by the child the day preceding the interview. Timely introduction of solid, semi-solid or soft foods was defined as the proportion of infants 6–23 months of age who started complementary foods at 6-8 months (WHO, [35]). MDD was assumed when a child was fed from at least four out of the seven food groups for breastfed child and four food groups with at least two milk feeding for non-breastfed child [35]. The food groups include: (1) grains, roots and tubers; (2) legumes and nuts; (3) dairy products; (4) flesh foods; (5) eggs; (6) vitamin-A-rich fruits and vegetables and (7) any other fruits and vegetables food groups.

A breastfed child was assumed to meet 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 6-23 months ([35,37]). The 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 [35,37], or non-breastfed children aged 6-23 months consumed two milk feedings and, attained MMF and MDD excluding dairy product [34]. Appropriate complementary feeding practices (ACFP) was defined if a child met all three key criteria (timely introduction of complementary food, MMD and MMF), and inappropriate when a child did not meet any of the three criteria.

Anthropometric measurement

Information on sex, date of birth, and age (months) were obtained using a semi-structured, interviewer-administered questionnaire. Weight of children was measured to the nearest 0.1kg using a weighing scale (Seca sahara 803). The scale was periodically re-calibrated using a known weight. The length of the child was measured to the nearest 0.1 cm using UNICEF length board.

Data analysis

Data were analysed using IBM Statistical Package for Social Sciences (SPSS) version 20.0. Socio-demographic and socioeconomic data were analysed using descriptive analysis and reported as mean (Standard deviation) for continous variables and frequency (percentage) for categorical variables. Anthropometric data were analysed using WHO Anthro software. Children were categorised as either normal (z-score: -2.0 to +2.0) or malnourished {wasting (W/H) z-score- (moderate: -3-<-2), severe (>-3); stunting W/A z-score- (moderate: -3-< -2), severe (>-3)} based on the WHO child growth standard [33]. Relevant statistical tests were applied where applicable including Chi square test at $P<0.05$. Birth order was re-categorised into two categories and binary logistic regression analysis was used to identify the association between the independent and outcome variables. Predictive variables associated with outcome variables with $p<0.2$ were entered into multivariable logistic regression analysis and associated variable that had $p<0.05$ and AOR with 95%CI were identified.

Ethical consideration

This study was approved by the University of Ibadan and University College Hospital Joint Ethics Committee with approval number UI/EC/18/0611.

Results

Characteristics of mothers, index children, and the households

The socio-demographic characteristics of the mothers, and index children are as shown in Table 1. A total of 390 mother and child pairs consented to participate in the study. The age of mothers was 28.7±5.6 years, 99.4% were married, 77.9%

Table 1
Socio-demographic characteristics of the mothers and index children.

Characteristics	Child Frequency	Percentage (%)	Characteristics	Maternal Frequency	Percentage (%)
Sex of the child			Mothers' age (years)		
Male	219	56.2	≤25	116	29.7
Female	171	43.8	26-30	138	35.4
			31-35	80	20.5
Age (months)			36-40	45	11.5
6-11	55	14.1	>40	11	2.8
12-17	83	21.3	Mean age ± SD	28.7± 5.6	
18-23	252	64.6			
Mean ± SD	14.5 ±5.1		Marital status		
			Single/separated	2	0.6
Position of the index child			Married	388	99.4
1st born	121	31.0			
2nd born	110	28.2	Type of marriage		
3rd born	81	20.8	Monogamy	304	77.9
≥4th born	78	20.0	Polygamy	85	21.8
Household size			Mothers occupation		
1-4	214	54.9	Business women	260	66.6
5-8	169	43.3	Private employed	16	4.1
>8	7	1.8	Daily labourers	26	6.7
Mean ± SD	4.57±1.58		Artisans	80	20.5
			Farmers	4	1.0
Stunting (Overall)	146	37.4	Unemployed	4	1.0
Male	84	21.5			
Female	62	15.9	Monthly income		
6-8 months	12	21.8	< #10,000 (<US$28)	186	47.7
9-11 months	29	34.9	10,000-20,000 (US$28-56)	182	46.7
12-23 months	105	41.7	>20,000 (>US$56)	22	5.6
Wasting (Overall)	50	12.8			
Male	32	14.6	Level of education		
Female	18	10.5	No formal education	20	5.1
6-8 months	7	12.7	Primary	66	16.9
9-11 months	5	6.0	Secondary	275	70.5
12-23 months	38	15.0	Tertiary	29	7.5
Underweight (Overall)	87	22.3	Antenatal visit		
Male	42	19.2	Yes	359	92.1
Female	46	26.9	No	31	7.9
6-8 months	9	16.4			
9-11 months	12	14.5	Place of delivery		
12-23 months	66	26.2	Primary Health Facility	382	98.0
			At home	5	1.2
			Traditional birth attendant	3	0.8

