PREVALENCE OF UNDERNUTRITION AND ASSOCIATED FACTORS AMONG CHILDREN 6 TO 59 MONTHS OF AGE IN REFUGEE CAMPS ALONG THAILAND-MYANMAR BORDER

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Abstract. Undernutrition remains a public health challenge among refugee children along Thailand-Myanmar border, and information on determinants of wasting and stunting is lacking. In order to identify such predictors a cross-sectional nutritional survey was conducted in nine refugee camps in 2017, involving 2,702 children 6-59 months of age. Bivariate and multivariate logistic regression analyses were employed to identify predictors. Prevalence of wasting and stunting was 2.1% and 28.8%, respectively. Low birth weight (<2,500 grams) [odds ratio (OR) = 4.7; 95% CI: 2.6-8.5] and uneducated mother (OR = 2.1; 95% CI: 1.2-3.5) were significant predictors of wasting, as was large household size (>4 people) for stunting (OR = 1.4; 95% CI: 1.1-1.7). Prevalence of childhood wasting was well below acceptable level, but stunting was moderate (per WHO criteria). Thus, it is crucial to strengthen nutrition interventions based on these predictors, especially among children with low birth weight and in families with mothers having minimal education.

Keywords: children, refugee camp, stunting, wasting, Thailand-Myanmar border

INTRODUCTION

In general, nutritional status is an important health outcome measurement among children (Rojroongwasinkul *et al*, 2013). Childhood undernutrition poses serious health and welfare challenges worldwide. Globally, an estimated 155 million children under the age of 5 years suffer from stunting and 52 million from wasting (Development Initiatives, 2017). Annually, undernutrition contributes to 45% of deaths among children under 5 years of age (Black *et al*, 2013). According to a UNICEF (2006) report, 98% of childhood mortality are reported in developing countries.

Wasting (weight-for-height <-2 z-scores) indicates acute nutritional deficiency and stunting (weight-for-height <-2 z-score) refers to a cumulative effect of poor maternal health and nutrition practices, inadequate infant and young child feeding (IYCF) practices and infection (WHO, 2014). Both wasting and stunting

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are associated with negative health outcomes in young children. For instance, stunting is associated with poor physical and cognitive development as well as low school performance in children and adolescents (Pollitt *et al*, 1993). In addition, risk of mortality increases when children are wasted and stunted at the same time (McDonald *et al*, 2013).

Several studies have shown prevalence of undernutrition as one common cause of mortality and morbidity among refugee children 6-59 months of age. For example, Bhutanese refugees living in camps in Nepal presented with 4.2% wasting and 26.9% stunting (CDC, 2014). In Ethiopia the prevalence of stunting, underweight and wasting is 27.6%, 26.1% and 8.9%, respectively (Jemal and Haidar, 2014). The important determinants of undernutrition among children under five years of age are level of parents' education, household income, sanitation practices, source of drinking water and number of siblings (Islam *et al*, 2013). Also, age of child, maternal illiteracy, uneducated parents and number of family members are potential contributors to stunting (Jemal and Haidar, 2014). The main factors related to wasting are child age, sharing and selling of food ration, duration of food ration and poor personal hygiene (Jemal and Haidar, 2014).

A previous study conducted in refugee camps along the Thailand-Myanmar border demonstrated among children 6-59 months of age, 5.7% are wasted and 45.7% stunted (Kemmer *et al*, 2003). According to a serial nutritional survey conducted biennially by The Border Consortium (TBC) and partners between 2003 and 2015 in these camps, wasting, while always at an acceptable rate of <5% (WHO, 2000), has gradually declined during this period and remained at ~2.0% since 2011; whereas the prevalence of stunting, while still considered high (>30%) (WHO, 2000) has declined 9% since 2013 and is currently at 31.8% from the latest survey (TBC, 2017).

Hence, this study was conducted to update wasting and stunting among children 6-59 months of age living in refugee camps along the Thailand-Myanmar border and identify risk factors, with the goal of applying the results to help design interventions to improve the nutritional status of these children.

