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Infant and young child feeding practices (IYCF): Its impact on nutritional status of infants 6-23 months in Akpabuyo, cross river state, Nigeria

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Abstract
Effective infant feeding practices remains a major child survival strategy. During the period of infancy and early childhood, good and optimal nutrition is essential to improve child survival and promote optimal health as infant and young child feeding practices directly affects infants' nutritional status and ultimately, impacts child survival. Hence, this study aimed at accessing Infant and Young Child Feeding (IYCF) practices of mothers and its impact on the nutritional status of children aged 6-23 months in a rural Nigerian community. A cross sectional survey involving 440 mother-infant pairs was conducted using a simple random sampling technique. Information on infant feeding practices, mothers' knowledge and attitude towards the WHO infant feeding guidelines, food intake and anthropometric characteristics of infants were obtained using a focused group discussion, semi-structured questionnaire and 24-hour dietary recall. Infant feeding indicators and anthropometric indices were estimated using the 2008 WHO recommendation and Anthro software, respectively. Data analysis was carried out with descriptive statistics (frequencies and percentage and results expressed as mean ± SD at significant levels of $p<0.05$. Mothers to a large extent still hold unto some traditional IYCF practices, therefore, compliance to the WHO recommendation on IYCF were low. About 51.60% of mothers-initiated breast feeding 1hour at birth, 23.00% fed breast milk exclusively for 6 months, 24.70% introduced complementary feeding at 6 months, 12.21% practiced continued breast feeding, minimum and high dietary diversity were 42.00% and 8.00% respectively. Using MUAC, the prevalence of mild malnutrition was observed in 41.10% and 31.40% while moderate malnutrition was observed in 14.72% and 7.94% of breastfed infants receiving complementary food and non-breast-fed infants receiving complementary food respectively. It can be concluded from the study that the nutritional status of children in Akpabuyo local Government Area is less than optimal, owing to ignorance on the path of the parents and inadequate food intake. This calls for an intervention.

Keywords: Infant, young child, feeding practices, nutritional status, mothers

Introduction

The first 2 years of a child's life are particularly important, as optimal nutrition during this period lowers morbidity and mortality, reduces the risk of chronic disease, and allows for better development overall [1]. To improve child survival and promote healthy growth and development, infant and young child feeding must be saved and adequate as under nutrition is estimated to be associated with 45% of all child deaths yearly [2, 1]. The prevalence of stunting is still on the increase globally and currently, an estimated149 million children fewer than five are stunted, 45 million wasted and 38.9 million overweight or obese. This has been on the increase over time [1]. Statistics from various national surveys showed that the prevalence of stunting among infants 6-59 months old has remained the largest burden of malnutrition. Since 2013, stunting rates in Nigeria has been above 30% with many states in the North West and North East of Nigeria recording over 40% prevalence above the WHO critical levels [3, 4, 5]. The national prevalence of stunting is similar to that of Sub-Saharan Africa (37%) and over time, has remained a nutritional problem in the country with serious and irreversible consequences. Underweight prevalence (19.9%) among children below five has been at the margin of the WHO 20% threshold for serious situation. Though higher than the global estimate of 15%, it has remained consistent with the rates in the West and Central Africa region (22%) since 2013 (National Population Commission-Nigeria [3, 4]. Nutrition for all humans and other mammals begins from the time of parturition with breastfeeding [6, 7, 8].

Optimal breastfeeding is so critical that it could save over 820 000 children under the age of 5 from death yearly. Current WHO report showed many infants and children do not receive optimal feeding, only about 44% of infants aged 0-6 months globally receive breast milk alone for 6 months over the period of 2015-2020 [1]. Complementary feeding period (6-24 months) is an important phase of the first 1000 days of human life. This critical window period requires adequate feeding for laying a sound, healthy foundation for optimal growth and development of a child [9]. If complementary feeding is not introduced timely, or is given inappropriately, an infant's growth may falter [1]. Inadequate nutrition during infancy has both immediate and long-term effects on the health and development of infants and young children. Its immediate effect can lead to serious functional complications as mortality and impaired/delay physical (irreversible stunting), cognitive development and increased obstetric risk [10, 11] while the long term effects include impaired intellectual performance, work and reproductive capacities [12, 13] and increased risk of degenerative diseases later in life [14]

To address this issue, the WHO currently set out the recommendation that infants should receive breast milk within 1 hour of birth, exclusively for the first two days after birth and under six months and subsequently, receive safe, appropriate, adequate complementary food and breast milk until 2 years and beyond [15]. Initiation of breast feeding immediately at birth followed by appropriate introduction of complementary feeding is a key determinant influencing healthy growth and development of infants [16]. In a scoring of 74 countries on infant and toddler feeding, it was found that complementary feeding was the area that needed improvement most and many countries scored "poor" on it [22]. With the high surge of malnutrition in previous studies carried out, it is pertinent to access the nutritional status of communities with observably high population of infants. To this end, this research was embarked on, to determine infant and young child feeding practices (breastfeeding/complementary feeding) of mothers and the nutritional status of children 6-24 months of age in Akpabuyo Local Government Area Cross River State.

Methods

Study design and setting

A community-based, cross-sectional baseline study was carried out in fifteen [15] communities in Akpabuyo LGA, Cross River State; namely Okoroba, Idebe, IkotAsikpo, Abisa, Abakot, IkotAdiaha, IkotEdemIta, IkotAnasua, Okon Idem, EsukEkpoEyo, IkotUmo, Atimbo, Idundun, Ebietokon and Anyaganse. Adopting a multistage random sampling procedure. A total of five (5) wards and three (3) communities were covered in each ward.