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were in polygamous marriage, and 66.6% were petty traders. The majority (91.9%) of the mothers had formal education of which 64.9% attained up to secondary education level, 92.1% attended antenatal care sessions and 98.0% used health facility for child delivery. Age of the index children was 14.5±5.1 months, 64.6% were aged 12-23 months, and 21.3% were aged 9-11 months. More than half of the children (56.2%) were male and 43.8% were female. Household size was 4.57±1.58, 54.9% had a household size of 1-4 members and 31.0% of index children were firstborn of the households. Anthropometric characteristics of index children are also presented in Table 1. Overall prevalence of stunting was 37.4%, higher in male (21.5%) than female children (15.9%), and declined with decreasing age from 41.4% among children aged 12-23 months, 34.9% in 9-11 months and 21.8% in 6-8 months old children. Wasting was at a level of 12.8%, also higher in male (14.6%) than female (10.5%) children; and varied with age. It was higher among children aged 12-23 months (15.0%) than 6-8 months (12.7%) and 9-11 months (6.0%). Underweight was 22.3% among index children and higher among female (26.9%) than male children (19.2%). It was 26.2% among children aged 12-23 months, 16.4% in 6-8 months and 14.5% in 9-11 months. Fig. 1.

Feeding practices of the index children

Table 2 shows the feeding practices of index children. Most (99.7%) of the children were breastfed, current breastfeeding was 99.3%, 98.8%, 85.9% and 48.3% among children aged 6-11, 12-15, 16-19 and 20-23 months, respectively (Fig. 2). Many children (72.3%) were introduced to complementary food at six months with an increase from 70.6% among children 12-23 months to 80.0% among children 6-8 months. Complementary feeding was initiated mostly with home-made foods (86.1%), 5.4% used mixed foods and 8.5% used commercial complementary foods

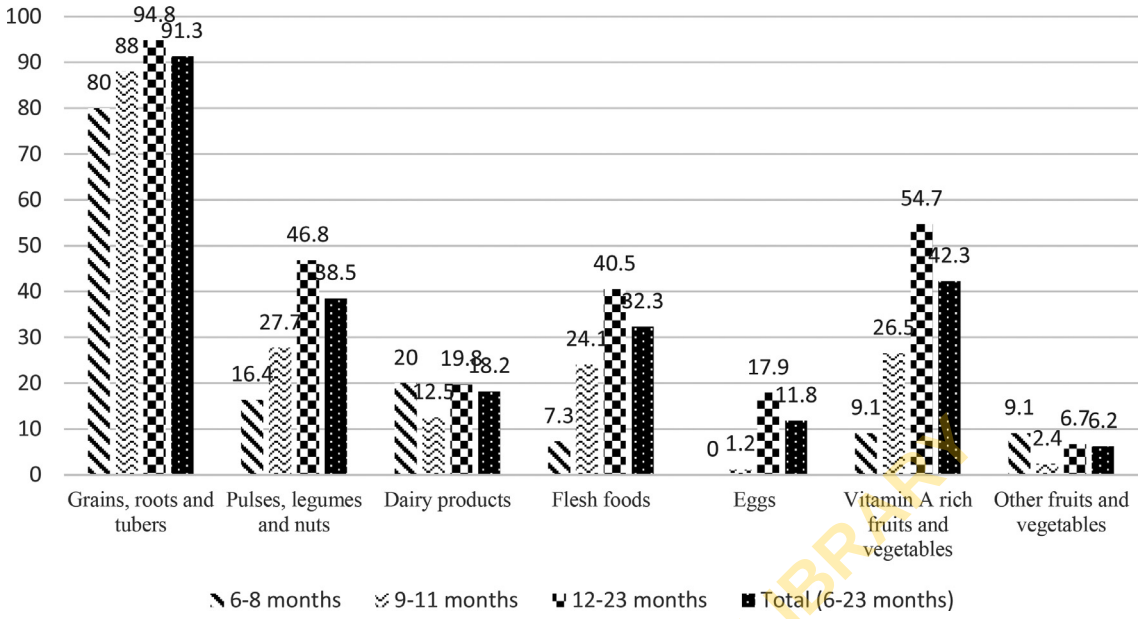

Fig. 1. Food group consumption among index children by age.