MATERIALS AND METHODS

Setting and study design

This cross-sectional study was part of on-going biennial nutrition surveys conducted under the Nutrition Program of TBC from May to September 2017 in children 6-59 months of age. The study was conducted in nine refugee camps (Ban Mai Nai Soi (Site 1), Ban Mae Surin (Site 2), Mae Ra Ma Laung, Mae La Oon, Mae La, Umpiem Mai, Nu Po, Ban Don Yang, and Tham Hin) located along Thailand-Myanmar border.

All procedures were approved by Mahidol University Central Institutional Review Board (No. MU-CIRB 2017-079.1204). Prior written informed consent in Burmese and Karen languages was obtained from the parents or legal guardian of all participants.

Study population

Households with children 6-59 months of age living in the camps during the study period were randomly selected using the TBC total population database (TPD) for the sampling process. Sample size was calculated using an estimated prevalence (4% wasting and 40% stunting) and precision (2% wasting and 5% stunting) based on the 2015 nutrition survey (TBC, 2015), with a 95% confi-

dence interval (CI), a design effect of 1 plus an addition of 10% to account for non-respondents. In all, 3,905 children were recruited with complete data for 2,702 children.

Data collection

Data were collected by assistants [TBC Nutrition Field Officers (NFOs) and health agency staff (nurses, community health workers and reproductive and child health workers)] trained by TBC and supervised by TBC and senior health agency staff.

A questionnaire was developed in English, then translated into Burmese and Karen languages. Parents or caretakers were interviewed using the questionnaire in their primary language. Questionnaires were designed to obtain information on children, mothers and households. Variables on the children were age (6 to 59 months), sex, birth weight (≥2,500 - <2,500 g), length of time in camp (<2-5 years), number of meals in last 24 hours (<3 - ≥3 meals), number of times of snacks in last 24 hours (>3 - ≤3 snacks), weight-for-height z-score (normal, ≥-2.0 z-score; wasting, <-2.0 z-score), and height-for-age z-score (normal, ≥-2.0 z-score; stunting, <-2.0 z-score). Also collected were mother's schooling (attended or not attended school), number of household members (>4 - ≤4 persons), household hunger scale (HHS) (little to no household hunger or moderate to severe hunger) (Ballard *et al*, 2011), and food consumption score (FCS) (acceptable or poor/borderline) (WFP VAM, 2008). The interviews took ~45 minutes per participant and all questionnaires were checked for completeness by supervisors prior to the mother or caregiver leaving the survey location.

Anthropometric measurements

Weight was measured to the nearest 0.1 kg using a calibrated Salter spring-type hanging scale (Gujarat, India), and length/height to the nearest 0.1 cm using a height board (UNICEF, New York, United States). Length of children 6 -23 months in age was measured in a recumbent position and height of children ≥2 years of age was in an upright standing position.

Nutritional status of children was classified according to WHO growth standards and assessed using weight-for-height (<-2 z-score) and height-for-age z-scores (<-2 z-score) for wasting and stunting, respectively (WHO and UNICEF, 2009).

Statistical analysis

Descriptive statistics, including frequencies and proportions, were used to describe characteristics of participants. Bivariate and multivariate logistic regression (stepwise) models were developed, and odds ratios (ORs) were calculated to evaluate predictors associated with wasting and stunting. Statistical tests are considered significant at p-value <0.05, with 95% confidence interval (CI). All data analyses were carried out using the Statistical Package for Social Science version 18 (IBM, Armonk, NY).

RESULTS

Of the 2,702 participants, children ages ranged from 6 to 59 months, mean age of 30 ± 15 months, with 28.4% in the age range of 12 to 23 months, followed by 25.6% of 24-35 months (Table 1). The ratio of boys to girls were approximately equal. Normal birth weight accounted for 92.3% of the children, 61.7% of whom lived in refugee camps from 2 to 5 years. During the previous 24 hours 58.9% of the children consumed ≥3 meals and 66.2% consumed a snack at least three times. Wasting was found in 2.1% of the

Table 1
Characteristics of children in refugee camps along Thailand-Myanmar border, May to September 2017.

