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CONTENTS

TABLES

FIGURES

ABSTRACT

Nutritional deficiencies are a major problem among developing countries such as Myanmar. They can occur in all age groups, but the impact is more severe among children age 6-23 months as this period is critical for child development, and irreversible damage can occur due to consequences of nutritional deficiencies. Proper infant and young child feeding (IYCF) practices are pivotal to tackle nutritional problems and to prevent irreversible consequences among children. To assess the current feeding practices among children age 6-23 months and associations with their nutritional status, we conducted a secondary data analysis using the 2015-16 Myanmar Demographic and Health Survey.

A total of 1,222 children age 6-23 months were included in this analysis. Twenty percent of children were stunted and 43% were moderately anemic. Regarding IYCF practices, only 16% of children received a minimum acceptable diet, 25% received diverse food groups, 58% were fed with minimum meal frequency, 85% currently breastfed, and 59% consumed iron-rich foods. Breastfeeding reduced the odds of being stunted. By background characteristics, male sex, perceived small birth size, children of short stature, and children of working mother were significant predictors of stunting. Iron-rich food consumption was inversely associated with moderate anemia. Among covariates, male sex and maternal anemia were also significant predictors of moderate anemia among children age 6-23 months.

The study concluded that stunting and anemia among young children in Myanmar are major public health challenges that need urgent action. Children should be fed with diverse food groups including iron-rich foods according to the World Health Organization (WHO) complementary feeding guidelines. While further prospective research is needed to determine the effect of feeding practice on linear growth, interventions such as iron supplementation, deworming, and nutritional education programs could help prevent stunting and childhood anemia and might reduce their prevalence in Myanmar.

KEY WORDS: stunting, anemia, infant and young child feeding practices, Demographic and Health Survey, Myanmar

1 INTRODUCTION

1.1 Background

Adequate nutrition is essential for growth and development of children, and malnutrition reflects poor social and economic development. Growth faltering results in adverse effects including poor physical and cognitive development, the impact of which may last a lifetime (UNICEF 2017). Short-term consequences include increased morbidity and mortality, developmental delay, and economic burden for sick children, while long-term consequences are stunted brains and stunted lives, hindering the development of entire societies. Hence, the period from birth to age 24 months is considered the "critical window" for the advancement of good growth, health, and behavioral and cognitive development (Onis and Branca 2016).

Stunting, a sign of chronic undernutrition, is defined as the percentage of children whose height for age is below minus two standard deviations from the median of the World Health Organization (WHO) Child Growth Standards (WHO 2016). The prevalence of stunting among children under age 5 varies globally. In 2013, about half of the world's 161 million stunted children lived in Asia, and over one-third in Africa (Onis and Branca 2016). About a quarter of the world's children under age 5 live in South Asia and, among them, 38% have stunted growth (UNICEF 2014). In Myanmar, prevalence of stunting was 35% in 2009-10 (UNICEF 2011) and decreased to 29% in 2017 (MOHS and ICF 2017).

According the WHO conceptual framework for childhood stunting, four main factors are responsible for stunting: (1) household and family factors—maternal disease, age, short stature, poor nutritional status, short birth intervals, poor care practices, inadequate water supply and sanitation, food insecurity, low caregiver education; (2) inadequate complementary feeding—poor-quality food, low dietary diversity and intake of food, infrequent and inadequate feeding, insufficient frequency of feeding; (3) inadequate practice of breastfeeding—early cessation of breastfeeding, non-exclusive breastfeeding; and (4) clinical and subclinical infection—diarrhea, malaria (Stewart et al. 2013).

A number of studies have described the determinants of stunting in developing countries. A study in India stated that birth weight, child feeding, women's nutrition, and household sanitation were the most significant predictors of stunting, and among children age 6-23 months a child with low birth weight had 2.5 higher odds of being stunted compared with children of normal birth weight (Aguayo et al. 2016). Another study conducted in Sri Lanka showed that stunting was significantly associated with poorly educated parents, low birth weight, and poor complementary feeding practices (Sujendran, Senarath, and Joseph 2015). Similar findings were found in an Ethiopia study, which showed that stunting was associated with child's sex, maternal age, maternal education, and occupational status (Agedew and Chane 2015). A study in Cambodia found that child's age, perceived birth size, family wealth status, and region of residence were significantly associated with stunting (Ettyang and Sawe 2016).

Childhood anemia is also a public health problem, with significant negative health consequences and adverse impacts on social and economic development (WHO 2015a). A child is considered to be anemic if blood hemoglobin level is less than 11 g/dl, where 10-10.9 g/dl is mild anemia, 7-9.9 g/dl is moderate anemia, and less than 7 g/dl is severe anemia (WHO 2008). WHO estimates that nearly two-thirds of preschool children in Africa and Southeast Asia are anemic. Severe anemia can cause child mortality.

According to recent data from the Demographic and Health Surveys (DHS), the prevalence of anemia in preschool children is 53% in Nepal and 56% in Cambodia (Ministry of Health Nepal and ICF 2017; National Institute of Statistics and ICF 2015). In Myanmar its prevalence was 40% in 2011 (WHO 2015a) and 58% in 2015-16 (MOHS and ICF 2017), showing that prevalence of childhood anemia has increased. The prevalence of anemia is also above 50% in some other countries—including 56% in Bangladesh, 59% in India, and 61% in Pakistan—but is below 50% in some other developing countries—at 44% in Afghanistan, 36% in Sri Lanka, 35% in Philippines, and 32% in Indonesia (WHO 2015a).

A number of studies have found prevalence of anemia to be associated with maternal factors, including maternal education, number of children under age 5, maternal age, and maternal anemia, and with child-related factors, including child's age under 24 months, low socioeconomic status, male sex, malaria, stunting, and wasting (Foote et al. 2013; Leal et al. 2011).

Nutritional status of children under age 2 is highly influenced by feeding practices. To assess feeding practice precisely and to compare within and across nations, WHO recommends using eight infant and young child feeding (IYCF) core indicators—early initiation of breastfeeding; exclusive breastfeeding for six months; continued breastfeeding at one year; introduction of solid, semi-solid, or soft foods; minimum dietary diversity; minimum meal frequency; minimum acceptable diet; and consumption of iron-rich or iron-fortified foods (UNICEF 2012).

It is important to prevent malnutrition within the critical period of life—during pregnancy and a child's first two years of life—by having proper IYCF practices. Proper IYCF practices protect children from undernutrition and over-nutrition and their consequences later in life. Infants with inadequate growth can catch up weight gain in the first two years of life and reduce the risk of child morbidity and mortality. Although Myanmar established National Strategy on IYCF practices since 2011 (MOHS and ICF 2017), there are very limited studies on IYCF practices in Myanmar. Furthermore, few studies have assessed the relationship between nutritional status of anemia and stunting with IYCF practices. Most of studies have focused on breastfeeding and complementary feeding without using IYCF indicators, making them difficult to compare. Therefore, this study was conducted to explore the relationship between nutritional status and IYCF practices, using the 2015-16 Myanmar Demographic and Health Survey (DHS) (MOHS and ICF 2017).