Table 2
Feeding practices of the children according to age category.

Variables	Total N= 390	6-8 months N =55	9-11 months N =83	12-23 months N=252
Ever breastfed child				
Yes	389 (99.7)	55 (100.0)	83 (100.0)	251 (99.6)
No	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.4)
Currently breastfeeding				
Yes	331 (84.9)	55 (100.0)	82 (98.8)	194 (77.0)
No	59 (15.1)	0 (0.0)	1 (1.2)	58 (23.0)
Age breastfeeding was discontinued				
<3 months	2 (0.5)	-	-	2 (0.8)
3-6 months	-	-	-	-
>6 months	56 (14.4)	-	1 (1.2)	55 (21.8)
Age complementary food was introduced				
< 6 months	53 (13.6)	9(16.4)	13(15.7)	31(12.3)
At 6 months	282 (72.3)	44 (80.0)	60 (72.3)	178 (70.6)
>6 months	55 (14.1)	2(3.6)	10(12.0)	43 (17.1)
Kind of complementary food				
Local (home-made) food	336 (86.1)	46 (83.6)	64 (77.1)	226 (89.7)
Commercially prepared baby food	33 (8.5)	5 (9.1)	11 (13.3)	17 (6.7)
Mixed food (commercial + local)	21 (5.4)	4 (7.3)	8 (9.6)	9 (3.6)
Meal frequency consumed in the past 24 hrs				
No meal (only breast milk)	28 (7.2)	11 (20.0)	8 (9.6)	9 (3.6)
1 meal	57 (14.6)	12 (21.8)	25 (30.1)	20 (7.9)
2 meals	119 (30.5)	19 (34.6)	24 (29.0)	76 (30.2)
3 meals	127 (32.6)	11 (20.0)	22 (26.5)	94 (37.3)
>3 meals	59 (15.1)	2 (3.6)	4 (4.8)	53 (21.0)

Frequency of consumption of the different food groups by the children over a 24-hour period is shown in Figure I. Grains, root and tubers group constituted the mostly consumed (91.3%), similar trend of consumption occurs across the three age groups with at least 80.0% in each group consuming grains, roots and tubers. Only 38.5% consumed pulses, legumes and nuts, 18.2% consumed dairy products, 32.3% consumed meat/fish, 11.8% consumed eggs, while vitamin A rich fruits and vegetables were consumed by 42.3% of the children and only 6.2% consumed other fruits and vegetables. Disaggregation of food group consumption according to age category further reveals a gradual increase in the consumption of pulses, legumes and nuts with age which peaks at 46.8% among children aged 12-23 months. Only 20.0% of the children within ages 6-8 months consumed dairy product and this was higher compared to the other age groups. Meat/fish and their products consumption (40.5%) and Vitamin A rich fruits and vegetables (54.7%) were higher among children 12-23 months as compared to age 9-11 (24.0%; 26.5%) and 6-8 months (7.3%; 9.1%), respectively. There was an increase in the consumption of egg from 0.0% among

