Infant and Young Child Feeding Index is not Associated with Stunting among Children (6-23 months) in the Upper Manya Krobo District of Ghana

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ABSTRACT

The complexity in measuring feeding practices makes it difficult to study the relation between infant feeding practices and child nutritional characteristics. This cross-sectional study carried out in the Upper Manya Krobo District (UMKD) among 260 children aged 6-23 months was aimed at understanding the association between an infant and young child feeding index (ICFI) and the stunting (LAZ) of children in UMKD. A structured questionnaire was used to collect data from the study participants in UMKD, and child feeding practices were assessed with a single 24-h recall and a food group frequency. ICFIs constructed for children aged 6-8 mo, 9-11 mo and 12-23 mo were divided into terciles. The association between child Length-for-age Z-score (LAZ) and ICFI was examined separately in each of the age groups. Generalized linear models were used to control for socio-demographic and economic factors. Adjusted mean LAZ in poor, average and good categories of ICFI were, respectively, -0.42, -0.17, and -0.04 ($p = 0.35$) among children aged 6-8 mo; -0.51, -0.44, and -0.89 ($p = 0.53$) among children aged 9-11 mo; and -1.23, -1.13, and -0.85 ($p = 0.19$) among children aged 12-23 mo. Among the components of ICFI, food group frequency (past 7 days) was positively associated with the length-for-age Z-score for children aged 12-23mo ($p < 0.05$) and 6-8mo ($p < 0.04$). However, current breastfeeding and dietary diversity score negatively predicted the LAZ of children aged 12-23 months ($p < 0.02$) and children aged 6-8 months ($p <0.03$) respectively. Infant and Child Feeding Index (ICFI) was independent of child Height-for-age Z-score (HAZ) and the seven-day food group frequency positively predicted child length for age Z-scores. Thus, increasing the consumption of foods from different food groups will likely lead to a reduction in stunting among rural Upper Manya Krobo children.

Keywords: Child feeding practices, Breastfeeding, Complementary feeding, infant and young child feeding index

Introduction

Optimal infant and young child feeding practices are crucial for good nutritional status, growth, and development. Conversely, inappropriate practices such as late initiation of breastfeeding, short duration of breastfeeding, and poor quality of complementary foods have been reported as main causes of childhood malnutrition (WHO, 2005). Childhood undernutrition is still a health challenge in Ghana (GDHS, 2014), with children in rural areas being more likely to be undernourished than their urban counterparts. The relationship between the quality of infant feeding practices and the nutritional status of children is complicated and difficult to establish. This is mainly because the different forms of feeding practices are age specific. The main practices that are usually assessed include breastfeeding, feeding frequency, and dietary diversity. Depending on the overall living conditions and socio-demographic context, the feeding practices of children may have different effects on their nutritional and health status (Hatloy *et al.,* 2000). Findings from studies which have investigated the association between an infant and young child feeding index (ICFI) as well as its components, on the one hand, and the nutritional status of children, on

the other, have been inconsistent. Whereas some studies (Ruel & Menon, 2002; Sawadogo *et al*., 2006; Khatoon *et al*., 2011) found significant association between ICFI and child nutritional status, other studies reported no correlation between the ICFI and child nutritional status (Ntab *et al*., 2005; Moursi *et al*., 2008). Previous studies in Ghana examined the relationship between feeding practices and certain aspects of breastfeeding, time of introduction of complementary foods, and the nutritional quality of complementary foods (Armar-Klemesu; Nti & Lartey, 2006). A challenge with such studies is that comparison between different age-groups may be difficult because of the age-specific recommendations for some indicators such as exclusive breastfeeding and feeding frequency. Additionally, comparability of data across different locations is a challenge. The need for a composite index that expresses all the feeding practices of children in a single summary is thus gaining importance across the globe (Ruel & Menon, 2002). This study was designed to investigate the association between ICFI and child length-for-age Z-score (LAZ) in the Upper Manya Krobo District of Ghana.

Methods

This cross-sectional study was conducted in the Upper Manya Krobo District of the Eastern Region of Ghana. The Ghana Health Service has divided the district into six sub-districts to facilitate health care delivery. Anyaboni and Asesewa sub-districts were selected using convenient sampling because they were easily accessible by the means of transport that was available to the researchers. Selection without replacement (Bissell, 1986) was used to randomly select 13 communities from the list of all communities in the two sub-districts. In all, 260 caregivers with children aged 6-23 months were recruited at the monthly child welfare clinics from November 2014 to February 2015.