1.2 Research Objectives

The primary objective of this study is to examine the relationship between IYCF practices and stunting and moderate anemia of children age 6-23 months. Specifically, the study aims to

(1) Describe the IYCF practices among children age 6-23 months

(2) Determine the prevalence of stunting and moderate anemia among children age 6-23 months

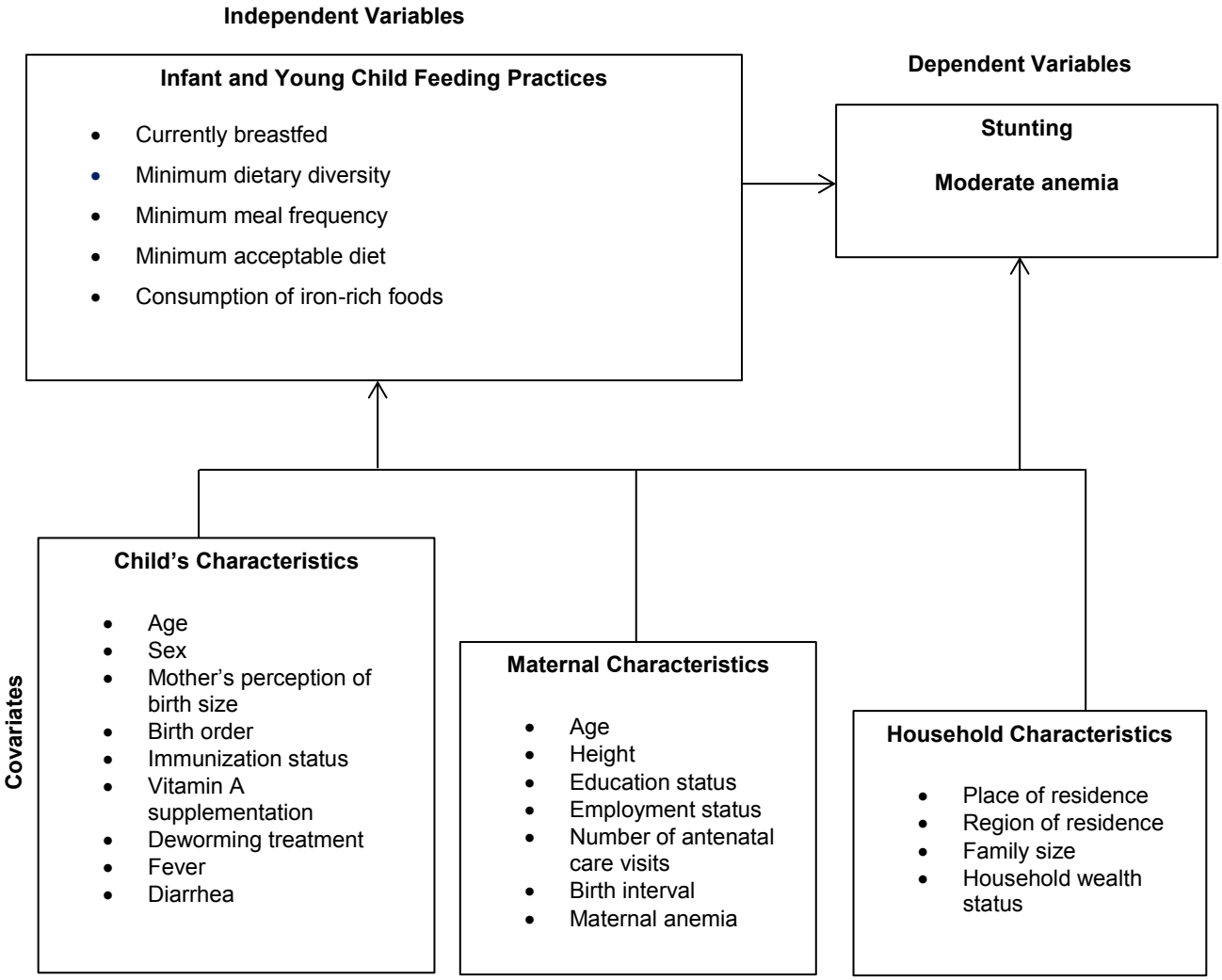
(3) Assess the relationship between IYCF practices and stunting among children age 6-23 months

(4) Examine the relationship between IYCF practices and moderate anemia among children age 6-23 months.

1.3 Conceptual Framework

Our conceptual framework was based on the WHO conceptual framework of childhood stunting (Stewart et al. 2013). We focused on five IYCF indicators—currently breastfed, minimum dietary diversity, minimum meal frequency, minimum acceptable diet, and consumption of iron-rich foods. We also considered other variables that might influence stunting and anemia. Figure 1 shows the adapted conceptual framework that incorporates key independent variables of interest and other covariates. These covariates include child's characteristics—age, sex, perceived birth size, birth order, immunization status, vitamin A supplementation, deworming, fever, and diarrhea; maternal characteristics—age, height, education status, employment status, number of antenatal care (ANC) visits, birth interval, and maternal anemia; and household characteristics—place of residence, region of residence, family size, and household wealth status.

Figure 1 Conceptual framework of associations of child, maternal, and household characteristics with infant and young child feeding practices, stunting, and moderate anemia of children age 6-23 months



2 DATA AND METHODS

2.1 Data

Our study used data from the 2015-16 Myanmar Demographic and Health Survey (DHS), which was conducted using nationally representative samples to estimate core demographic and health indicators of the whole country. The DHS survey also provides estimates separately for urban and rural areas, the 14 states and regions, and the Nay Pyi Taw Union Territory. The survey used two-stage sampling clusters (enumeration areas) as the primary sampling unit, and households as a secondary stage from which it sampled 13,260 households. Methods are described elsewhere (MOHS and ICF 2017). The survey interviewed a total of 16,800 women and 7,500 men age 15-49 in the selected households. The data collected included taking blood samples and anthropometric measures of all children age 6-59 months and women age 15-49. Our study, with the aim of assessing stunting and moderate anemia among children with respect to IYCF practices, used data for 1,222 children age 6-23 months whose information on feeding practices was collected through interviews with their mothers in the DHS survey.

2.2 Variables

2.2.1 Dependent variables

We used stunting and anemia as dependent variables. Stunting was calculated from height-for-age Z-score using the WHO Child Growth Standards (WHO 2014). Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered short for their age (stunting), or chronically undernourished. We excluded biologically implausible values such as less than (-6 SD) and greater than (+6 SD) in our study (WHO 2009). In Myanmar, most children under age 24 months (about 76%) are anemic. Hence we focused on moderate anemia, using cutoff value <10g/dl to detect the association between IYCF practices and childhood anemia. We also excluded from our analysis biologically implausible hemoglobin values such as less than 4g/dl and greater than 18g/dl (WHO 2015b).

2.2.2 Independent variables

To assess children's feeding practices, we used five IYCF indicators—currently breastfed, minimum dietary diversity, minimum meal frequency, minimum acceptable diet, and consumption of iron-rich foods (UNICEF 2012). These independent variables were recoded according to the following definitions using information about foods given to the child in the last 24 hours before interview.

Minimum dietary diversity is defined as proportion of children age 6-23 months who received foods from four or more food groups. The seven food groups used for tabulation of this indicator are: 1) grains, roots, and tubers; 2) legumes and nuts; 3) dairy products (milk, yogurt, and cheese); 4) flesh foods (meat, fish, poultry, and liver/organ meats); 5) eggs; 6) vitamin-A-rich fruits and vegetables; and 7) other fruits and vegetables.

Minimum meal frequency is defined as proportion of breastfed and nonbreastfed children age 6-23 months who received solid, semi-solid, or soft foods (but also including milk feeds for nonbreastfed children) the minimum number of times or more. Minimum is defined as: two times for breastfed infants age 6-8 months,

three times for breastfed children age 9-23 months, or four times for nonbreastfed children age 6-23 months. "Meals" include both meals and snacks (other than trivial amounts), and frequency is based on caregiver report.

Minimum acceptable diet is defined as proportion of breastfed and nonbreastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for nonbreastfed children) the minimum number of times or more. Minimum is defined as 2 times for breastfed infants 6–8 months, 3 times for breastfed children 9–23 months, 4 times for nonbreastfed children 6–23 months.

Consumption of iron-rich foods is defined as proportion of children age 6-23 months who receive an iron-rich food, which includes meat (and organ meat), fish, poultry, and eggs.

Currently breastfed is defined as children age 6-23 months still being breastfed.

2.2.3 Covariates

As the conceptual framework shows, this analysis considered characteristics of the child, the mother, and the household. Child's characteristics included age, sex, mother's perception of birth size, birth order, immunization, deworming treatment, and vitamin A supplementation in the last six weeks before interview, and fever and diarrhea in the last two weeks before interview. Maternal characteristics included age, height, education, employment, number of ANC visits, birth interval, and maternal anemia (<11 g/dl). Household characteristics included place of residence, region, family size, and household wealth status.

2.3 Statistical Analysis

We described background characteristics, including prevalence of stunting, moderate anemia and IYCF practices of the sample, using descriptive statistics as well as graphically. We used Pearson's chi-square test to assess association between dependent and independent variables separately for all the factors. We assessed the association of IYCF practices with stunting and moderate anemia using multiple logistic regression analysis adjusting the covariates. The results were presented using adjusted odds ratios (OR) with 95% confidence interval (CI). Multicollinearity was tested among IYCF practices, showing that minimum dietary diversity and minimum acceptable diet were highly correlated (r=0.75); hence, we removed minimum acceptable diet from the multiple logistic regression analysis.

