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Dietary Diversity and Nutritional Status of Children Aged 12-23 Months from Ayeyawady Region of Myanmar

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Complementary-feeding diet of Myanmar children often lacks diversity. This study was conducted in Ayeyawady from June to September 2012 to assess dietary diversity (DD) in complementary food of 12-23-month-old children (n=106) and to investigate relation between DD and their nutritional status. Dietary data were collected by 12-hr weighed-diet-record and 12-hr food-recall. Body weight and recumbent length of children were measured by using Salter-scale and wooden length-board. Data were analyzed by using SPSS software while anthropometric Z-scores were calculated by using WHO-Anthro Software. Foods were categorized into 7 food-groups. as in WHO classification. Dietary diversity score (DDS) was calculated based on sum of food-groups consumed by children. Results showed 70.8% (n=75) consumed <4 out of 7 food-groups whereas only 0.9% (n=1) consumed 6 food-groups. Stunting, wasting and underweight were found in 34.9% (n=37), 10.4% (n=11) and 26.4% (n=28); and severe stunting, wasting and underweight were found in 10.4% (n=11), 1.9% (n=2) and 9.4% (n=10), respectively. Children with DDS<4 were associated with higher prevalence of stunting (42.7%) compared to those with DDS≥4 (16.1%), (p=0.013). After considering potential confounders, linear regression showed DDS was a significant predictor of child's length-for-age Z-score (Adjusted-R^2=0.314, β=0.213, p=0.017), weight-for-age Z-score (Adjusted-R^2=0.237, β=0.279, p=0.003), and weight-for-length Z-score (Adjusted-R^2=0.039, β=0.247, p=0.019), respectively. Our study clearly highlighted that DDS is significant predictor of child's nutritional status. Therefore, education on proper complementary-feeding practices with emphasis on improving dietary diversity should be promoted to prevent children from growth faltering and its adverse effects.

Key words: Complementary feeding, Dietary diversity score, Nutritional status, Myanmar children

INTRODUCTION

Childhood undernutrition is highly prevalent in low- and middle-income countries, resulting in considerable increases in mortality and overall disease burden.[1] Globally, more than half of child deaths is contributed by undernutrition.[2] In Myanmar, Multiple Indicators Cluster Survey (2009-2010) showed undernutrition among under-five children still remains as a public health problem and the prevalence of stunting, wasting and underweight were 35.1%, 7.9% and 22.6%, respectively, based on the WHO child growth standard.[3] This will have serious implication in their developmental potentials and future risk of diseases[4] as well as economic growth of the country.

Adequate nutrition through appropriate infant and young child feeding (IYCF) during infancy and early childhood is essential for child growth and development.[5] Exclusive breastfeeding (EBF) up to 6 months of age and timely introduction

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of complementary food are the keys to achieve optimal growth and development of infant and young children.[6] However, both EBF and complementary feeding were poorly practiced in developing countries including Myanmar which may be associated with high prevalence of undernutrition among young children.[7]

Dietary diversity (DD), assessed by dietary diversity score (DDS) or index (DDI),[8, 9] is one of the indicators of WHO recommended IYCF practices[5] and is an important component of dietary quality to ensure adequate nutrient intake of young children.[10, 11] Consumption of higher number of food-groups is associated with improved nutritional adequacy of diet.[8] Studies have shown that DDS is positively associated with overall dietary quality and micro-nutrient intake of young children.[11, 12]

Most complementary food given to children in impoverished population are mainly based on starchy staples and are monotonous containing few animal-source foods.[13] Low DD is an important problem in poor communities which may lead to poor nutritional outcomes among children.[14, 15] Studies, either nationwide or small-scale, have been done in Myanmar to explore IYCF practices and children received limited number of food-groups in their complementary foods (unpublished data). Scarcity of data is available on relation between IYCF practices especially DD and nutritional status of children. This study was conducted to examine current IYCF practices, to assess DD in complementary food of 12-23-month-old children and to investigate relation between DD and their nutritional status.