Inclusion and Exclusion Criteria

A person was eligible to participate if she was a caregiver/mother of a child aged 6-23 months and living in the study community. Children with conditions that interfere with feeding (e.g. cleft palate) or anthropometric measurements (e.g. hunch back) were excluded from the study.

Data Collection

A structured questionnaire was used to collect information on socio-demographic characteristics and feeding practices/patterns (breastfeeding, bottle feeding, 24-hour dietary diversity, meal frequency, seven-day food group frequency) of study children and caregivers. The questionnaires were pretested before data collection started. Weight measurements of the children were taken using a Seca weighing scale (874 U) with a precision of 0.1kg and the recumbent length of children was measured using an infantometer with a precision of 0.1cm. The digital weighing scale and the infantometer were calibrated each day before use (NHANES, 2004).

Infant and Child Feeding Index (ICFI)

For the purpose of creating the infant and young child feeding index, the children were sub-divided into three age-groups: 6-8 months, 9-11 months and 12-23 months, similar to other studies (Khatoon *et al*., 2011; Moursi *et al*., 2008). The Infant and Child Feeding Index (ICFI) was constructed based on the principle proposed by Ruel and Menon (2002). The components that were used to create the index included: breastfeeding status (if the child was breastfed within 24 hours prior to the interview), bottle feeding (whether the mother fed the child from the bottle with a nipple within the 24 hours prior to the interview), dietary diversity (whether the child had received selected food groups in the 24 hours prior to the interview), food group frequency (the number of times and days the child had eaten from a particular food group within a week), and meal frequency (the number of times the child was offered solid or semi- solid foods within a day including meals and snacks). The scoring for each of the above components was dependent on the WHO feeding recommendations for the different child age groups (Dewey, 2003). The scoring for each component is shown in Table 1.

Table 1: Description of the scoring system used to create the feeding index

Variable	Scores		
	6-8 months	9-11 months	12-23 months
Breastfeeding	Yes=2	Yes=2	Yes=1
	No=0	No=0	No=0
Bottle-feeding	Yes=0	Yes=0	Yes=0
	No=1	No=1	No=1
Dietary Diversity (24 hours)			
Poor	0-3 food-groups=0	0-3 food-groups=0	0-3 one food-group=0
Average	4 food-groups=1	4 food-groups=1	4 food groups=1
Good	> 4 food-groups=2	> 4 food groups=2	> 4 food-groups=3
Food-group Frequency (Past 7 days)			
Poor	0 (no food in previous week)=0	0 or 1 = 0	0 through 3= 0
Average	1 or 2 =1	2 through 4=1	4 through 6=1
Good	3 or higher =2	5 or higher =2	7 or higher =2
Feeding Frequency			
Poor	0-1 time = 0	0-2 times = 0	0-2 times = 0
Average	2 times =1	3 times =1	3 times =1
Good	3 or more times = 2	4 or more times = 2	4 or more = 2
Total score(Min/Max)	0/9	0/9	0/9

Statistical Analysis

Data were entered, cleaned, and analyzed using SPSS version 16.0. Means and standard deviations were used to describe continuous variables, frequencies and proportions for categorical variables. The WHO Anthro software was used to convert the weight and length of the infants to the growth indices: weight-for-age (WAZ), weight-for-length (WLZ) and length-for-age Z-scores (LAZ). Infants with length-for-age Z-scores below a -2 standard deviation of the median reference LAZ were classified as stunted.

The relationships between child feeding practices and LAZ were examined. Analysis of variance was used for normally distributed continuous variables (child's length, child's age, caregiver's age, parity and number of children < 2years) for identifying differences between the three child age groups and Pearson's chi-square for categorical variables. A generalized linear model was used to determine the association between Infant and Child Feeding Index (ICFI) and child LAZ after adjusting for characteristics that were considered to be potential confounders. Factors accounted for in the model were identified through bivariate analyses and based on literature, and they included child age, sex, maternal marital status, maternal level of education and household size. Statistical significance was at a p-value less than 0.05.

Ethical Clearance

Ethical clearance was sought and obtained from the Institutional Review Board (IRB) of the Noguchi Memorial Institute for Medical Research (Study number: 012/14-15). The study was thoroughly explained to the

caregivers of the children and they were only recruited after they had given their consent by thumb-printing or signing an informed consent form.