We selected covariates that were significantly associated with outcome variables in the bivariate analysis and no collinearity with other variables. Thus in regression models, we adjusted two child's characteristics—sex and perceived birth weight; five maternal characteristics—education, employment status, height, number of ANC visits, and anemia; and two household characteristics—residence and household wealth status. We removed the region of residence variable from the analysis since we are not concerned with regional variation, and also removed deworming. Maternal age was removed due to collinearity (r=0.51) with household wealth status. We adjusted all these covariates in logistic regression analyses of dependent variables.

While we adjusted each analysis that involved a hypothesis testing for the design effect using a predefined parameter established as a function of PSU, strata, and sampling weights, we took into account sampling

weight for frequency and percentage estimations for adjusting representativeness and nonresponse. We carried out all analyses on STATA (v.15.1), and p value <0.05 was set as a statistical significance.

3 RESULTS

3.1 Background Characteristics

The analysis included a total of 1,222 children age 6-23 months. Table 1 shows that 37% were age 12-17 months, 54% were male, 12% were below average in perceived birth size, and 36% were firstborn. Regarding immunization, only 31% completed full immunization at their age. Forty-nine percent of children received vitamin A supplementation and 22% received drugs for intestinal parasites in the last six months before interview. Previous history of fever was found in 22% of children, and diarrhea had occurred in 16% of children in the last two weeks before interview. Among the mothers, about half were age 20-29, 15% had no formal education, 59% were employed, 31% were short-statured (<150 cm), 10% did not receive ANC, 12% delivered their last child with a <24 months birth interval, and 46% were anemic. By characteristics of the household, 75% of the children resided in rural areas. About half of the children were from four states/regions—15% from Shan State, 14% from Ayeyarwady Region, 12% from Yangon Region, and 11% from Mandalay Region. Only 32% of children were from large families of more than six members. Nearly half of children were from poor families (Table 1).

Table 1 Percent distribution of children age 6-23 months by child, mother, and household characteristics

Variables	Number	Percent
Child's characteristics		
Age in months		
6-11	399	32.6
12-17	454	37.2
18-23	369	30.2
Sex		
Male	658	53.9
Female	564	46.1
Perceived birth size*		
Average and above	1,033	87.7
Below average	145	12.3
Birth order		
1st child	434	35.5
2nd child	340	27.9
3rd child	186	15.2
4th and above	262	21.4
Immunization status		
No/not complete immunization	839	68.7
Complete immunization	383	31.3
Vitamin A received in last 6 months		
Not received	619	50.7
Received	603	49.3
Deworming in last 6 months		
No or don't know	957	78.3
Yes	265	21.7

Continued…

Table 1—*Continued*

Variables	Number	Percent
Fever in last two weeks		
No	956	78.2
Yes	266	21.8
Diarrhea in last two weeks		
No	1,025	83.9
Yes	197	16.1
Maternal characteristics		
Age of mothers (years)		
Less than 20	45	3.7
20-29	600	49.1
30-39	492	40.2
40-47	85	7.0
Mother's educational level		
No education	184	15.1
Primary	547	44.7
Secondary	392	32.1
Higher	99	8.1
Mother's employment status		
Not working	504	41.4
Working	714	58.6
Mother's height		
< 150 cm	373	31.0
150-159 cm	739	61.4
≥ 160 cm	91	7.6
Number of AN visits		
None	121	10.0
1-3	363	30.1
4 +	724	59.9
Birth interval group		
≥24 months	690	88.3
<24 months	92	11.7
Maternal anemia (<11 g/dl)		
No	642	54.1
Yes	545	45.9
Household characteristics		
Place of residence		
Urban	310	25.4
Rural	912	74.6
Region of residence		
Kachin	37	3.1
Kayah	10	0.8
Kayin	47	3.9
Chin	16	1.3
Sagaing	119	9.7

Continued…

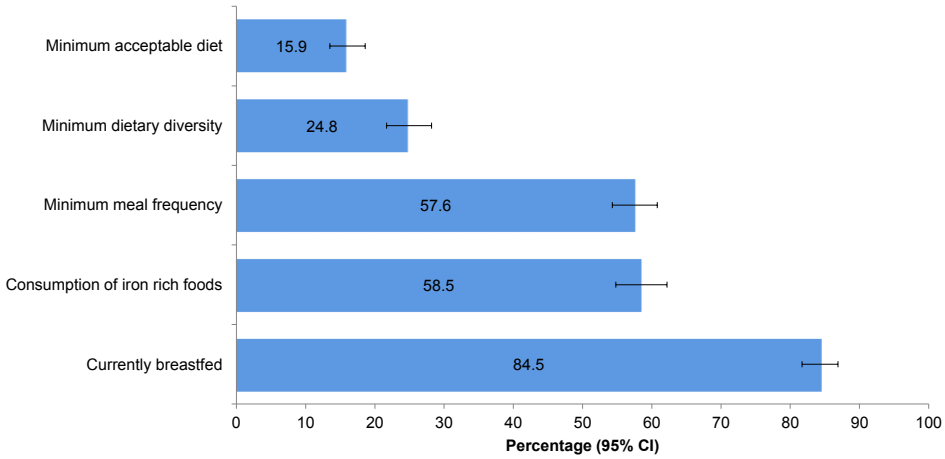
Table 1—*Continued*

Variables	Number	Percent
Tanintharyi	34	2.8
Bago	105	8.6
Magway	83	6.8
Mandalay	133	10.9
Mon	38	3.1
Rakhine	86	7.1
Yangon	143	11.7
Shan	180	14.7
Ayeyarwady	168	13.7
Nay Pyi Taw	23	1.8
Family members		
< 5	361	29.5
5-6	475	38.9
>6	386	31.6
Wealth Index		
Poorest	327	26.8
Poorer	271	22.2
Middle	211	17.2
Richer	215	17.6
Richest	198	16.2
Total	**1,222**	100.0

3.2 Prevalence of Infant and Young Child Feeding Practices among Children Age 6-23 Months

Figure 2 shows the prevalence of IYCF practices. Most children age 6-23 months (85%) were still being breastfed, and 25% of children achieved minimum dietary diversity (at least four food groups). The percentage of children who achieved minimum required meal frequency was 58%, while only 16% achieved a minimum acceptable diet (apart from breast milk). Finally, 59% of children were fed iron-rich foods in the last 24 hours.

Figure 2 Prevalence of infant and young child feeding practices among children age 6-23 months



3.3 Prevalence of Stunting and Differentials by Infant and Young Child Feeding Practices and Child, Maternal, and Household Characteristics

As Figure 3 shows, prevalence of stunting among children age 6-23 months was 20%. Figure 4 shows the prevalence of stunting by IYCF practices. Stunting was more prevalent in children who were not currently breastfed compared with those who were currently breastfed (30% versus 19%). However, stunting prevalence was higher in children who received minimum meal frequency compared with those who did not (23% versus 17%). The other IYCF practices were not significantly different in prevalence of stunting.

Table 2 shows results from bivariate analysis between stunting and other covariates. Stunting was more prevalent in older than younger children, male than female children, and children below average perceived birth size compared with children of average and above perceived birth size. However, stunting was inversely associated with vitamin A supplementation. Stunting was also more common in children whose mothers were less educated, of short stature (<150 cm), and employed. Stunting was significantly associated with place of residence, region of residence, and wealth index.