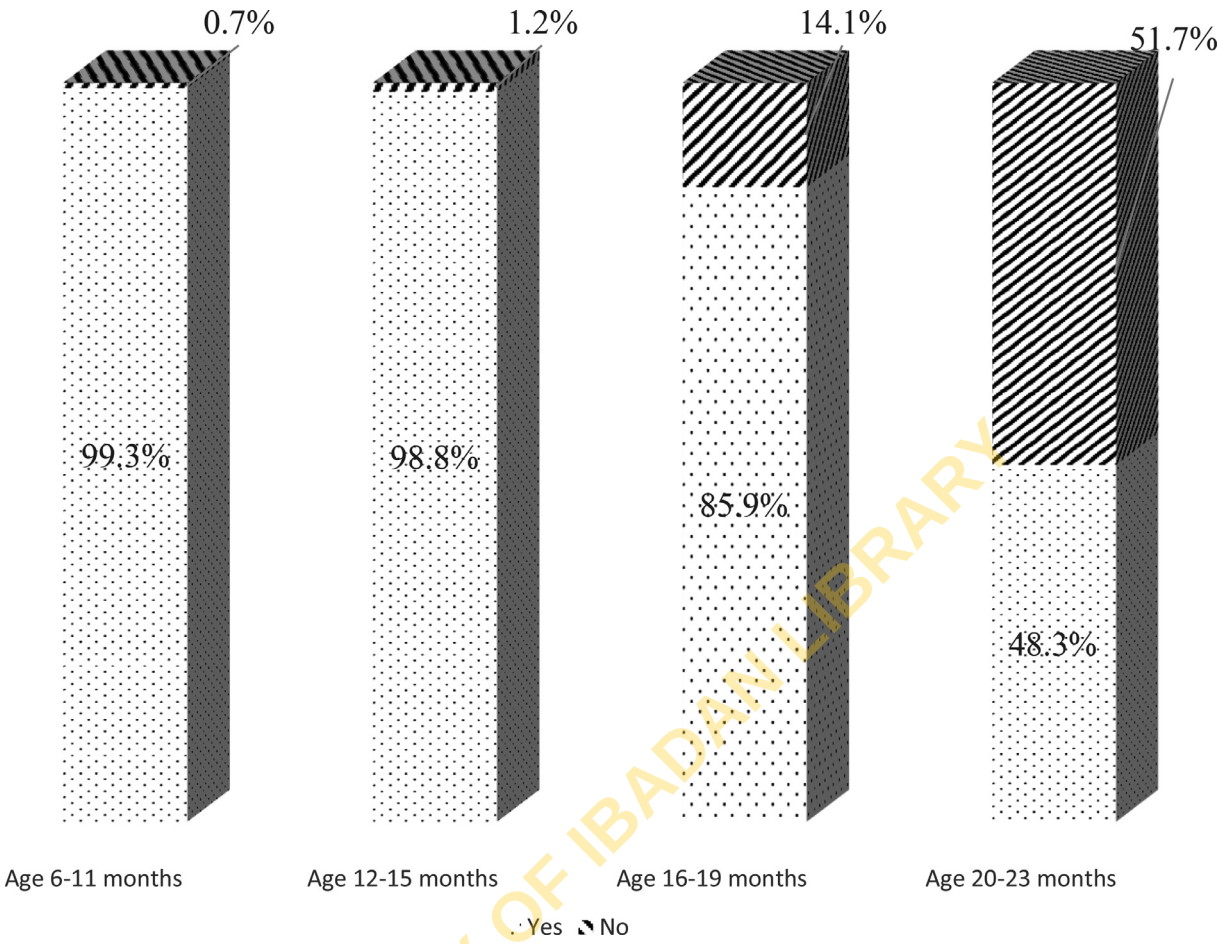

Fig. 2. Percentage currently breastfeeding.

children aged 6-8 months to 17.9 % among children aged 12-23 months. Other fruits and vegetables food group constituted the least consumed food groups and this was higher (9.1%) among children aged 6-8 months compared to other age groups.

Appropriate complementary feeding practices

Table 3 presents the infant and young child feeding practices of the mothers using the four selected WHO indicators. A large number of the mothers (72.3%) introduced complementary food at six months. Surprisingly, there is a gradual decline in the proportion of mothers who fulfilled timely introduction of complementary foods from 80.0% at age 6-8 months, 72.3% at 9-11 months, to 70.6% at 12-23 months. This reflects an improved practice in the younger cohort of infants, which may be related to better promotion of such practice. Also, only 17.7% met the minimum dietary diversity. Disaggregation by age shows that more children in the 12-23 months group (25.3%) met the MDD compared to 3.6% each in 6-8 and 9-11 months groups. MMF was attained by only 46.9% of the children. MAD, which is a composite indicator of both minimum dietary diversity and meal frequency, was only attained by 14.9% of the children. Minimum acceptable diet was higher among children aged 12-23 months compared to younger age groups. Based on the combination of the three indicators, only 10.0% of the children had appropriate complementary feeding and there was a sharp decline in the proportion of children who had appropriate complementary feeding from 13.9%, 3.6% to 1.8% among children aged 12-23, 9-11 and 6-8 months, respectively. This result is an indication of decline in complementary feeding practices despite arrays of interventions targeted at promoting appropriate complementary feeding. This result shows an improvement in timely introduction of complementary foods and minimum meal frequency. Older age children had better quality diets (higher % MDD), but quantity (MMF) may need to be improved, compared with younger age infants. Adequacy of CF (MAD) was met by only a minimal 3.6% among younger age children, and while higher in oldest age group, it remained very low (only 21%). Overall, however, the results showed that infants in the present study are far from having appropriate CF.