Results

A total of 260 children with a mean age of 13.7 ± 5.5 months participated in this study (Table 2). Of these, 51.9 percent were males, and the proportion of children who were males did not differ between the different age-groups (6-8mo, 9-11mo, and 12-23mo). The mean age of caregivers that participated in the study was 26.3 years, and most of them were married. The dominant occupations of caregivers in the area were farming (46.9%) and trading (43.5%). In all, about 66% of the children had been sick in the last two weeks prior to the interview; 7% had malaria, 18% had diarrhoea, 23% had fever, 43% had pneumonia and 11% had other sicknesses such as burns, rashes, and catarrh. About 70% of the children classified as having good feeding practices had been sick in the two weeks preceding the interview.

Table 2: Socio-demographic characteristics of the study participants

Characteristic	Total Sample	Child Age Groups			p-value [a]
		6-8 (n=63)	9-11 (n=47)	12-23 (n=150)	
Child Characteristic					
Age (mo)	13.7±5.5	6.75±0.80	10.1±0.88	17.82±3.26	<0.01
Sex					
Male	135(51.9)	31(49.2)	26(55.3)	78(52)	0.81
Female	125(48.1)	32(50.8)	21(44.7)	72(48)	
Caregivers Characteristic					
Caregiver's Age	26.3±7.2	25.5±6.3	24.5±5.20	27.2±7.9	0.05
Parity	2.74±1.80	2.57±1.78	2.40±1.46	2.91±1.87	0.18
Number of children <2yrs	1.10±0.20	1.04±0.21	1.04±0.20	1.06±0.24	0. 87
Age					
15-20	68 (26.2)	18(28.6)	13(27.3)	37(24.7)	0.18
21-29	112(43.1)	26(41.3)	26(55.3)	60(40.0)	
≥30	80(30.7)	19(30.2)	8(17.4)	53(35.3)	
Marital Status					
Single	22(8.5)	5(8.0)	4(8.5)	13(8.7)	0.56
Married	234(90)	58(92.0)	43(91.5)	133(88.7)	
Widow/Divorced	4(1.6)	0(0)	0(0)	4(2.6)	
Education					
None	36(13.8)	7(11.1)	4(8.5)	25(16.7)	0.23
Primary	210(80.8)	50(79.4)	40(85.1)	120(80.0)	
SHS/Tertiary	14(5.4)	6(9.5)	3(6.4)	5(3.3)	

[a]ANOVA for continuous variables. Post hoc: LSD Test. Pearson's chi-square for categorical variables; statistical significance is at p<0.05. SHS; senior high school

About 16.2% of the children were stunted (LAZ < -2 SD), and the mean LAZ was -0.76. LAZ increased with increasing child age [-0.19, -0.57 and -0.90, respectively for children aged 6-8 mo, 9-11mo and 12-23 mo, p-value<0.01] and a greater proportion of children aged 12-23 months were stunted as compared to children 6-8 months (22% versus 8%, p-value < 0.001) and 9-11 months (22% versus 11%, p-value <0.021).The distribution of the ICFI and its components among the three child age groups is shown in Table 3. Breastfeeding was almost universal (98.4%) for all the children and about 37.3% of the study participants were fed from bottles. Grains, roots, and tubers were the most consumed food groups, while eggs were the least consumed food group (1.3 ± 1.6 days). About 48% of children aged 12-23 months met their minimum dietary diversity as compared to only 12.7% of children aged 6-8 months. The mean ICFI scores were 5.83 ± 1.47, 6.34 ± 1.48 and 5.63 ± 1.91 for children aged 6-8 months, 9-11 months, and 12-23 months, respectively.

Table 2: ICFI Component distribution by age groups

Component	6-8 months (n=63)	9-11 months (n=47)	12-23 months (n=150)
Breastfeeding, %	98.4	97.9	92.3
Bottle-feeding, %	38.1	46.8	34.0
DDS[1], %			
Poor	87.3	59.6	52
Average	7.9	23.4	26.7
Good	4.8	17.0	21.3
FGF (Past 7 days)[2], %			
Poor	7.9	2.1	4.7
Average	19.0	14.9	24.0
Good	73.0	83	71.3
Meal Frequency, %			
Poor	8.0	8.0	14.0
Average	11.3	6.0	14.7
Good	80.7	86.0	71.3
ICFI[3]			
Minimum	3.0	3.0	1.0
Maximum	9.0	9.0	9.0
Median	6.0	7.0	6.0
Mean ± SD	5.83±1.47	6.34±1.48	5.63±1.91