Figure 3 Prevalence of stunting and moderate anemia (<10 mg/dl) among children age 6-23 months

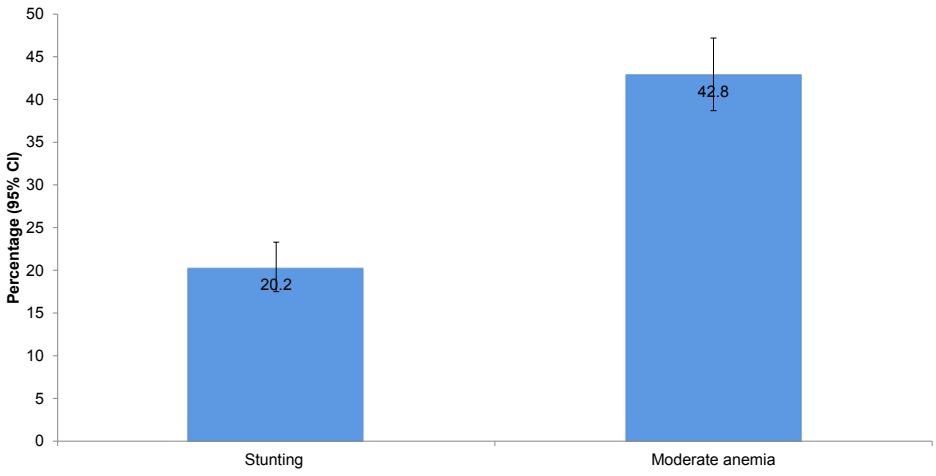


Figure 4 **Prevalence of stunting by infant and young child feeding practices among children age 6-23 months**

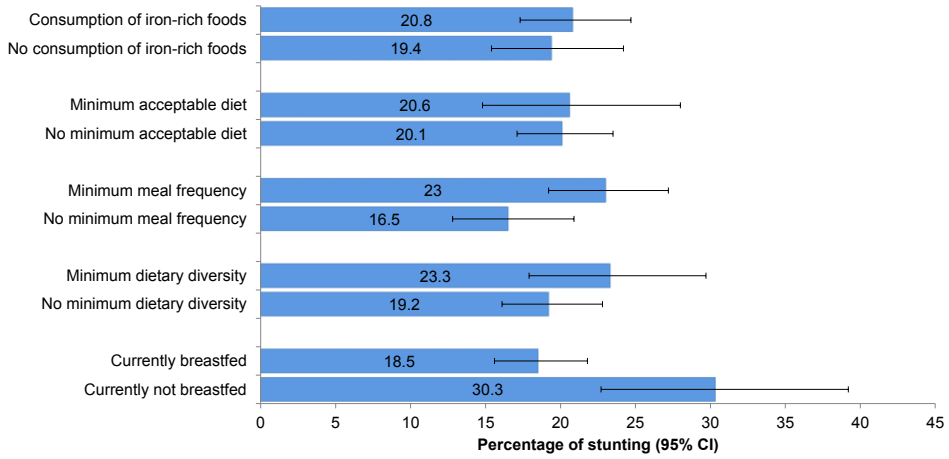


Figure 5 **Prevalence of moderate anemia by infant and young child feeding practices among children age 6-23 months**

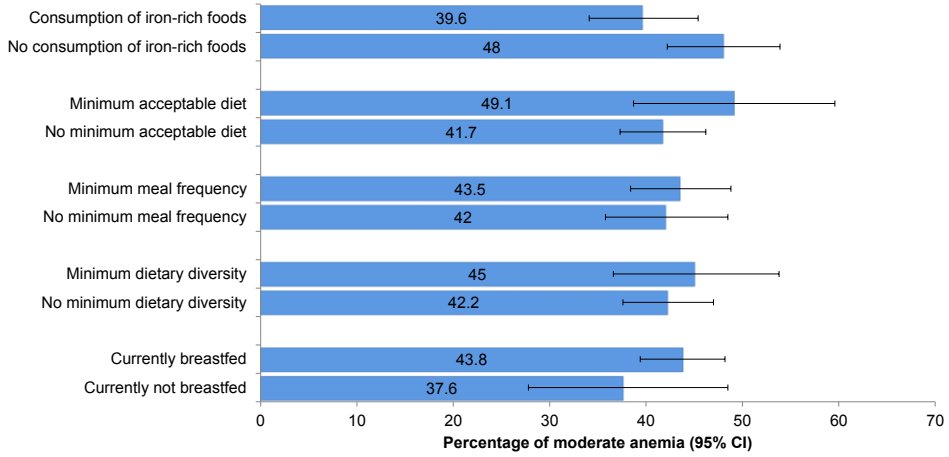


Table 2 Prevalence of stunting and moderate anemia among children age 6-23 months by child, maternal, and household characteristics

	Stunting			Moderate anemia		
	%	CI	p value	%	CI	p value
Child's characteristics						
Age			<0.001			0.318
6-11 months	14.2	[10.5,18.8]		42.8	[36.4,49.4]	
12-17 months	15.8	[12.0,20.6]		46.0	[39.9,52.1]	
18-23 months	32.1	[26.3,38.4]		39.3	[32.3,46.7]	
Sex			<0.001			0.001
Male	26.0	[21.8,30.6]		48.9	[43.6,54.2]	
Female	13.7	[10.5,17.7]		36.1	[30.3,42.4]	
Perceived birth size			<0.001			0.850
Average and above	18.1	[15.2,21.5]		42.8	[38.3,47.3]	
Below average	33.4	[25.3,42.6]		43.9	[33.0,55.4]	
Birth order			0.139			0.774
1st child	17.8	[13.7,22.7]		44.9	[38.2,51.7]	
2nd child	19.0	[14.4,24.7]		43.2	[36.1,50.6]	
3rd child	18.8	[12.2,27.8]		40.3	[31.9,49.4]	
4th and above	26.6	[20.6,33.7]		40.7	[33.9,47.9]	
Immunization status			0.109			0.917
No/not complete immunization	21.7	[18.5,25.3]		42.7	[38.2,47.4]	
Complete immunization	16.9	[12.7,22.2]		43.2	[35.9,50.7]	
Vitamin A in last 6 months			0.008			0.241
Not received/not known	16.3	[12.9,20.4]		45.1	[39.8,50.6]	
Received	24.2	[20.1,28.8]		40.7	[35.1,46.6]	
Deworming in last 6 months			0.099			0.692
No or don't know	18.8	[15.8,22.2]		43.3	[38.7,48.0]	
Yes	25.4	[18.7,33.5]		41.5	[33.4,50.0]	
Fever in last two weeks			0.635			0.572
No	20.6	[17.5,24.0]		43.4	[38.8,48.2]	
Yes	18.8	[13.3,26.0]		41.0	[33.6,48.9]	
Diarrhea in last two weeks			0.351			0.336
No	20.8	[17.7,24.2]		42.0	[37.3,46.9]	
Yes	17.2	[11.6,24.7]		47.3	[38.0,56.7]	
Maternal characteristics						
Age of mothers (years)			0.138			0.284
Under 20	31.1	[16.9,50.0]		36.8	[21.4,55.4]	
20-29	17.3	[13.9,21.2]		46.3	[40.4,52.4]	
30-39	22.6	[18.1,27.8]		39.7	[33.8,45.9]	
40-47	21.6	[13.2,33.3]		38.6	[26.5,52.2]	
Mother's educational level			<0.001			0.667
No education	31.6	[24.4,39.8]		41.5	[31.2,52.6]	
Primary	22.2	[18.0,27.1]		44.6	[39.0,50.3]	
Secondary	12.4	[8.9,17.0]		39.9	[33.4,46.8]	
Higher	18.8	[10.9,30.2]		46.5	[33.2,60.4]	