Variable	Number (%) (n = 2,702)
Age in months	
6-11	286 (10.6)
12-23	767 (28.4)
24-35	693 (25.6)
36-47	534 (19.8)
48-59	422 (15.6)
Sex	
Male	1,408 (52.1)
Female	1,294 (47.9)
Birth weight	
≥2,500 g	2,494 (92.3)
<2,500 g	208 (7.7)
Length of time in camp	
2-5 years	1,666 (61.7)
<2 years	1,036 (38.3)
Number of meals during previous 24 hours	
≥3	1,592 (58.9)
<3	1,110 (41.1)
Number of snack times during previous 24 hours	
≤3	1,790 (66.2)
>3	912 (33.8)
Weight for height z-score	
Normal (≥-2)	2,644 (97.9)
Wasting (<-2)	58 (2.1)
Height for age z-score	
Normal (≥-2)	1,924 (71.2)
Stunting (<-2)	778 (28.8)
Mother's schooling	
Attended school	2,047 (75.8)
Did not attend school	655 (24.2)
Number of people in household	
≤4	834 (30.9)
>4	1,868 (69.1)
Household hunger scale	
Little to no hunger	2,643 (97.8)
Moderate to severe hunger	59 (2.2)
Food consumption score	
Acceptable	2,660 (98.4)
Poor to borderline	42 (1.6)

participants and stunting in 28.8%.

Sixty-nine point one percent of the children had more than four family members living in their household and 75.8% of participants' mothers had attended school (Table 1). Ninety-seven point eight percent of households indicated they experienced little to no hunger and FCS was acceptable.

Bivariate analysis with individual models for each predictor of odds of wasting and stunting revealed age of child was an important predictor for stunting, while 48-59 months of age was associated with reduced odds of wasting (Table 2). Low birth weight (<2,500 g) is a significant predictor of wasting and stunting. Children who lived in refugee camps <2 years have a significant higher risk of wasting than those who had spent 2-5 years in the camps. Children of mothers who had attended school had a lower risk of wasting or stunting compared to children of mothers who had no education. A child in a household of >4 family members had 1.4 times the risk of stunting, but no association was found between number of family members and wasting. Number of meals during the previous 24 hours was inversely associated with stunting. However, among all children, there were no associations between sex, frequency of snack consumption, HHS and FCS with wasting or stunting.

Multivariate logistic regression analysis revealed although <10% of the children had low birth weight, they had 4.7 and 3.6 times greater chance of wasting and stunting, respectively (Table 3). Children 48-59 months of age had the lowest risk of wasting, whereas those of 6-11 months of age had the lowest chance of stunting. Mothers with no education posed a significant risk of rearing children with wasting but not stunting, Consuming snacks more than three times during the previous 24 hours of had a negative association with stunting but no association was found with regards to wasting. No relationships were found among other variables and children wasting or stunting condition.

DISCUSSION

This study of characteristic related to retarded growth of 2,702 children in refugee camps along Thailand-Myanmar border, during May to September 2017 shows nearly 2% and almost 30% of children under 5 years of age presented with wasting and stunting, respectively. According to WHO classification (WHO, 2000), the wasting condition determined is at an acceptable level while stunting is moderate. When compared with 2015 survey, prevalence of stunting has improved from the previous high severity condition (TBC, 2015). Multivariate logistic regression analysis, adjusted for all variables, revealed low birth weight was a predictor of wasting and stunting, while mother who had not attended school and large household size is predictor of wasting and stunting, respectively.

The prevalence of wasting among children was much lower than that in previous reports from South Asia, *eg* 19.1% in Bangladesh (Ali *et al*, 2013), 25.7% in Nepal (Ruwali, 2011), and 42% in India (Sengupta *et al*, 2010), and from Africa, *eg* 2.6% in Kenya (Olack *et al*, 2011), 3.9% in Nigeria (Aliyu *et al*, 2012) and 4.9% in Ethiopia (Asres and Eidelman, 2011). Similarly, prevalence of stunting from this study was lower than previous reports in Nepal (41%) (Osei *et al*, 2010) and Kenya (47%) (Olack *et al*, 2011). This might be partially explained by the acceptable household food status as evidenced by

Table 2
Bivariate logistic regression of predictors associated with undernutrition among children in refugee camps along Thailand-Myanmar border, May to September 2017.