Participants and sampling

Four hundred and forty mothers-infant pairs resident in Akpabuyo LGAs were estimated for the study using the sample size calculations in medical studies [17]. They were recruited using multistage sampling technique. Using this method, five (Nakanda, Eneyo South, EyoEdem, Atimbo East and Idundun) out of the ten [10] wards in Akpabuyo LGAs were randomly selected in stage one. In the second stage, three communities were randomly selected from each of the five wards making up a total of 15 communities. Villages in Akpabuyo are divided into communities with each having several households depending on the population density of the area. List of all households with at least one child 0-59 months old who received polio vaccines within the last one year from the Primary Health Care unit were systematically selected and the estimated sample size 440 eligible mother-child pair was allocated to the fifteen communities proportionally to the number of households in each community with infants 0-59 months old.

Instrument

Focus Group Discussion, Semi structured questionnaire, anthropometric measurements and 24 hour food recall were used as instrument for data collection. The questionnaire comprises of three sections and sub sections; Socio-economic and demographic characteristics, infant feeding practices (breast feeding, complementary feeding practices) used to measure mothers feeding practices, knowledge on the WHO/UNICEF feeding guidelines, beliefs and attitudes towards the recommended infant feeding practices, anthropometric measurements, physical /clinical, health status. The questionnaire was content validated by lecturers in the Department of Biochemistry (Human Nutrition and Dietetics Unit) and pre-tested by administering to twenty [20] respondents with similar characteristics in the communities who were not part of the target population for the study. Mothers provided all the information needed in the questionnaires.

Instrument Administration

Twelve (12) community health workers who were indigence of the study area were recruited and trained as research assistants for data collection exercise after three (3) days discussion of objectives of the study, methods for data collection, use of anthropometric equipment's, measuring techniques, identification of clinical signs for different nutritional deficiencies, 24 hours dietary recall and how to administer and interpret the questions in the questionnaire (where necessary). Objectivity and confidentiality on information gathered were emphasized and all interviews were conducted in Efik and English languages, since this is the language widely spoken in the study area. Data collection was between 8.00am-12.00 pm and 2 pm-6 pm daily for one hundred and twenty days (120) days excluding Sunday.

Data collection

All survey schedules were pre-tested before being used in the field. Information on household socio-economic and sociodemographic characteristics, such as community, religion, education, occupation and income, were collected. IYCF practices such as initiation of breast-feeding, reported EBF, age at initiating complementary feeding, Pre-lactal and colostrum feeding, continued breast feeding, minimum dietary diversity, and minimum meal frequency were also collected from mothers of children aged 6-23 months. Anthropometric measurements of the children were collected. Length/height (up to nearest 1 mm) was measured with an infantometer/anthropometer rod [19]. Supine measurement was used for infants less than eighteen months old while larger children were measured in standing position using an accuracy of one tenth of millimeter [19, 20, 18].

Weight was measured to nearest 100 g with a SECA weighing scale (SECA Deutschland, Hamburg, Germany [20]. Very irritable and small infants were weighed while hugging their mothers, then the mothers alone. The scale automatically calculated the weight of the child by difference. Calibration of the scale was done each day before starting work, to ensure the accuracy of the scale.

Mid upper arm circumference (MUAC) was measured using the WHO recommended MUAC tape according to standard anthropometric procedures. The values were recorded at where the "0" cm meet the tape and precision was recorded taken to 1 mm MUAC and recorded as the child's mid upper arm circumference [19, 20, 18].

Age of the infants was obtained through the birth certificate issued to their mothers at the hospitals/health centers where they were delivered. Mothers supplied information, using local calendars and events for children delivered at home.

The food intake data of the infants and young children were collected by individual 24hours food recall. The interviews included detailed description of foods consumed, processing methods, and local names. Amount of foods consumed by the infants were estimated by the respondent, expressed in terms of cups, plates, spoons and other utensils at home. Visual aids of fresh and cooked foods and different sizes of solid materials and pictures from food models were used to help respondents judge portion sizes of meat, fish, fruits and quantifying other food intake [23]. For mixed recipes, respondents were asked to describe the method of food preparation and the quantity of visible components (e.g. pieces of meat, fish, vegetables, etc.) eaten by the child. A medical officer of health (community health doctor) examined the infants and young children for clinical signs of malnutrition. The hair, mucosa, nails, finger tips, eye lid, abdomen and skin condition of the children were examined for signs of malnutrition due to poor nutrition and Helminthes infections.

Method of Data Analysis

Data collected on demographic characteristics were analyzed descriptively using frequencies, percentages, mean, and standard deviation. Chi-square test of association was used to determine the association between infant feeding practices and their nutritional status. The nutritional status of the children was assessed using weight-for-height, height-for-age, and weight-for-age *Z*-scores to define wasting, stunting, and underweight. Age and sex specificity of the questions were taken into consideration in the scoring. Reference values and cutoffs points described by [23, 24, 25, 26] were used to classify children into levels of nutritional status and Taking <-2SD as cut-off points for underweight, stunting and wasting and >2SD as cut-off points for overweight and obese (18). Children who were below 2SD from the reference median (median<−2SD) on the basis of weight-for-age, height-for-age and weight-for-height indices were classified as underweight, stunted and wasted, respectively; while children who were below 3SD from the reference median (median<−3SD) were classified as severely underweight, severely stunted and severely wasted, respectively. For the analysis using anthropometric data, only records with complete information on age, gender, weight, and height were included in the analysis.

DDS were calculated for each child using a set of 7 food groups [27] Grains, legumes and pulses, flesh foods, dairy and dairy products, eggs, vitamin A-rich fruits and vegetables, other fruit and vegetables. DDS is based on the number of food groups from which food is consumed daily. Low DDS = food is consumed from ≤ 3 food groups, medium = food is consumed from 4-5 food groups and high = food is consumed from > 5 food groups

Daily nutrient intake was calculated using the West African Food Composition Table [28] and the RNI estimated based on the [29, 30] recommended nutrient intake values for infants and young children 0-36 months. The weighed record (WR) comprised 24-hour dietary recall form with printed instructions.