[1]DDS refers to Dietary Diversity Score, [2]FGF; refers to food group frequency, [3]ICFI refers to Infant and Child Feeding Index

In this study, ICFI was not associated with LAZ for all the three child age groups after adjusting for potential confounders (Table 4). The adjusted mean LAZ of children with good feeding practices(-0.04, -0.89 and -0.85 respectively for children age 6-8 months, 9-11 months, and 12-23 months) were similar to the mean LAZ of children with average (-0.17, -0.44 and -1.13 respectively) and poor (-0.42, -0.51 and -1.23 respectively) feeding practices. Among the components of ICFI, currently breastfeeding was inversely associated with LAZ of children aged 12-23 months (p-value<0.02) and a similar association was observed between dietary diversity and LAZ among the younger age group children (p-value<0.03). However, LAZ was positively related to food group frequency (past 7 days) among children aged 6-8 months and 12-23 months (p-value<0.05).

Table 3: Adjusted relations of ICFI and its components with child LAZ by age groups[1].

		Length-for-Age Z-score[1]		
ICFI/Component	**Category**	**6 – 8 months**	**9 – 11 months**	**12 – 23 months**
ICFI	Poor	-0.42±0.22	-0.51±-0.41	-1.23±0.17
	Average	-0.17±0.24	-0.44±0.22	-1.13±0.12
	Good	-0.04±0.21	-0.89±0.32	-0.85±0.15
	P-value	0.35	0.53	0.19
Breastfeeding	Yes	-	-	-1.17±0.10
	No	-	-	-0.67±0.19
	P-value	-	-	0.02*
Bottle Feeding	Yes	-0.05±0.22	-0.46±0.29	-1.06±0.14
	No	-0.27±0.17	-0.67±0.27	-1.07±0.10
	P-value	0.44	0.63	0.94
Dietary Diversity Score	Poor	-0.25±0.14	-0.56±0.24	-1.14±0.12
	Average	-0.70±0.46	-0.73± 0.38	-1.16±0.16
	Good	-0.85±0.60	-0.36±0.49	-0.80±0.18
	P-value	0.03*	0.85	0.23
FGF[2] (Past 7 days)	Poor	-0.58±0.46	1.70±1.24	-1.87±0.40
	Average	-0.87±0.32	-0.76±0.49	-1.22±0.17
	Good	0.03±0.15	-0.59±0.20	-0.97±0.10
	P-value	0.04*	0.17	0.05*
Meal Frequency	Poor	-0.36±0.30	-0.85±0.39	-1.32±0.22
	Average	-0.40±0.26	-0.90±0.43	-1.13±0.21
	Good	-0.03±0.19	-0.32±0.25	-1.01±0.10
	P-value	0.48	0.38	0.42

[1]Values are presented as means ± SE. Comparisons were adjusted for the following factors; Child Age (For children 6-8 mo; (0 = 6mo, 1= 7-8mo), For children 9-11 mo; (0 = 9-10mo, 1 = 11mo), For children 12-23mo; 0 = 12-17mo, 1 = >17mo)), Sex (0 = Female, 1=Male), Marital Status (0 = Not Married, 1 = Married), Maternal level of education (0 = Never Schooled, 1 = Schooled) and Household size (0 = 1-6 persons, 1= >6). [2]FGF; refers to food group frequency. ICFI refer to Infant and Child Feeding Index

Discussion

This study provides information on infant and child feeding practices in the Upper Manya Krobo District of Ghana. Food group frequency (past seven days), which is an indication of the number of times and days the child had eaten from a particular food group within a week, positively predicted the LAZ among children aged 12-23 months. The positive association between food group frequency and the LAZ of the older age group children is comparable to results of other studies that have documented the benefits of eating from a variety of foods for the growth of children. When children eat from a large variety of food items they are more likely to meet their daily nutrient requirements and needs. Children in a lipid and glucose study in Tehran (Mirmiran *et al.,* 2004) who had eaten from a large number of food groups had higher BMI and nutrient adequacy than their counterparts. In Madagascar, Moursi *et al.* (2008) observed that children consuming a high number of food groups had a higher LAZ ($r = 0.41$; $p<0.05$). Similar findings were reported by Steyn and colleagues in South Africa who observed that 1-8year old children who received different food items (food variety score of 5.5) presented better height-for-age Z-scores than their counterparts ($r = 0.21$; $p<0.0001$) (Steyn *et al*., 2005). In our study breast feeding was negatively associated with the LAZ of study participants aged 12-23 months. The reverse causality between breastfeeding and LAZ of children observed in this study has also been reported by other researchers. In Senegal, Ntab *et al.* (2005) observed lower height-for-age Z-scores among breastfed children. Simondon *et al.* (1998) observed that mothers in the same country prolonged breastfeeding for malnourished children in order to improve their health status and reduce the mortality risk associated with the weaning of such children.