Table 3
Infant and young child practices of the mothers based on age categories using WHO selected indicators.

Indicators	Total N=390	6-8 months N=55 (%)	9-11 months N=83 (%)	12-23 months N=252 (%)
Timely introduction of complementary food				
Met	282 (72.3)	44 (80.0)	60 (72.3)	178 (70.6)
Not met	108 (27.7)	11 (20.0)	23 (27.7)	74 (29.3)
Minimum dietary diversity				
Met	69(17.7)	2(3.6)	3(3.6)	64(25.3)
Not met	321(82.3)	53 (96.4)	80 (96.4)	188 (74.6)
Minimum meal frequency				
Met	183(46.9)	32(58.2)	26(31.3)	125(49.6)
Not met	207(53.1)	23(41.8)	57(68.7)	127(50.4)
Minimum acceptable diet				
Met	58(14.9)	2 (3.6)	3 (3.6)	53 (21.0)
Not met	332(85.1)	53 (96.4)	80 (96.4)	199 (79.0)
Complementary feeding				
Appropriate	39(10.0)	1(1.8)	3(3.6)	35(13.9)
Inappropriate	351(90.0)	54 (98.2)	83(96.4)	217(86.1)

Table 4
Determinants of appropriate complementary feeding practices (ACFP) among mothers of children 6-23 months in Iseyin, Nigeria.

Variables	ACFP Yes	ACFP No	Crude OR (95%CI)	Adjusted OR (95% CI)
Age of the children (months)				
6-8	1	54	1	1
9-11	3	80	2.03 (0.21-19.98)	2.20 (0.21-23.07)
12-23	35	217	8.71 (1.17-65.00)*	8.32 (1.05-66.31)*
Highest Educational level of the mother				
No formal education	2	18	1	1
Primary	5	61	0.74 (0.13-4.13)	0.80(0.12-5.28)
Secondary	24	251	0.86 (0.19-3.93)	.80 (0.15-4.28)
Tertiary	8	21	3.43 (0.64-18.26)	2.21 (0.35-13.88)
Mother's income (naira)				
<10,000 (<US$28)	8	177	1	1
10,000-20,000 (US$28-56)	25	157	3.54 (1.55-8.08)	2.89 (1.22-6.87)*
>20,000 (>US$56)	6	16	7.95 (2.29-27.54)	7.78 (1.86-32.58)**
Child's birth order				
1-3	37	275	5.11 (1.21-21.70)	4.53 (1.02-20.14)*
4-6	2	76	1	1
Sex of the child				
Male	17	204	1	1
Female	22	147	1.80 (0.92-3.50)	1.63 (0.79-3.63)
Living with spouse				
Yes	19	332	0.39 (0.14-1.11)	0.44 (0.13-1.54)
No	5	34	1	1

* P-value ≤ 0.05
** p-value ≤ 0.01 ACFP – Appropriate Complementary Feeding Practice

Determinants of complementary feeding practices

The determinants of appropriate complementary feeding practices are shown in Table 4. Bivariate analyses show that only age of children was significantly associated with appropriate complementary feeding practice. Children aged 12-23 months were about nine times more likely to have appropriate complementary feeding than those aged 6-8 months (COR-8.71; 1.17-65.00).

In the multivariate logistic regression analysis, age of index children, mother's income and child's birth order were significantly associated with appropriate complementary feeding practice. Children aged 12-23 months were more likely to have appropriate complementary feeding compared to those aged 6-8 months (AOR-8.32, 1.05-66.31). Also, mothers who earned more than 20,000 naira (<US$56) monthly were about eight times (AOR-7.78, 1.86-32.58), and those who earned 10,000-20,000 naira (US$28-56) monthly were about three times (AOR-2.89, 1.22-6.87) more likely to practice appropriate complementary feeding practice compared to those that earned less than 10,000 naira (US$28))monthly. In addition, the odd of appropriate complementary feeding practices was about five times higher among children in 1-3 birth order compared to those in 4-6 birth order (AOR-4.53, 1.02-20.14).