MATERIALS AND METHODS

Study design and population

This study was a cross-sectional survey conducted from June to September 2012 in Ayeyawady Region, Myanmar. This survey was preliminary phase of an intervention trial (Clinical Trials.gov Identifier: NCT01758159) entitled "Optimized complementary feeding improves the effect of iron supplementation on micronutrient status, growth and gut microbiota of 12-23-month-old Myanmar children, 2013".[14] Pantanaw and Nyaungdone townships were randomly selected from Maubin District of Ayeyawady and one village-tract each from these two townships were selected. Every mothers residing in these villages having 12-23-month-old children (who were apparently healthy and not suffering from any illness which could interfere their dietary intakes) were invited to participate in this survey. Dietary intake and anthropometric data were collected from 106 children.

Ethical approval

Ethical approval was obtained from "The Ethical Committee on Medical Research Involving Human Subjects, Department of Health, Ministry of Health, Myanmar" (Ethical Committee-1/2012-505) and verbal informed consent was obtained from mothers who participated in survey.

Data collection

Data on socio-demographic characteristics and IYCF practices were collected by interviewing mothers using standardized pre-tested structured questionnaires. The primary purpose of this survey was to develop local food-based Complementary Feeding Recommendations using Linear Programming approach to improve nutrient intake among 12-23-month-old Myanmar children.[16]

Therefore, dietary data were collected by 12-hour weighed-diet-record (WDR) and recall of any foods consumed in subsequent 12-hr, single 24-hr recall and 5-day food record to get 7-day food-group consumption pattern as described in previous paper.[17] The dietary data presented in this paper were taken only from 12-hr WDR and subsequent 12-hr recall. All foods and beverages consumed by child between 06:00 and 18:00 hours on the day of data collection were weighed using Tanita digital scale (model KD-160, USA; precision±1g) and recorded

by trained enumerators. A 12-hour recall for all foods and drinks consumed from 18:00 hour on that day to 06:00 hour the next morning was also collected. Using standardized methods,[18] body weight of children was measured using Salter scale (Model 2356S, England, precision±1g) with child minimally clothed. Recumbent length was measured using a length board (precision±0.1 cm).

Data analysis

Anthropometric data were analyzed using WHO-Anthro Software (version 2.0.4) and children were categorized as stunted (length-for-age/LAZ<-2SD), wasted (weight-for-length/WLZ<-2SD) or underweight (weight for age/WAZ<-2SD), and as severely stunted (LAZ<-3SD), wasted (WLZ<-3SD) or underweight (WAZ<-3SD) according to WHO 2006 multicentre growth reference standards.[19] All means±SD and percentages for socio-demographic data, IYCF practices and nutritional status were analyzed by SPSS for Windows (Chicago, IL USA; version 16). For creation of dietary diversity score (DDS), a score of 1 was assigned if child ate 1 or more food from a given food-group and 0 if not. These values were, then, summed up for all 7 food-groups to get total DDS with a range of 0-7.[12]

The 7 food-groups were: grains, roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin-a-rich fruits and vegetables; other fruits and vegetables.[5] Two different types of cut-off points were used for DDS categories: (DDS<4 *vs.* DDS≥4) based on WHO/UNICEF IYCF indicators;[5] and (DDS≤1, DDS=2, DDS=3, DDS=4, DDS≥5) based on the previous study.[15]

RESULTS

Socio-demographic characteristics of study population

Mean age of studied children was 18.9±4.0 months and 48.1% (n=51) were boys (Table 1). Mothers were between age of 18-43 years (mean±SD=29.4±6.3), most mothers (66.7%) finished primary school or less and nearly half were unemployed. Monthly family income was 90,000 (60,000-150,000) kyats [median (Inter-quartile-range)]. Only 28.3% (n=30) of families drank boiled water from river or tube well. Only about half of caregivers practiced hand washing before child feeding (56.2%, n=58) and after using toilet (42.2%, n=43).