We also observed that dietary diversity score was negatively associated with the LAZ of children aged 6-8 months. This finding could be due partly to the observation that a higher percentage of the children with good feeding practices were sick and that the mothers probably increased the number of food groups fed to their sick children to improve recovery, just as mothers in the reverse causality hypothesis between breastfeeding duration and stunting (Moursi *et al.,* 2008; Ntab *et al.,* 2005; Simondon *et al.,* 1998) tend to increase breastfeeding for malnourished children. However, dietary diversity score has been related to better height-for-age Z-score in children in Latin America (Ruel & Menon, 2002) and among children aged 12-23months in Burkina Faso (Sawadogo *et al.,* 2006).

This study found no association between the length-for-age Z-score and a composite feeding index of children aged 6-23 months residing in the Upper Manya Krobo District of Ghana. This observation could be due to differences in feeding practices. Our findings were consistent with other studies among rural Senegalese children (Ntab *et al.,* 2005) which found no association between ICFI and child height-for-age Z-score ((adjusted means: -1.01, -1.06, and -1.20 Z-scores for the poor, average and good feeding practices, respectively, p-value >0.05), or linear growth (6.2, 6.0, and 6.3 cm/7 month for the 3 groups, respectively, p-value >0.05) among 12-42 month-olds. Our findings are also in line with those of Moursi *et al.* (2008) who assessed child feeding practices using a summary index with data collected at three-month intervals, then studied its stability over time and its association with child growth in urban Madagascar. The study found that the cross sectional ICFI was neither associated with child weight-for-length Z-score (p-value = 0.14) at six months nor with length-for-age Z-score (p-value = 0.22, 0.08 and 0.1 respectively at baseline, three months and six months).

Nevertheless, our findings were contrary to the evaluation by Ruel and Menon (2002) using demographic and health survey data of children aged 6-36 months from seven Latin American countries, who showed a significant relationship between feeding practices and height-for-age Z-score for children aged 12-36 months (p-value <0.005). The researchers showed that for poor, average and good feeding practices, relations with height-for-age Z-score were weaker and less consistent for the younger age group children (9-11 months) but increased with age. A possible explanation for the

observed contrast could be that our sample size was not large enough to detect significant differences among the children. Ruel and Menon used 1599 - 6347 children 12-36 months of age per data set and observed differences, while this study used 260 children. Sawadogo *et al.* (2006) in Burkina Faso also found a significant positive relationship between a modified ICFI and the height-for-age Z-score of children aged 6-11months (p-value = 0.003) and 12-23 months (p-value = 0.002). The differences between our findings and those from these other studies may be due to the differences in the study areas. The feeding practices of children may be different across continents and countries, and as such, Burkinabe children or Latin American children feeding practices may be different from those of the Upper Manya Krobo District. Eggs, for instance, were rarely eaten in Upper Manya Krobo from our findings, but were reported fed to more than half of the children in the Ruel & Menon study in Latin America. Also, after the Ruel & Menon study, new feeding recommendations for breastfeeding infants have been published (Dewey, 2003), in particular with a lower number of recommended daily meals than previously (that is, 2-3 at 6-8 months of age and 3-4 thereafter). We awarded marks based on the current feeding recommendations. The difference in the feeding recommendations used in awarding marks in our study and the Ruel & Menon study could be a possible explanation for the differences in the findings.

Limitation

We assumed that the feeding practices identified in the study represent the usual feeding practices of the study children The cross sectional design of the study might not reflect the usual feeding practices of the study children. The relation could be different if data had been taken at other times.

Conclusion

The study showed that the composite feeding index (ICFI) was not associated with the nutritional status of study participants in the study area. However, a seven day food group frequency positively predicted the LAZ of the study children. Thus, increasing the consumption of foods from different food groups will lead to a reduction in stunting among the study children.

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