Discussion

The overall prevalence of appropriate complementary feeding practices in this study was 10.0% and decline with younger age groups. The value is the same as the Nigeria national level reported in NDHS 2013 ([20] NPC/ICF 2014), although only three indicators were used in computing national average. In addition, the national survey of 2014 that uses only three of the indicators showed a similar decline in appropriate complementary feeding with age (NPC/ICF 2014). This result is a clear indication of lack of improvement in the overall complementary feeding practices. It is also an indication that about 90 percent of children aged 6-23 months were not appropriately fed and therefore missed the benefits of appropriate complementary feeding. The prevalence of appropriate complementary feeding practices in this study is low compared to findings from other African countries including 13.8% in Northern Ghana [29], 56.5% in North East Ethiopia [16] and 62.8% in Northern Ethiopia [30] but higher than 9.5% reported in Southern Ethiopia [12].

In this study, timely initiation of complementary feeding was 72.3% and prevalence increase with decreasing age, thereby suggesting an improvement overtime. Minimum dietary diversity is 17.7% and is lower among children 6-8 and 9-11 months than children aged 12-23 months, thus reflecting worsening dietary diversity among younger children. Minimum meal frequency was 46.9%, minimum acceptable diet was 14.9% and continued breastfeeding at age 20-23 months was 48.3%. The major determinants of appropriate complementary feeding practices in the study population were child's age, child's birth order and mother's income. Both minimum dietary diversity and minimum meal frequency in this study are lower than national average of 19% and 58%, respectively (NPC/ICF 2014). The variation in the context of the studies may be responsible for this variation, however, this result remains unacceptable considering the fact that the study was conducted in southern Nigeria where educational level and access to health information and services are considered to be better in comparison to northern Nigeria.

This result shows an improvement in timely introduction of complementary foods and minimum meal frequency while minimum dietary diversity and minimum acceptable diets are declining with increasing age. Timely introduction of complementary feeding (72.3%) in this study is similar to 73.5% reported in Southern Ethiopia [12] and higher than 69.5% and 25.0% reported in Ekiti and Cross river states, Nigeria, respectively [26,31]. This improvement in point incidence and across the age groups may be attributed to myriads of interventions at health facility and community levels to promote appropriate infant and young child feeding practices [23]. This is also a reflection of hope on the improvement of infant and young child feeding practices if the current efforts could be sustained or scaled up. In addition, it suggests that sustained intervention and fidelity in the implementation of infant and young child feeding programmes could contribute to the lofty goals reducing stunting in children to 10% and wasting to 5% as envisioned in Africa Union's Agenda 2063.

For a child to attain minimum dietary diversity, he or she must consume at least four out of the seven food group daily [34]. Dietary diversity appears to be a major challenge of complementary feeding in many Africa countries. Studies across Africa have shown low minimum dietary diversity such as 16% in Nigeria [22,25], 16.5-18.8% in Southern Ethiopia [12], and 35.6% in Ghana [29]. The decreasing prevalence of minimum dietary diversity with decreasing age agrees with the trend reported in a national report (NPC/ICF 2014). This result could be linked to the cultural practices of initiating complementary feeding with a thin cereal gruel [27], which often is energy dense but nutrient poor and gradual introduction of diverse family foods afterwards. It is particularly interesting that home-made meals constituted the major complementary foods in the study setting. This indicates the need to focus interventions on improving dietary diversity around the transition period from exclusive breastfeeding to initiation of complementary feeding. Some food groups are particularly underrepresented in the complementary food of this study population such as eggs, dairy foods and other fruits and vegetables. The poor use of egg and dairy foods could be cost related as protein rich foods are relatively expensive in Nigeria. Further, some traditional beliefs discourage consumption of eggs among infants as it is believed that such predisposes to kleptomania [21]. In addition, high cost of animal foods like eggs contribute to low use as infants' foods [8]. Low intake of fruits and vegetables, and meat explains higher burden of micronutrients deficiencies especially of iron and zinc among under five children in Nigeria [10,14]. Low intake of dairy products is an indication for limited intake of calcium. The poor dietary diversity shows the need to explore the dietary structure of common complementary foods to identify dietary and nutrients gaps that must be addressed to improve diet quality. Further, it calls for concerted efforts by governments, development partners and food industries, particularly the baby foods manufacturers, to promote quality of traditional complementary foods. Conversely, continuation of breastfeeding up to age 20-23 months was only in 48.3% of the cases and this is higher than the national coverage of 27.8% (NPC/ICF, 2019). Furthermore, this result indicates the need to have a holistic re-engineering of the national food system to address the food culture, and increase production, affordability and use of nutritious foods in promoting nutritional quality of complementary foods. This would also contribute to achieving the Africa Union's Agenda 2063 to

reduce stunting and wasting to 10% and 5%, respectively. A report has shown that breastfeeding until 2 years or beyond have beneficial effect for both mother and child such as reduced mortality and morbidity, improved social adjustment for the child and reduced incidence of breast cancer in the mother [3].