Table 1. Socio-demographic characteristics and nutritional status of 12-23-month-old children (n=106)

Characteristics	n (%)
Child characteristics	
Age (months)†	18.9±4.0
Gender (male)	51(48.1)
Nutritional status	
Length for age Z-score†	-1.7±1.1
Stunting,	37(34.9)
Severe stunting	11(10.4)
Weight for length Z-score†	-0.8±0.9
Wasting	11(10.4)
Severe wasting	2(1.9)
Weight for age Z-score†	-1.4±1.0
Underweight	28(26.4)
Severe underweight	10(9.4)
Household members†	5.1±1.9
Hygienic characteristics	
Boiling water for drinking	30(28.3)
Hand washing after toilet	43(42.2)
Hand washing before child feeding	58(56.2)
Maternal characteristics	
Age (years)†	29.4±6.3
Education	
No schooling	4(3.8)
Primary school or less	70(66.7)
Middle school	16(15.2)
College/University	4(3.8)
Graduate/Post-graduate	11(10.5)
Occupation	
Unemployed/ Dependent	47(44.3)
Manual labor	24(22.6)
Farming/fishing	9(8.5)
Vendors	15(14.2)
Private employee	9(8.6)
Government employee	2(1.9)
Monthly family income‡ (Quartile), kyats	
<60,000	20(18.9)
60,000-89,000	26(24.5)
90,000-149,000	23(21.7)
≥150,000	37(34.9)

†mean±SD for all such values
‡1 kyat=0.00078 USD
Stunting=LAZ<-2SD
Wasting=WLZ<-2SD
Underweight=WAZ<-2SD,
Severe-stunting=LAZ<-3SD
Severe-wasting=WLZ<-3SD
Severe underweight=WAZ<-3SD

Nutritional status of children

Mean LAZ of children was -1.7±1.1 while WLZ was -0.8±0.9 and WAZ was -1.4±1.0, respectively. Stunting, wasting and underweight were found in 34.9% (n=37), 10.4% (n=11) and 26.4% (n=28), respectively; whereas severe stunting, severe wasting and severe underweight were found in 10.4% (n=11), 1.9% (n=2) and 9.4% (n=10), respectively (Table 1).

Infant and young child feeding (IYCF) practices

Majority of children (87%, n=93) received breastfeeding within one hour after birth, 98.1% (n=104) received colostrum feeding, while 45.3% (n=48) of mothers reported that their children were given EBF up to 6 months of age and 78.7% (n=83) of children were still being breastfed at the time of survey. Children were fed solid, semi-solid, or soft foods starting at the age of 8±3.3 months (range: 1-18 months) and about half of caregivers had habit of feeding their children less frequently than usual when they got sick (Table 2).

Table 2. Infant and young child feeding practices

IYCF practices	n(%)
Early initiation of breastfeeding (within one hour after birth)	93(87)
Colostrum feeding	104(98.1)
Exclusive breastfeeding	48(45.3)
Still breastfeeding	83(78.7)
Age of introduction of complementary foods (month)†	5.8±3.3
Feeding frequency during illness	
Same frequent as usual	45(42.5)
More frequent than usual	8(7.5)
Less frequent than usual	53(50)
Dietary diversity score (DDS)Ŧ‡	3(2-4)
DDS≥4 (MDD* achieved)	31(29.2)
DDS<4 (MDD* not achieved)	75(70.8)

†Mean±SD, Ŧ Median (Inter-quartile range), ‡Dietary diversity score calculated based on number of food-groups consumed out of 7-Groups: * MDD=Minimum dietary diversity, IYCF=Infant & young child feeding

Table 3. Dietary diversity score as determining factor for children's nutritional status (n=106)‡