Predictor	Wasting (weight for height <-2 z-score)			Stunting (height for age <-2 z-score)		
	Number (n = 58)	OR (95% CI)	p-value*	Number (n=778)	OR (95% CI)	p-value*
Age in months						
6-11	2	1		37	1	
12-23	11	1.0 (0.5-2.3)	0.951	200	2.4 (1.6-3.5)	<0.001
24-35	15	0.8 (0.3-1.8)	0.553	126	3.5 (2.4-5.0)	<0.001
36-47	8	0.7 (0.3-1.8)	0.505	180	3.4 (2.3-5.0)	<0.001
48-59	22	0.2 (0.0-0.8)	0.024	235	2.9 (1.9-4.3)	<0.001
Sex						
Male	34	1		417	1	
Female	24	0.8 (0.5-1.3)	0.317	361	0.9 (0.8-1.1)	0.324
Birth weight						
≥2,500 g	42	1		663	1	
<2,500 g	16	4.9 (2.7-8.8)	<0.001	115	3.4 (2.6-4.6)	<0.001
Length of time in camp						
2-5 years	28	1		536	1	
<2 years	30	1.7 (1.0-2.9)	0.036	242	0.6 (0.5-0.8)	<0.001
Number of meals during previous 24 hours						
≥3	28	1		493	1	
<3	30	1.6 (0.9-2.6)	0.098	285	0.8 (0.6-0.9)	0.003
Number of snack during previous 24 hours						
≤3	43	1		532	1	
>3	15	0.7 (0.4-1.2)	0.202	246	0.9 (0.7-1.0)	0.136
Mother schooling						
Attended school	36	1		567	1	
Did not attend school	22	1.9 (1.1-3.3)	0.010	211	1.2 (1.0-1.5)	0.027
Number of people in household						
≤4	13	1		204	1	
>4	45	1.6 (0.8-2.9)	0.162	574	1.4 (1.1-1.7)	0.001
Household hunger scale						
Little to no hunger	55	1		761	1	
Moderate to severe hunger	5	2.5 (0.8-8.3)	0.128	17	1.0 (0.6-1.8)	0.997
Food consumption score						
Acceptable	58	1		765	1	
Poor to borderline	0	0.0 (1.0-1.0)	1.000	13	1.1 (0.6-2.1)	0.756

*Significance at p-value <0.05. CI, confidence interval; OR, odds ratio.

Table 3
Multivariate logistic regression of predictors associated with undernutrition among children in refugee camps along Thailand-Myanmar border, May to September 2017.

Predictors	Wasting (weight for height <-2 z-score)		Stunting (height for age <-2 z-score)	
	OR (95% CI)	*p*-value*	OR (95% CI)	*p*-value*
Age in months				
6-11	1		1	
12-23	1.0 (0.4-2.2)	0.909	2.5 (1.7-3.7)	<0.001
24-35	0.7 (0.3-1.8)	0.489	3.9 (2.7-5.8)	<0.001
36-47	0.7 (0.3-1.8)	0.473	4.0 (2.7-5.9)	<0.001
48-59	0.2 (0.0-0.8)	0.022	3.4 (2.2-5.1)	<0.001
Sex				
Male	1		1	
Female	0.7 (0.4-1.2)	0.190	0.9 (0.8-1.1)	0.266
Birth weight				
≥2,500 g	1		1	
<2,500 g	4.7 (2.6-8.5)	<0.001	3.6 (2.7-4.9)	<0.001
Length of time in camp				
2-5 years	1		1	
<2 years	1.7 (1.0-2.9)	0.050	0.8 (0.6-1.0)	0.067
Number of meals during previous 24 hours				
≥3	1		1	
<3	1.3 (0.7-2.2)	0.412	0.8 (0.7-1.0)	0.056
Number of snack times during previous 24 hours				
≤3	1		1	
>3	0.9 (0.5-1.7)	0.813	0.8 (0.7-1.0)	0.013
Mother's schooling				
Attended school	1		1	
Did not attend school	2.1 (1.2-3.5)	0.010	1.1 (0.9-1.4)	0.201
Number of people in household				
≤4	1		1	
>4	1.3 (0.7-2.5)	0.374	1.4 (1.1-1.7)	0.001
Household hunger scale				
Little to no hunger	1		1	
Moderate to severe hunger	2.3 (0.7-8.0)	0.187	0.9 (0.5-1.7)	0.835
Food consumption score				
Acceptable	1		1	
Poor to borderline	0.0 (0.0-0.0)	0.998	1.2 (0.6-2.3)	0.662