Estimated breast milk consumed was compared with estimation based on Medical Research Council data. A feed of at least 10 minutes duration, was estimated to be approximately 135 g for infants aged 6-7 months and 100 g for those aged 8-12 months. Where feeding duration was less than 10 minutes, consumption was estimated proportionally [31, 32, 33]. Quantity of milk consumed daily was compared with that described by [34, 35, 36]. Infant 6-24 months should suckle at least 486-896 mls of breast milk daily or 600-1000 mls daily, quantity decreasing with increased age.

The nutritional status of children was assessed according to SD classification [37, 38] using the WHO Child Growth Standards [18, 38]. Children who were below 2 SD from the reference median (median<−2 SD) on the basis of weight-for-age, height-for-age and weight-for-height indices were classified as underweight, stunted and wasted, respectively; while children who were below 3 SD from the reference median (median<−3 SD) were classified as severely underweight, severely stunted and severely wasted, respectively

Statistical analysis

Descriptive statistics (frequencies and percentage) was used to analyze the data collected from questionnaire. All filled questionnaires were cross checked by field supervisors and the principal investigators. The Statistical Package for Social Scientists (SPSS) version 20.0 for WINDOWS (SPSS Inc, Chicago, IL) was used to convert raw anthropometric data (weight, height and MUAC of the children). Survey frequency was used to calculate socio-demographic characteristics of the study population. Numeric (DDS) and categorical variables (gender) were presented as mean ± SD and as percentage (%) at a significance level $p<0.05$. The anthropometric measurements (weight, height) and age was analyze using Anthro 2005 software (18), to indicate height-for-age (stunting), weight-for-age (underweight), and weight-for height (wasting). Z-scores below-2SD and-3SD was classified as, moderate and severe cases.

Results

Table 1: Gender, age of children, marital status and age of mothers in ALGA

Variables	Frequency	Percentage (%)
Gender of child		
Male	238	54.09
Female	202	45.90
Total	440	100
Age of child (months)		
6-8	83	18.86
9-11	44	10.00
12-24	313	71.13
Total	440	100
Age of mother(years)		
<20	47	10.68
20-45	385	87.50
≥45	8	1.81
Total	440	100
Mothers marital status		
Married	371	84.31
Single	53	12.04
Separated	9	2.04
Divorced/widowed	7	1.59
Total	440	100

Table 2: Socio economic and demographic information of mothers/fathers in ALGA

Variable	Frequency	Percentage
Mothers educational level		
No formal/primary education	180	41.11
Secondary education	251	57.04
Tertiary education	8	1.61
Adult literacy classes	1	0.22
Total	440	100
Fathers educational level		
No formal/primary education	150	34.09
Secondary	251	57.04
Tertiary	38	8.63
Adult literacy	1	0.22
Total	440	100
Mothers occupation		
Farming/trading	240	54.54
Self employed/housewives/student	171	38.86
Civil servant	30	6.81
Total	440	100
Fathers occupation		
Farming/trading	190	43.18
Civil servant	89	20.22
Artisan	69	15.68
Transporter	56	12.72
Others	36	8.18
Total	440	100
Mothers income		
Dependant	129	29.31
<50,000	282	64.09
50,000-100,000	27	6.13
>50,000	2	0.45
Total	440	100
Fathers income		
<50,000	263	59.77
50,000-100,000	165	37.50
>50,000	12	2.72
Total	440	100
House hold size		
3	113	25.66
4	115	26.13
5	70	15.90
>5	142	32.27
Total	440	100