Determinants	Un-standardized coefficients		Standardized coefficients (β)	p value†	95% CI for B	
	B	SE			Lower	Upper
Length for age Z-score[1]						
Dietary Diversity Score	0.201	0.083	0.213	0.017*	0.037	0.365
Age of child (month)	-0.132	0.022	-0.500	<0.001***	-0.175	-0.089
Gender of child	0.066	0.182	0.031	0.717	-0.295	0.426
Family income (kyats/month)	$4.009E^{-7}$	0.000	0.038	0.663	0.000	0.000
Education of mother	0.089	0.061	0.128	0.150	-0.033	0.210
Weight for length Z-score[2]						
Dietary Diversity Score	0.194	0.081	0.247	0.019*	0.032	0.355
Age of child (month)	-0.032	0.021	-0.144	0.142	-0.074	0.011
Gender of child	.130	0.179	0.073	0.469	-0.225	0.484
Family income (kyats/month)	$6.996E^{-7}$	0.000	0.080	0.440	0.000	0.000
Education of mother	0.003	0.060	0.005	0.958	-0.116	0.122
Weight for age Z-score[3]						
Dietary Diversity Score	0.244	0.081	0.279	0.003**	0.083	0.405
Age of child (mo)	-0.099	0.021	-0.402	<0.001***	-0.141	-0.056
Gender of child	0.109	0.178	0.055	0.543	-0.244	0.462
Family income(kyats/month)	$7.006E^{-7}$	0.000	0.072	0.437	0.000	0.000
Education of mother	0.053	0.060	0.083	0.375	-0.065	0.172

‡ Output from Linear-Regression analysis

[1] Length-for-age Z-score as dependent variable, Model's R^2=0.347, adjusted-R^2=0.314 (p<0.001)

[2] Weight-for-length Z-score as dependent variable, Model's R^2 b=0.085, adjusted-R^2=0.039 (p<0.112)

[3] Weight-for-age Z-score as dependent variable, Model's R^2=0.274, adjusted-R^2=0.237 (p<0.001)

† Significant at *p<0.05, **p<0.01, ***p<0.001

Dietary diversity

Children consumed 3(2-4) food-groups [median (Inter-quartile-range)] during 24-hour period (Table 2). Out of 7 food-groups, only 29.2% (n=31) of children achieved minimum dietary diversity (MDD) (i.e., consumed ≥4 food-groups)[5] while 70.8% (n=75) consumed <4 food-groups and none of them consumed 7 food-groups during 24-hour period (Fig. 1).

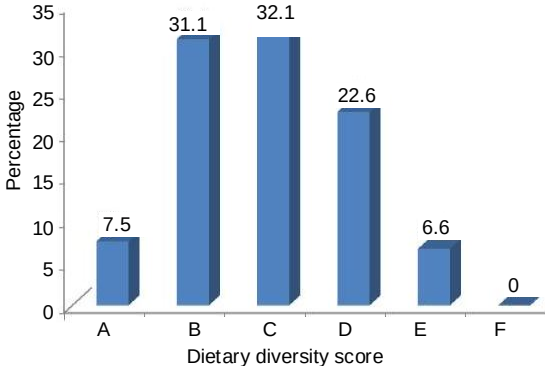

Fig. 1. Dietary diversity score of complementary feeding diet consumed by children (n=106)

Relation between dietary diversity score and nutritional status

Pearson-Chi-square analysis showed children who did not eat flesh foods had higher prevalence of stunting (57.9% *vs.* 29.9%, p=0.032), underweight (47.4% *vs.* 21.8%, p=0.041), and those who did not eat other fruits/vegetables had higher prevalence of stunting (39.8% *vs.* 11.1%, p=0.028), underweight (30.7% *vs.* 5.6%, p=0.037) than those who ate these food groups. Children who consumed<4 food-groups had higher prevalence of stunting than those consumed ≥4food-groups (42.7% *vs.* 16.1%, p=0.013) whereas prevalence of wasting and underweight were not significantly different between those two groups.

After controlling potential confounders (child's age, gender, maternal education and family income), DDS is the significant predictor of child's LAZ (Adjusted-R^2=0.314, β=0.213, p=0.017), WLZ (Adjusted-R^2=0.039, β=0.247, p=0.019), and WAZ (Adjusted-R^2=0.237, β=0.279, p=0.003), respectively (Table 3).