Adequacy in the quantity and quality of foods is important to promote adequate growth and development. The minimum meal frequency is recommended to ensure adequacy of energy and nutrient intakes. However, only 46.9% met the minimum meal frequency, this is lower than 58.0% in the national report (NPC/ICF 2014) and suggests that considering the stomach capacity of these children, the number of feeding occasions was not enough to supply adequate energy and nutrients intake to meet physiological requirements. Minimum meal frequency in this study was lower than reported 67.3-94.5% in Southern Ethiopia [12] and 57.3% in Ghana [29]. The prevalence of children aged 6-8 months who attained MMF was higher compared to a study by Olatona et al. [25] which reported only 2%. The overall prevalence of MMF was lower than the report of Ogbo et al. [22] which reported 56% and the report on North west Ethiopia [17] which reported 63%.

Minimum acceptable diet is a composite indicator of minimum dietary diversity and minimum meal frequency. This study reflects that about 85% of the children do not meet minimum acceptable diet largely due to poor dietary diversity, and are, therefore, susceptible to malnutrition. The minimum acceptable diet in this study corroborates with the national coverage report and studies across Nigeria [15,19,25,28]. The minimum acceptable diet is also similar to the 14.9-16.3% reported in Southern Ethiopia [12] and considerably lower than reported practice level of about 25% in Ghana [29].

In the present study, child's age, birth order and mothers' income are the key determinants of appropriate complementary feeding practice. Children aged 12-23 months were 8.7 times likely to have appropriate complementary feeding than those aged 6-8 months. Studies in Ethiopia [12,15], Ghana [29], Zambia [9] and Tanzania [32] have reported similar findings. This finding can be attributed to integration of family meals in the foods of the older children as compared to high reliance on gruel for the younger children. Thus, the dietary diversity of the household is more easily reflected in the dietary intake of older children than younger children, thus, contributing to the meeting of the minimum dietary diversity. Also, the older children are more likely to have an increased number of feeding occasions, thereby, enhancing the likelihood of meeting the minimum meal frequency and ultimately the minimum adequate diet. The birth order is another key determinant of appropriate complementary feeding in the present study. Children in 1-3 birth order are 4.5 times more likely to enjoy appropriate complementary feeding practices than children in 4-6 birth order. This appears to be a new finding; however, earlier studies have shown that birth order is significantly associated with timing of complementary feeding in Nigeria [24] and minimum dietary diversity in Nepal [13]. A possible explanation of this finding is the better care practices that are often available with small family size. Income is also found to be significantly associated with appropriate complementary feeding practice. This finding is consistent with the report of an earlier study in Cross River State, Nigeria where income influenced the complementary feeding practices of mothers [31]. This finding is, however, at variance with the report from Ghana where income displayed no significant association with feeding practices [12]. Low income may predispose to low feeding frequency, poor dietary diversity and lower quantity of meal served which would ultimately affect the complementary feeding practices.

Conclusion

Appropriate complementary feeding practices remain very low among the study population. Although timely introduction of complementary foods has increased across the age groups overtime, minimum dietary diversity and minimum adequate diet among children aged 6-23 months have declined. These indices partly explain the high burden of malnutrition and consequently high burden of morbidity and mortality among infants and young children in Nigeria. The key determinants of appropriate complementary feeding are child's age, birth order and mother's income. These determinants showcase the need to intensify efforts at promoting optimal infant and young child feeding and, strengthen programmes targeted at women empowerment.

Ethical consideration

The study was approved by the Uiversity of Ibadan/University College Hospital, Ibadan Ethics Committee (UI/EC/18/0611) and written informed consent was obtained from the study participants.

Authors' contributions

A.O., A.O.R. and O.T.J. designed the research study, H.O., S. B., and A.O.R. provided the resources, A.O., A.O.R., O.T.J. and S.B. performed the research, A.O.R, A.O. and O.T.J. prepared the draft manuscript, H.O. and S.B. conducted writing-review and edit. All authors have read and approved the final manuscript.

Declaration of Competing Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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