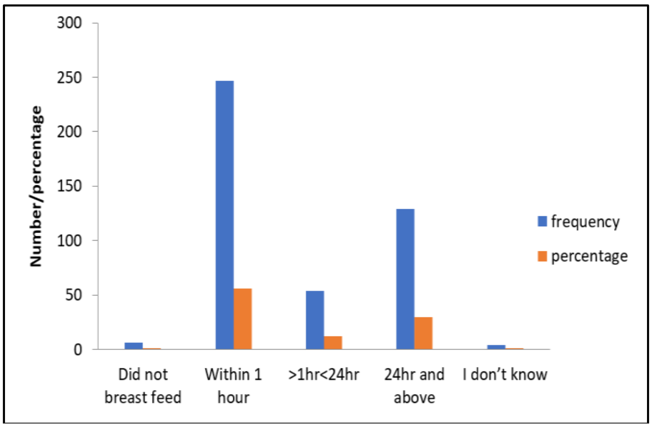

Fig 1: Breast feeding and early initiation of breast feeding by mothers in ALGA

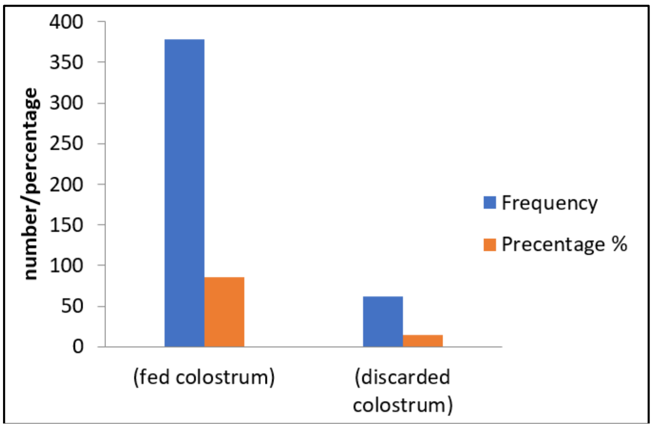

Fig 2a: Proportion of infants fed colostrum by mothers in ALGA

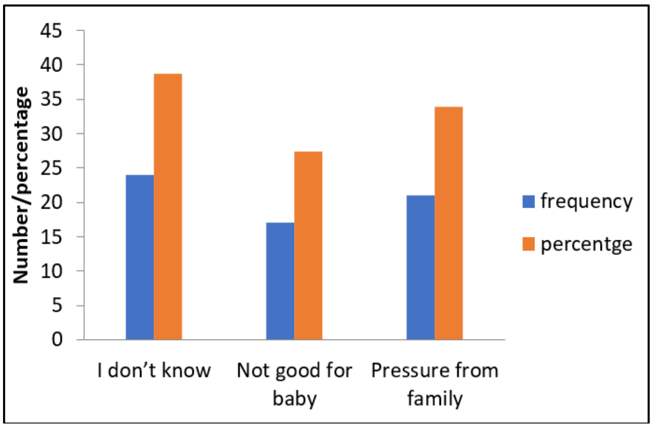

Fig 2b: Reasons for discarding colostrum by mothers in ALGA

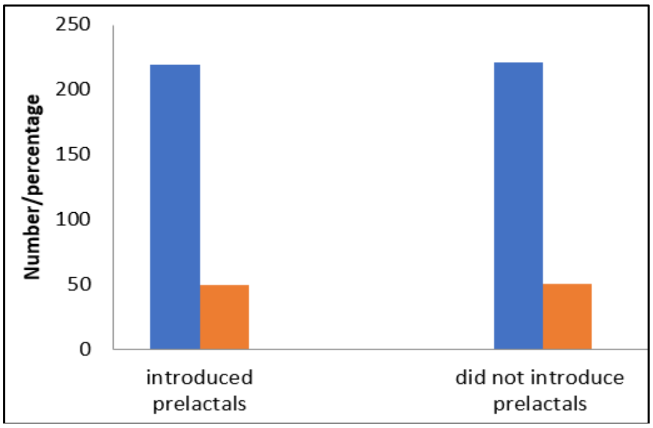

Fig 3a: Introduction of prelactals by mothers in ALGA

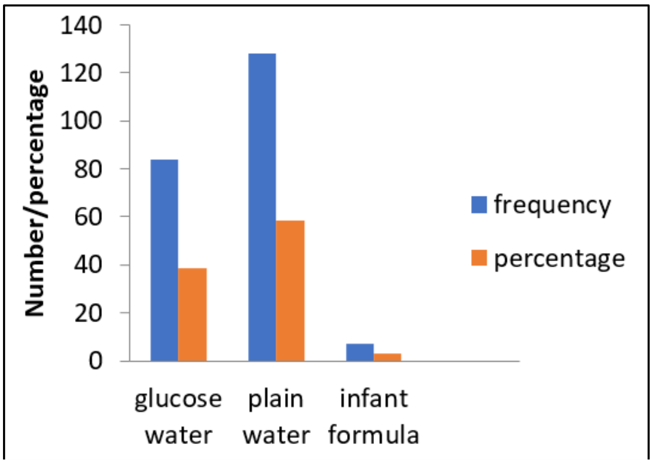

Fig 3b: Types of prelactals introduced by mothers in ALGA

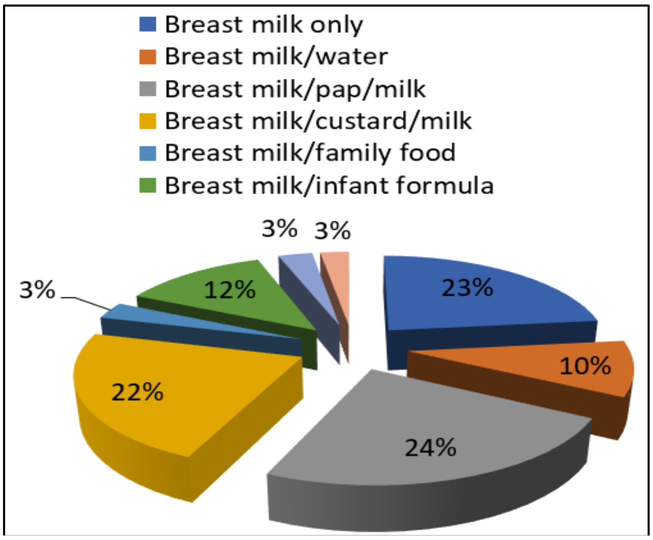

Fig 4: Reported breast feeding pattern of mothers in ALGA

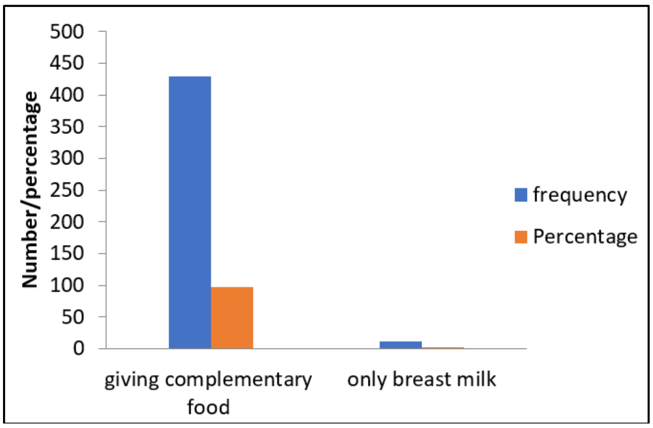

Fig 5a: Introduction of complementary feeding by mothers in ALGA

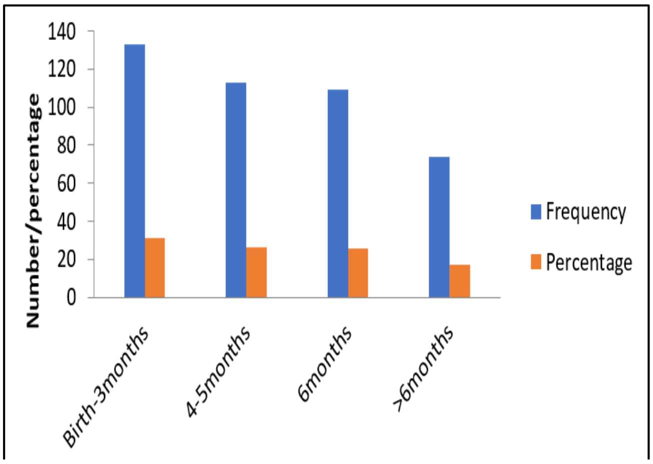

Fig 5b: Age of introducing complementary food by mothers in ALGA

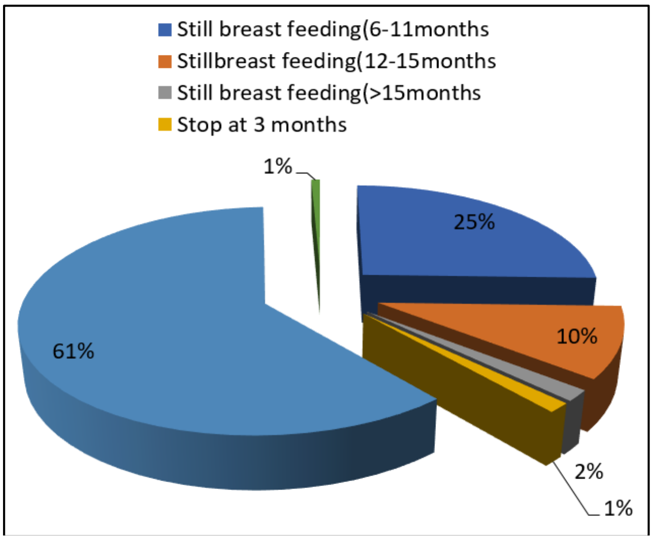

Fig 6: Continued breast feeding by mothers in ALGA

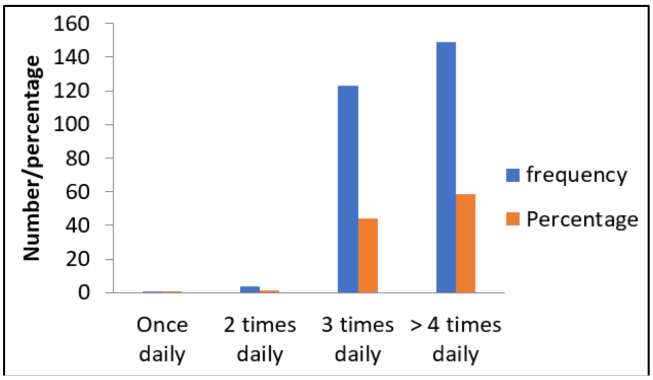

Fig 7a: Frequency of complementary feeding for non-breast fed infants

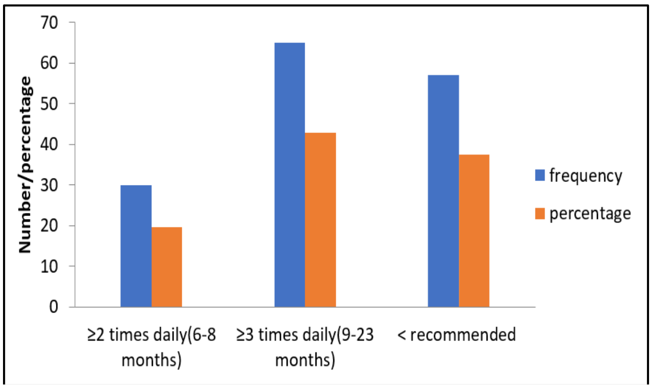

Fig 7b: Frequency of complementary feeding for breast fed infants

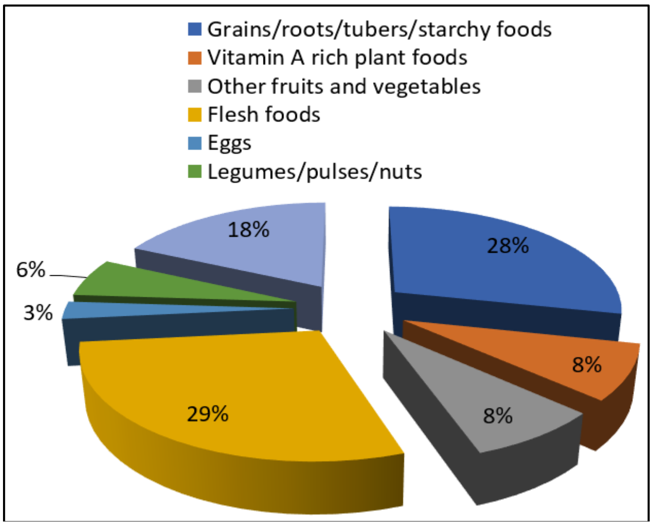

Fig 8: Distribution of infants by food groups based on 24 hour food recall

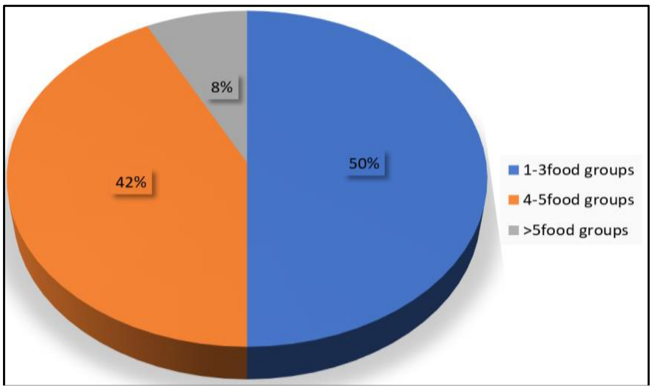

Fig 9: Dietary diversity score of infants and young children in ALGA

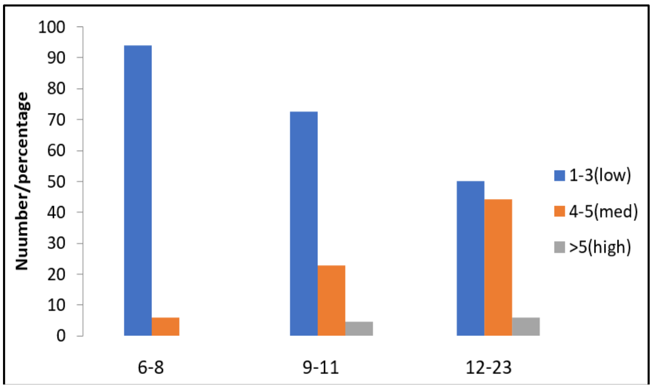

Fig 10: Dietary diversity score within age groups

Table 3: Age and anthropometric indices of infant and young children in ALGA