DISCUSSION

This cross-sectional survey was conducted in Ayeyawady Region of Myanmar where prevalence of both acute and chronic under-nutrition among under-five-children is higher than national figure.[3] These findings showed that under-nutrition (stunting, wasting and underweight) among 12-23-month-old-children existed as severe public health problem in study area.[20] Children consumed less diverse food groups than recommended and more than two-third of them did not achieve MDD.[5] Correlation and regression analyses showed DDS is significantly associated with child's nutritional status. DDS among 12-23-month-old Myanmar children was significantly associated with their anthropometric status. In addition, after controlling potential confounders, DDS is the significant predictor of child's LAZ, WLZ and WAZ. Cross-sectional nature of this study limited to make conclusion that low DDS is casual factor for high prevalence of under-nutrition.

However, a review on 11 demographic and health surveys has shown that there was a positive association between DDS and child's nutritional status.[21] Recent studies also reported that DDS is a strong predictor of stunting among Bangladeshi children and of subsequent growth among Zambian infants.[22, 15] These evidences support the findings that low DDS (as a result of sub-optimal IYCF practices) might be the significant contributor of child nutritional status. Therefore, it is necessary to improve IYCF practices so as to feed children with diverse food groups.

Although it was observed that majority of mothers practiced early initiation of breast-feeding and colostrum feeding although a lot more work need to be done to improve

EBF in the community. Study population had habit of using un-boiled water for drinking and poor habit of hand washing. Half of mothers in the study reported that they feed their children less frequently during illness than usual. This raises a concern that improper feeding practices during illness might have imposed additional burden for these children to catch up their growth. A previous study done in Sri Lanka, where wasting existed as serious public health problem among preschool children, also showed that mothers fed less to their children during illness.[23] Poor water, hygienic practices and child feeding during illness found in the study might contribute to high prevalence of under-nutrition.

Studies have shown that DDS is proxy indicator for micronutrient intake as well as dietary quality.[10, 12] Rate of achieving MDD is lower in Myanmar children as compared to 6-23-month-old Nepalese children (29.2% *vs.* 34.2%).[24] Median number of food-groups consumed by Myanmar children is also lower than 12-23-month-old children from some other countries.[9] Low DDS in the study may lead to poor diet quality and hence poor nutritional status. Anthro-pometry status of young children in study area was relatively poor and prevalence of stunting, wasting and under-weight was higher than that of national level. This should be addressed urgently.

This study finding suggested that poor feeding practices reflected in DDS might be main reason for poor nutritional status and, therefore, efforts must be done to improve their feeding practices. Ayeyawady is the region with highest rural population[25] whose main occupation is agriculture and is the main area of rice production for the country. Fishery and poultry products are also as common as in other rural areas of Myanmar. Despite local availability of food, feeding with them is still unsatisfactory probably because poor knowledge of caregivers on such nutrient-rich foods and efforts should be made to improve their knowledge. Another potential constraint may be affordability to purchase variety of food-groups. Therefore, it is imperative to find out a solution to overcome these constraints and WHO has been working to promote food-based approaches to improve nutritional status of children by using a software known as Optifood. This software is based on a mathematical model called Linear Programming approach and has been shown successful to develop food-based-recommendations to improve nutrient quality of diet of young children using locally available foods at lowest cost.[16, 26]

Conclusion

Complementary feeding diet of 12-23-month-old Myanmar children lacks diversity. This study highlighted that DDS is the significant predictor of child's nutritional status: higher DDS is associated with greater anthropometric Z-scores. Stunting, wasting and underweight existed as severe public health problems among under 2-year children in Ayeyawady and actions should be undertaken to address these problems. More comprehensive approach, local food-based-recommendations developed by Linear Programming, should be used to improve nutrient quality of diet of young children. Health education services should be strengthened to promote appropriate complementary feeding practices with emphasis on improving dietary diversity to prevent children from growth faltering and its adverse effects.

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