Continued…

Table 2—*Continued*

	Stunting			Moderate anemia		
	%	CI	p value	%	CI	p value
Mother's employment status			<0.001			0.739
Not working	14.2	[10.8,18.3]		43.6	[37.6,49.7]	
Working	24.7	[20.8,29.1]		42.3	[37.1,47.7]	
Mother's height			<0.001			0.910
< 150 cm	30.7	[24.8,37.3]		43.9	[37.3,50.7]	
150 - 159 cm	15.8	[12.7,19.5]		42.3	[37.0,47.7]	
≥ 160 cm	13.3	[7.0,23.9]		44.1	[30.5,58.7]	
Number of ANC visits			0.079			0.025
None	20.9	[13.6,30.5]		28.2	[20.5,37.3]	
1-3	24.4	[19.3,30.5]		45.2	[38.3,52.4]	
4 +	17.5	[14.2,21.4]		43.1	[38.1,48.4]	
Birth interval group			0.136			0.509
>=24 months	20.4	[16.7,24.6]		42.0	[37.1,47.1]	
<24 months	29.2	[18.9,42.2]		37.2	[25.5,50.7]	
Maternal anemia (<11 g/dl)			0.647			<0.001
No	19.9	[16.5,23.8]		36.0	[30.9,41.4]	
Yes	21.1	[17.2,25.6]		50.7	[44.9,56.5]	
Household characteristics						
Place of residence			<0.001			0.421
Urban	10.4	[7.0,15.3]		39.8	[31.4,48.7]	
Rural	23.4	[20.1,27.0]		43.9	[39.1,48.8]	
Region of residence			0.002			0.053
Kachin	15.0	[8.9,24.2]		45.7	[33.8,58.0]	
Kayah	32.7	[23.8,43.1]		36.6	[27.9,46.3]	
Kayin	14.1	[8.2,23.2]		37.2	[28.5,46.9]	
Chin	27.9	[20.5,36.8]		39.7	[30.9,49.2]	
Sagaing	21.4	[13.3,32.6]		47.7	[34.3,61.4]	
Tanintharyi	11.4	[4.9,24.1]		38.6	[30.2,47.8]	
Bago	9.2	[4.3,18.9]		39.3	[26.4,53.8]	
Magway	14.8	[6.2,31.5]		58.1	[44.6,70.4]	
Mandalay	25.1	[15.4,38.2]		33.1	[21.6,47.0]	
Mon	18.5	[10.3,30.9]		49.0	[36.1,62.1]	
Rakhine	20.8	[14.5,28.8]		52.4	[38.0,66.4]	
Yangon	9.5	[4.6,18.8]		41.4	[28.2,55.9]	
Shan	29.7	[20.4,41.1]		23.4	[13.5,37.5]	
Ayeyarwady	30.7	[22.4,40.5]		49.2	[35.6,62.9]	
Nay Pyi Taw	13.9	[8.0,23.0]		50.7	[30.1,71.1]	
Family members			0.084			0.198
< 5	15.7	[11.9,20.6]		45.0	[37.5,52.8]	
5-6	22.3	[18.1,27.2]		38.5	[33.1,44.2]	
>6	21.9	[17.2,27.3]		46.2	[38.9,53.6]	

Continued…

Table 2—*Continued*

	Stunting			Moderate anemia		
	%	CI	p value	%	CI	p value
Wealth Index			0.023			0.378
Poorest	26.3	[20.8,32.7]		43.8	[35.8,52.1]	
Poorer	20.7	[15.4,27.1]		42.6	[35.1,50.5]	
Middle	21.5	[16.1,28.1]		50.0	[40.5,59.5]	
Richer	13.2	[8.3,20.4]		40.7	[32.2,49.9]	
Richest	14.9	[9.3,23.1]		35.7	[25.6,47.2]	
Total	**20.2**	**[17.5,23.3]**		**42.8**	**[38.7,47.2]**	

3.4 Prevalence of Moderate Anemia and Differentials by Infant and Young Child Feeding Practices and Child, Mother, and Household Characteristics

The prevalence of moderate anemia among children age 6-23 months was 43% (Figure 3). Figure 5 shows the prevalence of moderate anemia by IYCF practices. The prevalence of moderate anemia was higher in children who had not received iron-rich foods compared with those who had (48% versus 40%). Other IYCF practices were not associated with moderate anemia.

Table 2 presents results of bivariate analysis between moderate anemia and other covariates. Among child characteristics, only gender was significantly associated with moderate anemia—male children were more likely than female children to be anemic. By maternal characteristics, children of anemic mothers were more likely to be anemic than children of non-anemic mothers, while children whose mothers had made no ANC visits had lower prevalence of anemia than those whose mothers had made either two or three ANC visits, or the recommended four or more visits.

3.5 Adjusted Multiple Logistic Regressions: Stunting

Table 3 shows results of the adjusted multiple logistic regressions for stunting. The odds of stunting among currently breastfed children were 47% lower than for nonbreastfed children (aOR=0.53; 95%CI 0.31, 0.90). Apart from this, no other IYCF practices were significantly associated with stunting. Among covariates, female children were less likely to be stunted than male children (aOR=0.46; 95%CI 0.30, 0.71). Children with less than average perceived birth size had higher odds of stunting compared with children with average or above birth size (aOR=2.48; 95%CI 1.50, 4.09). Children of working mothers were more likely to be stunted (aOR=1.97; 95%CI 1.32, 2.95). Children of mothers whose height was greater than or equal to 150 cm had lower odds of stunting compared with children of mothers with height less than 150 cm (aOR=0.43; 95%CI 0.28, 0.67 for mother's height 150–159 cm) (aOR=0.40; 95%CI 0.17, 0.93 for mother's height ≥ 160 cm). Moreover, children from rural areas were more likely to be stunted compared with urban children (aOR=2.01; 95%CI 1.11, 3.65).

Table 3 **Association between IYCF practices and nutritional status (stunting and moderate anemia) among children age 6-23 months after adjusting for covariates**

	Stunting		Moderate anemia	
Variables	**AOR**	**95% CI**	**AOR**	**95% CI**
IYCF variables				
Currently breastfed				
No	1.00		1.00	
Yes	0.53*	0.31 - 0.90	1.24	0.77 - 1.99
Minimum dietary diversity				
No	1.00		1.00	
Yes	0.91	0.56 - 1.48	1.36	0.87 - 2.11
Minimum meal frequency				
No	1.00		1.00	
Yes	1.42	0.91 - 2.23	1.13	0.80 - 1.60
Consumption of iron-rich foods				
No	1.00		1.00	
Yes	1.17	0.72 - 1.91	0.67*	0.47 - 0.97
Child's characteristics				
Sex of child				
Male	1.00		1.00	
Female	0.46***	0.30 - 0.71	0.63**	0.45 - 0.87
Perceived birth weight				
Average and above	1.00		1.00	
Below average	2.48***	1.50 - 4.09	1.06	0.64 - 1.76
Maternal characteristics				
Maternal education				
No education	1.00		1.00	
Primary	0.73	0.43 - 1.25	0.88	0.53 - 1.48
Secondary	0.52	0.26 - 1.03	0.84	0.47 - 1.49
Higher	1.12	0.41 - 3.03	1.06	0.44 - 2.53
Mother's employment status				
Not working	1.00		1.00	
Working	1.97***	1.32 - 2.95	0.97	0.69 - 1.36
Mother's height				
<150 cm	1.00		1.00	
150-159 cm	0.43***	0.28 - 0.67	1.09	0.76 - 1.55
≥ 160 cm	0.40*	0.17 - 0.93	1.31	0.65 - 2.60

Continued…

Table 3—*Continued*

	Stunting		Moderate anemia	
Variables	**AOR**	**95% CI**	**AOR**	**95% CI**
Number of ANC visits				
None	1.00		1.00	
1-3 times	1.44	0.78 - 2.64	2.28**	1.22 - 4.28
At least 4 times	1.32	0.66 - 2.64	2.37**	1.27 - 4.43
Maternal anemia (<11 mg/dl)				
No	1.00		1.00	
Yes	1.03	0.72 - 1.48	1.72**	1.25 - 2.36
Household characteristics				
Residence				
Urban	1.00		1.00	
Rural	2.01*	1.11 - 3.65	0.99	0.59 - 1.67
Wealth index				
Poorest	1.00		1.00	
Poorer	0.83	0.51 - 1.35	0.83	0.51 - 1.37
Middle	0.82	0.46 - 1.46	1.14	0.66 - 1.97
Richer	0.60	0.29 - 1.22	0.80	0.47 - 1.38
Richest	0.74	0.32 - 1.73	0.55	0.25 - 1.22

AOR = adjusted odds ratio, ***p<0.001, **p<0.01, *p<0.05

3.6 Adjusted Multiple Logistic Regressions: Anemia

Table 3 also shows the results of the adjusted multiple logistic regressions for moderate anemia. The consumption of iron-rich foods was the only IYCF practice significantly associated with moderate anemia. The odds of moderate anemia among children who consumed iron-rich foods were 33% lower than those of children who did not consume them (aOR=0.67; 95%CI 0.47, 0.97). Similar to stunting, moderate anemia was significantly associated with gender—female children were less likely to be anemic than male children (aOR=0.63; 95%CI 0.45, 0.87). Maternal anemia was also associated with childhood anemia. The odds of moderate anemia among children of anemic mothers were 1.72 times higher than the odds among those of non-anemic mothers (aOR=1.72; 95%CI 1.25, 2.36). However, the odds were higher among children of mothers who attended four or more ANC visits (aOR=2.37; 95%CI 1.27, 4.43) and 1-3 ANC visits (aOR=2.28; 95%CI 1.22, 4.28) compared with those of mothers who attended no ANC visits.