Age/indices	Frequency	Percentage%
Age in months		
6-8	83	18.86
9-11	44	10.00
12-23	313	71.13
Total	440	100
Indices		
Underweight		
Normal weight	388	88.18
Moderate underweight	37	8.40
Severe underweight	8	1.81
Overweight	5	1.13
Obese	2	0.45
Stunting		
Normal height	148	33.63
Moderate stunting	164	37.27
Severe stunting	128	29.09
Wasting		
Normal weight	371	84.31
Moderate wasting	7	1.59
Overweight/obese	62	14.09
MUAC		
Normal health	232	52.72
Mild-moderate malnutrition	200	45.55
Severe malnutrition	8	1.81
Total	440	400

ALGA= Akpabuyo Local Government Area

Table 4: Anthropometric indices of infants by age groups (in months) in ALGA

Indices	6-8 months	9-11 months	12-24 months
Underweight	F %	F %	F %
Normal weight	69(83.13%)	36(81.81%)	283(90.41%)
Moderate underweight	11(13.25%)	4(9.09%)	22(7.02%)
Severe underweight	2(2.40%)	1(2.27%)	5(1.59%)
Overweight	-	2(4.54%)	3(0.95%)
Obese	1(1.20%)	1(2.27%)	-
Total	83	44	313
Chi-square value =	15.4	Df=8	P=0.056
Stunting			
Normal height	27(32.53%)	21(47.72%)	100(31.94%)
Moderate stunting	28(33.73%)	14(31.81%)	122(38.97%)
Severe stunting	28(33.73%)	9(20.45%)	91(29.07%)
Total	83	44	313
Chi square value =	5.51	Df=4	P=0.24
Wasting			
Normal	71(85.54%)	36(81.81%)	264(84.34%)
Moderate wasting	1(1.20%)	-	6(1.91%)
Overweight	5(6.02%)	3(6.81%)	30(9.60%)
Obese	6(7.22%)	5(11.36%)	13(4.15%)
Total	83	44	313
Chi square	6.45	Df=6	P=0.38
MUAC			
Normal	34(40.96%)	22(50.00%)	176(56.23%)
Mild-moderate malnutrition	47(56.62%)	21(47.72%)	132(42.17%)