*Significance at *p*-value <0.05. CI, confidence interval; OR, odds ratio simultaneously adjusted for all variables in the table.

participants' report of little to no hunger. The Demographic and Health Survey of Myanmar, 2015-2016 reported 7% prevalence of wasting and 29% of stunting (MoHS and ICF, 2017), while 20.7% prevalence stunting in Vietnam was recorded (Ali *et al*, 2013).

The age range of 6 to 59 months was a significant predictor of stunting as shown in other studies (Jemal and Haidar, 2014; Fentahun *et al*, 2016); in most cases, the older the children become, the more prone to the possibility of stunting. The reason could be that in this age range children are nutritionally vulnerable, so poor nutritional reserves and inadequate compensatory feeding could contribute to the development of stunting. Understandably, appropriate food quality and quantity are important factors for reducing undernutrition among children under five years of age. Although bivariate analysis found a positive relationship between risk of stunting children aged 6 to 59 months and duration of stay in refugee camp of <2 years, multivariate analysis showed no such association. It might be due to that, length of time in camp was one of the factors affecting stunting and wasting, other factors, such as availability of food rations in the camps, have higher impact than length of time in camp, which impact the results obtained from the multivariate analysis. Interestingly, children who consumed snacks more than three times during 24 hours prior to conducting the questionnaire had less risk of stunting; however, there are no other studies that showed a similar relationship.

The findings of wasting and stunting associated low birth weight are in agreement with several other studies (Jesmin *et al*, 2011; Correia *et al*, 2014; Rahman *et al*, 2016). It is generally accepted that children who are underweight at birth have a tendency to remain underweight during early childhood. For instance, a study in Bangladesh concluded birth weight is the most crucial influence on subsequent growth status during infancy (Arifeen *et al*, 2000).

The relationship between mother's education and childhood undernutrition has been reported in other studies (Frost *et al*, 2005; Rayhan and Khan, 2006; Siddiqi *et al*, 2011). An earlier survey study found 61.5% of mothers living along Thailand-Myanmar border do not have any formal education (Wichaidit *et al*, 2011). Mothers who received schooling are more likely to be able to raise their families' income, thereby able to provide higher quality of food and better healthcare to their children (Frost *et al*, 2005; Hien and Kam, 2008).

Other studies have showed a significant correlation between household size and stunting, wasting and underweight (Hien and Kam, 2008; Mahyar *et al*, 2010). Large household size results in less available food per person, with a negative impact on a child growth rate.

The strengths of this study lie with the large number of participants strengthening reliability of results and the applications of bivariate and multivariate regression analyses in which each variable is controlled for and thus clearer results are obtained. Nevertheless, limitations of the study are the lack of inclusion of family income and cultural variables reported as significant predictors (Islam *et al*, 2013; Reliefweb, 2013).

In summary, the study shows prevalence of childhood wasting was acceptable in the refugee camps along Thailand-Myanmar border, but stunting was of moderate severity. Low birth weight was associated with subsequent wasting and

stunting. Mothers with no formal education had greater odds of rearing children with wasting condition. Children aged 6 to 59 months and from large household size were significantly associated with higher odds of stunting. Thus, in order to improve the nutritional status among these refugee children, it is crucial to refine the current nutrition intervention strategies in refugee camps to take into account these findings. Moreover, tackling childhood wasting and stunting require the cooperation of various stakeholders (health, social, agricultural and educational) and different levels of involvement (planning, monitoring and evaluation).

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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