4 DISCUSSION

This study examined the prevalence of stunting, moderate anemia, and IYCF practices among children age 6-23 months, and the association of IYCF practices with stunting and anemia. The findings show that stunting and anemia are public health problems in Myanmar, with 20% of children age 6-23 months stunted and 43% moderately anemic. Prevalence of all IYCF practices is low apart from breastfeeding, with less than a fifth of children receiving a minimum acceptable diet and less than half receiving adequate meal frequency and iron-rich food consumption. Three-fourths of children have a diverse diet. The prevalence of stunting and anemia varies by background characteristics of children, mothers, and households. Stunting varies greatly among regions, from 9% to 32%. Children from rural and poor families are more likely to be stunted. As children's age increases, the prevalence of stunting also increases, and stunting is more common among male than female children. Stunting is also more common among children of mothers who are of short stature and mothers who are employed. Childhood anemia also varies by region, from 21% to 58%, but does not vary much by place of residence or wealth index. Similar to stunting, anemia is also more prevalent among male than female children. Maternal anemia is significantly associated with childhood anemia. Among IYCF practices, regression analysis showed that breastfeeding is significantly associated with lower odds of stunting, while consumption of iron-rich foods is inversely associated with childhood anemia.

The national estimate of stunting in Myanmar among children under age 5 is 29% (MOHS and ICF 2017). Among those under age 2, a recent review of 137 developing countries reported a prevalence of stunting of 36% (Danaei et al. 2016), which is above the 20% prevalence reported in our study. A recent study in the Ayeyarwady region of Myanmar reported that stunting among children age 12-23 months was 35% (Hlaing et al. 2017), which is close to our regional estimate of stunting in Ayeyarwady (30%), and is consistent with regional variations in stunting prevalence. Our study found that stunting is more prevalent in rural areas, among poor families, male children, children of small birth size, children of short stature, and children with working mothers. These findings are consistent with the findings of a study conducted in Ghana in 2011, which had found that child characteristics such as age, gender, reported size at childbirth, breastfeeding status, having diarrhea or fever in the preceding two weeks; household characteristics such as number of children in the household, child health insurance status, household wealth, ethnicity, religion and region were risk factors for undernutrition (Miah, Apanga, and Abdul-Haq 2016). In our study, children still being breastfed were less likely to be stunted. Apart from this, other IYCF practices are not associated with stunting.

Our findings are not consistent with other studies in the region. A study in Bangladesh on IYCF practice among children age 0-23 months found that children fed with adequate dietary diverse foods were negatively associated with stunting (Zongrone, Winskell, and Menon 2012). Another study in India reported that children who were not fed minimum meal frequency had 63% higher odds of being stunted, and that lower consumption of eggs was associated with increased odds of stunting in children age 6-23 months (Aguayo et al. 2016). In contrast, another study in Sri Lanka stated that dietary diversity was not significantly associated with any anthropometric failure among children age 6-23 months (Perkins, Jayatissa, and Subramanian 2018). Our study found a protective effect of breastfeeding on stunting, which might be due to the immune correlates found in the breast milk or to the fact that breast milk may reduce exposure to other environmental pathogens. Compared with nonbreastfed children, breastfed children could

be more likely to avoid the occurrence of diarrhea and respiratory infections and as a result could avert hospital admission (Victora et al. 2016).

For anemia, our estimates for children age 6-23 months (76% for all anemia and 43% for moderate anemia) are higher than regional WHO estimates for any anemia among children age 6-59 months (WHO 2015a). However, our estimates are lower than in the study in Myanmar by Hlaing and colleagues, which found any anemia prevalence among children age 1-2 to be 88% (Hlaing et al. 2015). A global review of anemia reported that anemia prevalence is highest among children under age 1 followed by age 1-4 compared with other age categories. Moreover this trend did not change favorably from 1990 to 2010 (Kassebaum et al. 2014). Our study shows that the prevalence of anemia among children who consumed iron-rich foods is significantly lower than that of children who did not consume them. Moreover, mothers who attended four or more ANC visits also fed their children more iron-rich foods (Appendix A).

These findings are not consistent with a Bangladesh study of anemia among children age 6-11 months and feeding practices, which showed that there was no association between anemia and previous-day consumption of iron-rich food and consumption of a minimum acceptable diet (Rawat et al. 2014). Another study in Laos found no association between anemia and breastfeeding (Kounnavong et al. 2011). The possible reason for the finding of no association of IYCF practices with stunting and moderate anemia in our study is that the DHS survey asked about feeding practices in the last 24 hours before interview and assumed it to be the usual dietary pattern. However, it might not be representative for all children because food consumption might vary day by day (Krasevec et al. 2017). Although IYCF indicators are simple and effective in assessing complementary feeding practices for large-scale surveys, the level of sensitivity and specificity of these indicators on dietary quality should be considered in assessing association of IYCF with the linear growth of children (Jones et al. 2014).

Although a study conducted in Myanmar stated that iron deficiency was the main cause of anemia, the biomarkers recommended by WHO for iron status in populations were not used in their study (Hlaing et al. 2015). Our study could not provide the evidence of low iron levels among children with anemia, as the DHS does not collect biomarkers for iron status. Hence further research is needed to explore the main causes of anemia. Our study also found higher prevalence of childhood anemia among children of mothers who attended either one to three ANC visits or four and more compared with mothers with no ANC visits. This association might be because the DHS survey was cross-sectional, and in our analysis we were unable to control all possible confounders and their mediation. The association of ANC visits with childhood anemia may have been more indirect than direct, since anemia was not assessed directly after birth but rather when the child was older. Another possibility is that women who make more ANC visits are women who may also be more anemic themselves.

IYCF practices of Myanmar are poor among South/Southeast Asian countries. Regionally, Myanmar's IYCF practices of minimum meal frequency, diverse food consumption, and minimum acceptable diet are lower than in Nepal, Cambodia, and Indonesia, and more or less similar to Pakistan, Afghanistan, and Bangladesh. Iron-rich food consumption in Myanmar is lower than in Cambodia and Indonesia but higher than in Bangladesh, Nepal, and India (International Institute for Population Sciences India and ICF International 2017; Ministry of Health Nepal and ICF 2017; Ministry of Public Health (MOPH) and ICF 2017; National Institute of Population Research and Training (NIPORT) and ICF 2016; National Institute of Population Studies (NIPS) [Pakistan] and ICF 2013; National Institute of Statistics and ICF 2015;

National Population and Family Planning Board (BKKBN) and ICF 2013). Many factors influence IYCF practices. Among them, maternal characteristics of education and ANC visits were found to be far more important than other household variables such as family size, wealth index, and child characteristics. The study found that the higher the level of maternal education, the better the IYCF practices. Similarly, IYCF practices among mothers who attended four or more ANC visits were better than among mothers who attended fewer than four ANC visits. Details are presented in Appendix A. Hence improving female education and offering universal ANC services accompanied with community-based nutritional education could be an alternative way to improve IYCF practices.

Strengths and Limitations

This study was the first to assess the association between IYCF practices and nutritional status of children age 6-23 months at the national level in Myanmar. The study findings are nationally representative. All the analyses accounted for the cluster survey design, and the regression results were presented after adjusting the covariates. As the 2015-16 Myanmar DHS is a cross-sectional study, our study cannot make any claims about the causality of the associations. Although IYCF practices were assessed by asking mothers about the types of liquids and foods the child consumed during the previous day or night (last 24 hours) before interview, respondent recall and reporting bias could have possibly influenced the results. We assumed that the practices reported by mothers are more or less the same throughout the children's life and assessed their association with stunting and anemia. Hence, if the reported practices and actual practice were different, it would influence the study's findings. All of the IYCF practices were calculated by combining information from more than one variable; as a result, the practices will be under- or over-estimated depending on the accuracy of the reported practices.