Severe malnutrition	2(2.40%)	1(2.27%)	5(1.59%)
Total	83	44	313
Chi square value=	9.72	Df=6	P=0.14

F = frequency, % = percentage, MUAC= mid upperarm circumference

Table 5: Clinical signs of malnutrition in infants 6-23 months in ALGA

Clinical signs	Frequency	Percentage (%) $
Oedema	4	0.90
Pallor	202	45.90
Rashes	198	45.00
Hair dyspigmentation	34	7.72
Rickets	41	9.31
Scabies	6	1.36
Flaky skin desquamation	4	0.90
Bleeding gum	3	0.68
Distended abdomen	92	20.90

$= Percent more that 100% due to multiple responses

Table 6: Relationship between feeding practices and anthropometric indices of IYC in ALGA

Indices	Complementary food and breast milk	Complementary food only	Total
Underweight	F %	F %	
Normal weight	142(87.11%)	246(88.80%)	388
Moderate underweight	14(8.57%)	23(8.30%)	37
Severe underweight	3(1.84%)	5(1.80%)	8
Overweight	2(1.22%)	3(1.10%)	5
Obese	2(1.22%)	-	2
Chi square value =	3.461	Df =4	P =0.848
Stunting			
Normal height	53(32.51%)	95(34.29%)	148
Moderate stunting	63(38.65%)	101(36.46%)	164
Severe stunting	47(28.83%)	81(29.24%)	128
Chi square value =	0.234	Df =2	P =0.889
Wasting			
Normal	138(84.66%)	233(84.11%)	371
Moderate wasting	3(1.84%)	4(1.44%)	7
Overweight	11(6.74%)	27(9.74%)	38
Obese	11(6.74%)	13(4.69%)	24
Chi square value =	1.968	Df =3	P =0.573
MUAC			
Normal health	69(42.33%)	163(58.84%)	232
Mild malnutrition	67(41.10%)	87(31.40%)	154
Moderate malnutrition	24(14.72%)	22(7.94%)	46
Severe malnutrition	3(1.84%)	5(1.80%)	8
Total	163	277	440
Chi square value =	12.57	Df =3	P =0.006*

F = frequency, % = percentage. Significant differences (p<0.05) were observed in MUAC (Mid upper arm circumference)

Discussion

The subjects involved in this study were mothers and infants 6-23 months of age. A total of 440 mother/child pair of varying ages was used. Majority of the mothers (87.5%) were within the active child bearing age (20-45) and a few were within the peak age of child bearing (>45). About 10% of the nursing mothers were less than 20 years (teenage) while 12% were single mothers. Teenage pregnancy rate (10%) in the study area is similar with the World Health Organization standard that teenage pregnancies should not exceed 10% of the total pregnancies [39]. Observations from previous studies have shown that in the USA most teenage mothers were inexperienced, lack of parenting readiness and had insufficient knowledge of adequate breast feeding and its benefits. Thus, lack skills to incorporate breastfeeding into their lifestyle and prevent or manage problems associated with breast feeding. This usually is the reason for early discontinuation of breastfeeding in this age group [42, 40, 41, 43, 44].

Most of the respondents had incomplete education (primary/secondary) which could be the reason for their (women) increased engagement in farming activities and petty trading. Women with low status usually have little or no control over house hold resources, less access to information and health services resulting in their low self-esteem due to low income or no income at all [45]. This to a greater extent will affect the nutritional status of the women, birth weight and development of the infants and the quality of care their infants will receive.

The present study observed sub optimum IYCF practices among infants 0-23-month-old. Most mothers are aware of adequate infant feeding but still hold unto certain beliefs and practices in relation to adequate breast feeding. They prefer what is suitable, acceptable and affordable resulting in their low compliance to the WHO recommendations on breast feeding of infants and young children. Nearly all the assessed infants 0-23 months old were breastfed (97.5%) but the other indicators of IYCF were inadequate and sub-optimal. About half of the respondents (56.1%) initiated breast feeding one hour at birth, this show that the other half must have introduced plain water or other liquids as glucose water and milk substitutes initially to the infants before commencing breast feeding irrespective of the nutrient and protective benefits of colostrum to the infants. This percentage is above the [4] and [5] national averages of 32.8% and 19.2%, respectively. The common use of glucose or plain water as pre-lactals could be attributed to their belief that water should be given first to cleanse the babies' stomach and quench thirst. Based on quantitative data from the study, the major reason for delayed initiation of breast feeding is insufficient breast milk at birth. Several studies have shown that pre-lactal feeding delays early initiation of breast feeding, deprives infants of colostrum, proper and complete establishment of lactation, causes poor exclusive breast-feeding practices and is a major reason for early cessation of breast feeding [46].

During the FGD it was observed that mothers exhibited a good knowledge of exclusive breast feeding (EBF). However, it was not practiced by majority of the mothers as less than a quarter of the respondents (23%) reported giving only breast milk to their infants for six months before introducing other foods and liquids. This is consistent with the national [4] and [5] averages of 23.7% and 27.2%, respectively. Major reasons for not feeding breast milk only to their infants prior to reaching 24 weeks (6 months) were insufficient breast milk, their excessive crying (infants), poor nutrient intake by mothers, lack of finances and external support. This showed that their perception on breast milk adequacy in quality and quantity to sustain the infant in the first six month is a constraint to adequate breast feeding. Exclusively breast-fed infants are at a lower risk of diseases like diarrhoea and pneumonia. UNICEF in 2011, highlighted that breast-feeding is a preventive intervention and the most important element in reducing child morbidity and mortality [67]. WHO recommends that infants should receive complementary foods at 6 months of age in addition to breast milk. However, in the present study, different periods of introducing complementary foods were observed. The complementary feeding practices are far from optimal as only 24.7% introduced complementary food at 6 months while 16.8% after six months indicating poor compliance to the WHO recommendation on complementary feeding practices. These practices of early and late introduction of complementary food are not appropriate as it predisposes infants to allergies, digestive problems, inadequate food intake and several opportunistic infections as GIT and Helminthes infections especially in low-income areas where portable water is not available and unhygienic conditions prevail, thus giving rise to onset of malnutrition, a major cause of infant morbidity and mortality in Africa [47, 48].

In the present study, a decline in continued breast feeding for 2 years and beyond was observed. Most of the respondents (61.00%) discontinue breast feeding at 12 months while about 10.00% were still breast feeding between 12-15 months and 1.00% above 15 months. This practice is not in keeping with the UNICEF/WHO recommendation of 2 years. Major reasons were insufficient breast milk, excess work load, poor maternal nutritional status and their perception that after 12 months breast milk was no longer necessary. Many mothers commented that, breast milk is no longer necessary when the child starts eating home food (preferably at first birthday) and breast feeding after 12 months will result in poor maternal health.

The short duration of breast feeding differed with the 18 months duration reported by the 2013 NDHS for rural communities in Nigeria [49, 5] and has been implicated as one of the factors associated with a high prevalence of stunting in children less than five years of age in China [50]. Other studies have diverse reasons for early termination of breast feeding as fatigue, lack of support, excessive work load [51, 52]. Majority of the infants received complementary foods 2 or 3 times daily with only a few giving additional snacks once daily. Appropriate number of feeds depends greatly on the energy density of the family foods and portion sizes consumed at each meal. From the 24 hours dietary recall the proportion of breast-fed infants 6-8 months who receive complementary foods the appropriate number of times daily were below the national average (42.9%) for minimum meal frequency. For the average breast-fed infants, the WHO recommended that infants 6-8 months old should initially be fed 2-3 times daily increasing to 3-4 times for 9-24 months with a healthy snack offered at least once daily to provide nutrients to the infant [53 54]. Some of the respondents however, admitted feeding their breast-fed infants (9-23 months) 3-4 times and non-breast fed infants (6-23 months) 3 times and above daily as seemed appropriate not considering the infants ages. Savory snacks (biscuit) and fresh fruits were the most frequent snacks given by few of the respondents. Similar studies conducted in Nigeria, India and Ghana showed that mothers were not aware of the WHO appropriate age-specific frequency of complementary feeding [55, 56], thus feeding is done based on what is considered appropriate not necessarily according to infant age. Inappropriate feeding frequency can result in under-nutrition when it is below the required number of times as well as overweight and obesity in later life when it is in excess due to over-nutrition [54].