5 CONCLUSIONS

The study found that among every five children age 6-23 months one was stunted and two were moderately anemic. Only half of children received minimum meal frequency, only one-fourth ate diverse food groups, fewer than one out of five had minimum acceptable diet and fewer than half received iron-rich foods. About 85% children were still being breastfed and this practice was significantly associated with lower odds of stunting. Place of residence, child's sex, perceived birth size, mother's height, and employment status were also significant predictors of stunting. All IYCF practices studied were not associated with moderate anemia except for iron-rich food consumption, which was inversely associated with moderate anemia. Among covariates, child's sex and maternal anemia were also significant predictors of moderate anemia.

The study concluded that stunting and anemia among children age 6-23 months in Myanmar are major public health challenges that require urgent action. Children should be fed with diverse food groups including iron-rich foods according to WHO complementary feeding guidelines. Continued breastfeeding to age 2 and beyond should also be promoted. Since stunting begins in the prenatal period, nutritional promotion for pregnant mothers and early and regular ANC visits should be encouraged. While further prospective research is needed to determine the effect of feeding practice on linear growth, interventions such as iron supplementation, deworming, and nutritional education programs could help prevent stunting and childhood anemia and might reduce their prevalence in Myanmar.

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APPENDIX

Appendix Table A **Prevalence of infant and young child feeding practices by child, maternal, and household characteristics**

	Currently breastfed			Minimum dietary diversity			Minimum meal frequency			Minimum acceptable diet			Iron-rich or iron-fortified food			
	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	Total
Child's characteristics																
Age			<0.001			<0.001			0.051			0.004			<0.001	
6-11 months	97.0	[94.6,98.4]		12.6	[9.0,17.2]		55.1	[50.0,60.0]		9.9	[6.7,14.4]		37.4	[31.9,43.2]		399
12-17 months	87.1	[82.5,90.6]		27.8	[22.9,33.3]		55.1	[49.9,60.3]		19.2	[15.1,24.1]		65.5	[59.7,70.9]		454
18-23 months	67.9	[61.4,73.7]		34.2	[28.8,40.0]		63.3	[57.2,69.0]		18.1	[14.1,22.9]		72.6	[67.2,77.4]		369
Sex			0.087			0.022			0.550			0.736			0.704	
Male	82.7	[79.0,85.9]		27.8	[23.4,32.8]		56.7	[51.9,61.3]		16.2	[13.1,19.9]		59.1	[54.3,63.7]		658
Female	86.6	[82.9,89.6]		21.2	[17.6,25.3]		58.7	[54.1,63.1]		15.4	[12.2,19.3]		57.8	[52.7,62.9]		564
Perceived birth size			0.937			0.423			0.758			0.153			0.041	
Average and above	84.1	[81.1,86.8]		25.5	[22.2,29.0]		57.9	[54.1,61.5]		16.6	[14.0,19.6]		59.7	[55.7,63.5]		1,034
Below average	83.9	[75.7,89.6]		22.0	[15.1,31.1]		56.3	[46.8,65.3]		11.0	[6.1,18.9]		49.6	[40.3,58.8]		145
Birth order			0.215			0.031			0.572			0.060			0.008	
1st child	81.7	[76.8,85.8]		28.8	[23.8,34.4]		57.0	[51.8,61.9]		19.7	[15.4,24.7]		64.5	[59.0,69.6]		434
2nd child	87.5	[82.5,91.2]		25.2	[20.3,30.7]		58.7	[52.3,64.8]		15.7	[11.7,20.7]		58.8	[52.2,65.1]		340
3rd child	82.6	[74.4,88.5]		24.8	[18.4,32.6]		61.6	[53.4,69.2]		13.7	[8.9,20.5]		56.8	[48.5,64.8]		186
4th and above	86.6	[81.6,90.5]		17.6	[12.8,23.7]		54.3	[47.1,61.4]		11.2	[7.7,16.1]		49.3	[42.0,56.7]		262
Immunization status			0.373			0.285			0.249			0.432			0.105	
No/not complete immunization	83.7	[80.2,86.6]		23.7	[20.1,27.8]		56.2	[52.4,60.0]		15.2	[12.5,18.3]		56.7	[52.5,60.9]		839
Complete immunization	86.4	[81.1,90.4]		27.1	[22.1,32.8]		60.6	[54.2,66.7]		17.4	[13.0,22.8]		62.4	[56.2,68.2]		383
Vitamin A in last 6 months			0.007			0.012			0.021			0.033			<0.001	
Not received/not known	88.0	[84.3,90.9]		20.8	[16.7,25.6]		53.7	[48.9,58.5]		13.2	[10.2,16.8]		51.7	[46.3,57.1]		619
Received	81.0	[76.7,84.6]		28.9	[24.6,33.5]		61.6	[57.0,65.9]		18.6	[15.1,22.8]		65.5	[60.9,69.8]		603
Deworming in last 6 months			0.005			<0.001			0.133			0.002			<0.001	
No or don't know	86.5	[83.7,88.8]		22.1	[18.9,25.8]		56.2	[52.4,59.9]		14.0	[11.5,16.8]		55.3	[51.1,59.4]		957
Yes	77.5	[69.8,83.6]		34.3	[28.3,40.9]		62.8	[55.1,69.9]		22.6	[17.3,29.0]		70.1	[63.0,76.3]		265
Fever in last two weeks			0.004			0.588			0.975			0.720			0.560	
No	82.8	[79.4,85.7]		25.2	[21.6,29.2]		57.6	[53.9,61.2]		15.6	[13.0,18.6]		58.0	[53.8,62.1]		956
Yes	90.7	[86.3,93.8]		23.3	[18.1,29.4]		57.7	[51.4,63.8]		16.6	[12.2,22.2]		60.3	[53.2,67.1]		266

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Appendix Table A—*Continued*

	Currently breastfed			Minimum dietary diversity			Minimum meal frequency			Minimum acceptable diet			Iron-rich or iron-fortified food			
	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	Total
Diarrhea in last two weeks			0.431			0.184			0.744			0.405			0.852	
No	84.9	[81.9,87.4]		23.9	[20.6,27.6]		57.4	[53.7,60.9]		15.4	[12.8,18.4]		58.4	[54.1,62.5]		1,025
Yes	82.7	[76.4,87.5]		29.1	[22.3,37.0]		58.8	[50.7,66.5]		18.1	[12.8,25.1]		59.2	[51.3,66.7]		197
Maternal characteristics																
Age of mothers (years)			0.104			0.313			0.302			0.549			0.005	
Under 20	74.7	[56.2,87.2]		12.1	[4.5,28.7]		56.1	[39.5,71.5]		10.3	[3.4,27.3]		37.0	[22.4,54.5]		45
20-29	82.9	[78.9,86.3]		25.4	[21.0,30.3]		54.6	[50.5,58.7]		15.3	[12.1,19.3]		62.2	[57.0,67.1]		600
30-39	87.7	[83.7,90.9]		25.8	[21.6,30.4]		60.7	[55.2,65.9]		17.5	[14.2,21.4]		58.3	[52.8,63.5]		492
40-47	82.4	[71.7,89.6]		21.6	[13.4,32.9]		61.5	[49.2,72.5]		12.9	[6.8,23.1]		45.4	[33.5,57.8]		85
Mother's educational level			0.723			<0.001			0.665			0.009			<0.001	
No education	83.6	[75.0,89.7]		15.0	[8.7,24.6]		53.2	[45.8,60.5]		9.8	[5.1,18.1]		45.2	[35.3,55.5]		185
Primary	85.9	[81.7,89.2]		21.4	[17.6,25.7]		58.1	[52.9,63.1]		13.6	[10.7,17.2]		54.1	[48.8,59.3]		547
Secondary	83.9	[79.1,87.8]		27.8	[22.9,33.3]		58.0	[52.3,63.4]		19.2	[15.2,24.0]		66.8	[61.4,71.7]		392
Higher	80.9	[70.2,88.3]		49.8	[38.2,61.4]		61.5	[48.6,72.9]		26.1	[17.5,36.9]		75.1	[62.9,84.3]		99
Mother's employment status			0.077			0.026			0.001			0.096			0.570	
Not working	87.0	[82.7,90.3]		20.7	[16.6,25.5]		50.6	[45.2,56.0]		13.3	[10.0,17.4]		57.4	[52.0,62.6]		504
Working	82.7	[79.3,85.6]		27.5	[23.4,32.0]		62.5	[58.3,66.5]		17.5	[14.4,21.1]		59.3	[54.5,64.0]		715
Mother's height			0.982			0.104			0.687			0.021			0.089	
< 150 cm	84.7	[80.1,88.4]		24.6	[19.5,30.5]		58.5	[53.1,63.8]		15.0	[11.5,19.5]		54.2	[47.7,60.5]		373
150 - 159 cm	84.3	[80.9,87.2]		23.1	[19.7,26.8]		56.3	[51.8,60.7]		14.5	[11.7,17.9]		59.4	[55.0,63.7]		739
≥ 160 cm	84.8	[73.4,91.9]		34.5	[24.2,46.5]		61.2	[48.1,72.9]		27.0	[17.8,38.9]		68.5	[55.9,78.9]		91
Number of ANC visits			0.729			0.003			0.085			<0.001			<0.001	
None	86.6	[79.0,91.8]		13.0	[7.3,22.2]		46.5	[36.6,56.7]		3.5	[1.2,9.9]		41.9	[30.8,53.8]		121
1-3	85.8	[80.6,89.8]		20.4	[15.2,26.8]		58.3	[52.2,64.0]		12.6	[8.8,17.8]		53.3	[47.4,59.1]		363
4 +	84.1	[80.5,87.2]		28.5	[24.9,32.3]		58.9	[54.7,63.1]		19.7	[16.7,23.1]		63.4	[59.1,67.5]		724
Birth interval group			0.169			0.084			0.485			0.093			0.083	
≥24 months	87.0	[83.7,89.7]		23.3	[19.8,27.2]		58.1	[53.7,62.3]		14.7	[11.9,18.0]		56.2	[51.6,60.8]		690
<24 months	81.2	[69.3,89.2]		14.8	[8.5,24.5]		53.8	[42.3,64.9]		7.1	[2.9,16.3]		45.1	[33.3,57.6]		92