This present study observed that traditional and indigenous grains, starchy roots and tubers were the major food groups fed to the infants. Consumption of milk, legumes/ pulses were low and that of egg was much less. Mothers who fed meat and fish did so in very minimal proportion (< 20 g) with reasons that these foods (meat/fish) were expensive and most times not readily available for the family. Half of the population in this study received food from at least four food groups the previous day but the proportion of infants who received animal source foods and β-carotene rich fruits and vegetables were < 30% on the day of recall. Low dietary diversity was observed more in younger infants 6-8 months old than infants 12-23 months who receive food from at least 4 food groups. Most mothers during the focus group discussion admitted that very minimal proportions of meat/fish were given to the infants during feeding: Observation from this study also revealed that dietary diversity increased with age but food sources were mostly plant based with little animal source foods, fruits and vegetables. The WHO recommended feeding practices suggest that infants between 6-23 months receive food from at least 4 main food groups daily: eggs, meat, fish, milk, fruits, vegetables and grains [57] to ensure adequate diet intake and good health. Plant source foods alone cannot provide the needed nutrient to support healthy growth in infants. Low consumption of animal source foods (ASFs) has also been reported in developing countries, resulting in inadequate dietary intake and poor infant growth [59].

The values obtained for underweight were lower than [4] and [5] national averages (22.8% and 19.9%) respectively while stunting among infants 6-23 months were higher than [4] and [5] national prevalence (43.0%) and (32%) respectively. These values for stunting falls within the WHO critical situation (≥ 40%) for stunting. Malnutrition in infants and young children is among the major nutritional problem in Nigeria which is assumed to start within the period of 6-24 months of age and increases with age [60]. This shows that chronic malnutrition (stunting) in the study area among infants 6-23 months is of public health significance and calls for prompt action. Underweight and wasting in this study were comparable with [4] 13.9% ; 5.5% and [5] 10.4%; 4.0% values for Cross River State, respectively while moderate and severe stunting were higher than both the [4] 20.1% ; 7.0% and [5] 17.8% ; 4.1% values for Cross River State, respectively. Malnutrition in infants and young children even in its mildest form can have adverse short and long term effect on the child's intellectual performance, work and reproductive capacities [12, 13, 54, 61].

High prevalence of stunting observed in 6-23 months and underweight in 6-8 months old could be attributed to the nutrition transition period (introducing other foods) and probably inappropriate infant feeding practices (breast feeding and complementary feeding) [62, 63]. Stunting in infants and young children before the second year of life reflects a continuing process of "failing to grow" or "stunting", while for older children, it reflects a state of "having failed to grow" or "being stunted" [2]. The prevalence of underweight (10.2%) and wasting (1.6%) were lower than stunting which shows that stunting is a major problem of infants and young children in the study area. Several factors including nutrition and infections play a major role in reducing a child's height-for-age [64] as was observed in Malawi, where stunted children had lower plasma levels of all essential amino acids compared to non-stunted children due to inadequate intake of quality protein [65]. Other studies have also reported stunting to be a more prevalent form of malnutrition among infants and young children less than five years of age [49, 66].

From the study no significant differences were observed in the nutritional status (underweight, stunting, wasting) of infants receiving breast milk and complementary food with those receiving only complementary foods. However, the MUAC which is a more sensitive indicator in assessing malnutrition in infants and young children showed significant differences in the two groups recording high incidence of mild to moderate malnutrition among infants receiving breast milk and complementary foods. Reasons could be that foods given to complement breast milk were not adequate in quantity and quality and the breast-feeding technique was poor thus, resulting in infants receiving very little breast milk not sufficient to provide adequate essential nutrients required to ensure optimal health. Although most of the respondents (70%) reported breast feeding their infants on demand and feeding other foods as required, results from this study showed that most of the infants did not receive breast milk after 12 months which may have affected their nutritional status.

Conclusion

The prevalence of under nutrition among infants 6-23 months of age in ALGA was observed to be high and associated with sub optimal infant feeding practices as poor EBF, early introduction of complementary food, illiteracy of the mother and low dietary diversity. Improving mothers' knowledge about IYCF practices and nutritional intervention will help in improving the nutritional status of children.

Declarations

Ethics Approval

Ethical clearance for the study was obtained from the Ethics and Research Committee of Cross River State Ministry of Health (Ref. number RP/REC/2016/445) after submitting the project proposal with the necessary documents required by the Ethical Committee. Local permission was obtained from the Cross River State Ministry for Local Government and Chieftaincy Affairs in addition to the local government authorities. Administrative permit was also obtained from the administrators and medical officers in charge of the selected health facilities used for the study, while written and signed informed consent was obtained from the participants prior to interview.

Author's contribution

Winifred Fila contributed to the methodology, laboratory analyses and data collection and writing of the paper.
Joel Johnson contributed to the conceptualization of the research, validation, modulation of the research and also writing of the paper. All authors read and approved the final manuscript.

Compliance with ethical standards

This study adheres to all conventional ethical practices as applied to this research.

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Disclosure of conflict of interest

The authors declare that none of the work reported in this study could have been influenced by any known competing financial interests or personal relationships.

Data availability

All data generated or analyzed during this study are included in this published article.

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