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Appendix Table A—*Continued*

	Currently breastfed			Minimum dietary diversity			Minimum meal frequency			Minimum acceptable diet			Iron-rich or iron-fortified food			
	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	Total
Maternal anemia (<11 g/dl)			0.069			0.18			0.061			0.552			0.144	
No	82.3	[78.4,85.6]		26.0	[21.8,30.7]		60.4	[56.0,64.6]		16.0	[12.8,19.9]		60.9	[56.0,65.5]		642
Yes	86.9	[82.9,90.0]		22.3	[18.5,26.5]		53.7	[48.4,59.0]		14.7	[11.7,18.3]		55.6	[50.0,61.1]		545
Household characteristics																
Place of residence			0.043			0.001			0.113			0.023			0.001	
Urban	80.1	[74.3,84.9]		33.9	[27.5,40.9]		53.0	[46.3,59.6]		20.8	[15.9,26.7]		69.0	[61.7,75.5]		310
Rural	86.0	[82.8,88.7]		21.7	[18.3,25.5]		59.1	[55.3,62.9]		14.2	[11.6,17.3]		54.9	[50.6,59.2]		912
Region of residence			<0.001			<0.001			<0.001			<0.001			0.103	
Kachin	73.7	[61.4,83.1]		37.5	[26.0,50.7]		39.3	[29.4,50.1]		18.0	[10.2,29.9]		62.5	[52.4,71.6]		37
Kayah	79.2	[69.8,86.2]		21.6	[13.2,33.3]		74.1	[63.1,82.8]		14.6	[7.0,27.9]		55.0	[43.1,66.4]		10
Kayin	84.7	[74.5,91.2]		17.8	[9.9,30.0]		37.8	[27.6,49.2]		6.4	[2.7,14.1]		50.6	[40.8,60.3]		47
Chin	87.8	[81.2,92.4]		11.8	[5.4,23.7]		55.4	[46.4,64.1]		6.4	[2.3,16.5]		49.8	[36.0,63.7]		16
Sagaing	94.5	[88.2,97.5]		9.5	[5.2,16.8]		58.6	[46.0,70.2]		6.0	[2.3,14.5]		57.9	[46.6,68.4]		119
Tanintharyi	85.0	[76.1,91.0]		19.1	[12.6,27.9]		62.6	[45.8,76.8]		13.2	[7.7,21.9]		57.8	[44.2,70.3]		34
Bago	87.3	[77.5,93.2]		28.8	[20.8,38.3]		60.8	[50.4,70.3]		20.3	[13.3,29.8]		59.3	[47.6,70.1]		105
Magway	95.0	[84.3,98.5]		32.3	[22.1,44.4]		78.1	[65.6,87.0]		24.2	[15.4,36.0]		62.7	[50.2,73.6]		83
Mandalay	80.6	[68.2,89.0]		46.8	[36.3,57.6]		80.6	[71.8,87.1]		32.3	[23.5,42.5]		67.4	[55.7,77.3]		133
Mon	86.4	[70.3,94.4]		14.1	[7.2,25.7]		60.5	[43.3,75.4]		6.3	[2.6,14.9]		51.2	[40.5,61.7]		38
Rakhine	88.5	[80.1,93.6]		17.0	[10.6,26.1]		34.5	[26.6,43.4]		7.2	[3.2,15.6]		54.3	[43.7,64.4]		86
Yangon	90.2	[83.1,94.5]		14.1	[7.4,25.0]		40.5	[30.2,51.8]		11.3	[5.3,22.5]		67.6	[55.3,77.8]		143
Shan	65.7	[53.9,75.8]		30.8	[19.0,45.9]		63.4	[53.5,72.3]		17.1	[9.8,28.2]		46.2	[33.7,59.3]		180
Ayeyarwady	87.5	[77.5,93.4]		20.5	[13.9,29.3]		51.9	[41.8,61.8]		12.9	[8.2,19.7]		59.4	[47.6,70.2]		168
Nay Pyi Taw	93.9	[84.3,97.8]		41.1	[30.4,52.8]		73.0	[57.3,84.5]		36.6	[25.5,49.4]		71.4	[57.2,82.3]		22
Family members			<0.001			0.053			0.709			0.024			0.305	
< 5	90.3	[86.0,93.4]		26.5	[21.6,32.1]		56.2	[50.3,62.0]		19.9	[15.6,25.0]		58.0	[51.8,64.0]		361
5-6	85.6	[81.2,89.0]		20.4	[16.2,25.5]		59.3	[54.0,64.4]		11.4	[7.9,16.1]		56.1	[50.3,61.7]		475
>6	77.8	[72.2,82.5]		28.5	[23.1,34.6]		56.8	[50.7,62.6]		17.6	[13.5,22.6]		62.0	[56.3,67.3]		386

Continued…

Appendix Table A—*Continued*

	Currently breastfed			Minimum dietary diversity			Minimum meal frequency			Minimum acceptable diet			Iron-rich or iron-fortified food			
	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	%	CI	p value	Total
Wealth Index			0.002			<0.001			0.407			0.010			<0.001	
Poorest	88.3	[82.6,92.2]		18.5	[13.8,24.4]		54.1	[47.8,60.4]		10.8	[7.6,15.2]		51.3	[44.3,58.2]		327
Poorer	87.4	[81.7,91.5]		18.3	[13.5,24.3]		54.6	[47.8,61.2]		13.6	[9.3,19.3]		57.9	[50.8,64.7]		271
Middle	89.2	[83.0,93.3]		22.7	[17.2,29.4]		62.4	[54.5,69.6]		15.6	[11.0,21.5]		51.1	[43.5,58.6]		211
Richer	79.3	[72.7,84.6]		31.7	[24.0,40.6]		59.5	[51.4,67.1]		20.8	[14.8,28.2]		66.9	[58.4,74.4]		215
Richest	75.1	[66.2,82.2]		38.7	[30.8,47.1]		60.2	[52.0,67.9]		22.3	[16.5,29.3]		70.1	[61.7,77.3]		198
Total	**84.5**	**[81.7,86.9]**		**24.8**	**[21.7,28.2]**		**57.6**	**[54.3,60.8]**		**15.9**	**[13.5,18.6]**		**58.5**	**[54.8,62.2]**		**1,222**