

## Prevalence and predictors of growth stunting in children within 1,000 days in dry zone, Pakokku Township, Myanmar

Isareethika Jayasvasti\* Saw Nyein Chan\*

Aroonsri Mongkolchati \* Manisthawadee Jayasvasti \*\*

**Jayasvasti I, Chan SN, Mongkolchati A, Jayasvasti M. Prevalence and predictors of growth stunting in children within 1,000 days in dry zone, Pakokku Township, Myanmar. Chula Med J 2018 Jul – Aug; 62(4): 737 - 53**

**Background** : *Under - nutrition is leading to a global public health problem associated with child morbidity and mortality especially low and middle income countries, Myanmar was also still facing under nutrition especially growth stunting is the highest rate compared with others.*

**Objective** : *To explore the prevalence and predictors of growth stunting in children among 1,000 days in Dry Zone, Pakokku Township, Myanmar.*

**Methods** : *A cross-sectional and community based study was conducted with 393 participants. Multi-stage sampling technique was drawn to select these respondents at Pakokku Township in Myanmar. Data were collected from mothers with children under 2 years of age. Using 6 parts of structured questionnaires by face - to - face interview. Emergency Nutrition Assessment (ENA) smart software was used for nutritional status assessment based on WHO's references to calculate child's height to get Z score (standard deviation score). Stunting was assessed by comparing the body length with age. It could be categorized as stunting when the body length is less than -2 compared to standard deviation. Chi-square and multiple logistic regression were performed to examine factors associated with stunting.*

\* ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, Thailand

\*\* Department of Environmental Engineering, Faculty of Engineering, Chulalongkorn University, Thailand

**Results** : *The prevalence of stunting was 14.8 %. The following factors were significantly associated with stunting: children in large family size (more than 2 children) (AOR=2.13, 95% CI 1.05 - 4.31), children aged 13 to 24 months (AOR = 4.52, 95% CI 1.20 - 16.9), children were born with low birth weight and small gestation period (AOR = 3.26, 95% CI 1.34 - 7.95 and AOR = 2.67, 95% CI 1.33 - 5.43), mothers with shorter height (< 145 cm) (AOR = 3.84, 95% CI 1.29 - 11.48) (P <0.05).*

**Conclusion** : *Maternal factors were mainly associated with child's stunting. Nutrition investments should be added for the young especially those under two years old. Nutrition promotion should be focused for both mother and child since the mother is pregnant. Family planning service should be provided and promoted to mothers in this area.*

**Keywords** : *Stunting, 1,000 days children, dry zone, Myanmar.*

Correspondence to: Jayasvasti I, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand.

E-mail: graphkodom@gmail.com

Received for publication. May 30, 2018.

อิสริย์ฐิติกา ชัยสวัสดิ์, ขอ เญ่ง ขาน, อรุณศรี มงคลชาติ, มนัญจาวดี ชัยสวัสดิ์. ความชุกและปัจจัยทำนายภาวะแคระแกร็นในเด็กที่มีอายุในช่วง 1,000 วัน ที่อาศัยอยู่ในเขตแห้งแล้ง เมืองปาโกะกู ประเทศเมียนมาร์. *จุฬาลงกรณ์เวชสาร* 2561 ก.ค. - ส.ค.; 62(4):737 - 53

**เหตุผลของการทำวิจัย** : ภาวะทุพโภชนาการ เป็นสาเหตุของปัญหาด้านสาธารณสุขในระดับโลก ซึ่งมีความเกี่ยวข้องกับภาวะการป่วยและการตายของเด็ก โดยเฉพาะอย่างยิ่งในประเทศที่มีรายได้ต่ำและรายได้ปานกลาง ประเทศเมียนมาร์ยังคงเผชิญกับภาวะทุพโภชนาการในเด็ก โดยเฉพาะภาวะแคระแกร็นมีอัตราสูงสุดเมื่อเทียบกับประเทศอื่น

**วัตถุประสงค์** : เพื่อค้นหาความชุก และปัจจัยที่สามารถทำนายภาวะแคระแกร็นในเด็กที่มีอายุในช่วง 1,000 วัน ที่อาศัยอยู่ในเขตแห้งแล้ง เมืองปาโกะกู ประเทศเมียนมาร์

**วิธีการทำวิจัย** : การศึกษาในชุมชนแบบภาคตัดขวาง ดำเนินการในกลุ่มตัวอย่างจำนวน 393 ราย โดยการสุ่มแบบหลายขั้นตอน เพื่อคัดเลือกกลุ่มตัวอย่างจากเมืองปาโกะกู ประเทศเมียนมาร์ เก็บข้อมูลจากมารดาของเด็กที่มีอายุน้อยกว่า 2 ปี โดยการสัมภาษณ์รายบุคคลด้วยแบบสอบถามจำนวน 6 ตอน ประเมินภาวะโภชนาการโดยใช้ Emergency Nutrition Assessment (ENA) ซอฟต์แวร์อ้างอิงจากองค์การอนามัยโลกในการคำนวณความสูงของเด็กเพื่อให้ได้ค่า Z score โดยภาวะแคระแกร็นประเมินจากส่วนสูงเปรียบเทียบกับอายุ ซึ่งสามารถจัดกลุ่มส่วนสูงที่อยู่ในช่วงค่าส่วนเบี่ยงเบนมาตรฐานที่น้อยกว่า -2SD หมายถึงมีภาวะแคระแกร็น วิเคราะห์ข้อมูลด้วยไคสแควร์และการทดสอบลอจิสติคพหุคูณ เพื่อค้นหาปัจจัยที่มีความสัมพันธ์กับภาวะแคระแกร็น

**ผลการศึกษา** : ความชุกของเด็กที่มีภาวะแคระแกร็นเท่ากับร้อยละ 14.8 และปัจจัยต่อไปนี้มีความสัมพันธ์อย่างมีนัยสำคัญกับการเกิดภาวะแคระแกร็นในเด็กที่อาศัยอยู่ในครอบครัวใหญ่คือมีจำนวนเด็กมากกว่า 2 คน (AOR = 2.13, 95% CI 1.05 - 4.31) เด็กที่มีอายุอยู่ระหว่าง 13 ถึง 24 เดือน (AOR = 4.52, 95% CI 1.20 - 16.9) เด็กที่มีน้ำหนักแรกคลอดต่ำและคลอดตอนมีอายุครรภ์น้อย AOR = 3.26, 95% CI 1.34 - 7.95 และ AOR = 2.67, 95% CI 1.33 - 5.43) และมารดามีความสูงน้อยกว่า 145 เซนติเมตร (AOR = 3.84, 95% CI 1.29 - 11.48) โดยปัจจัยที่ทำนายโอกาสการเกิดภาวะแคระแกร็นได้ดีที่สุดคือเด็กที่มีอายุระหว่าง 13 ถึง 24 เดือน

**สรุป** : ปัจจัยเกี่ยวกับมารดาเป็นปัจจัยหลักที่มีความสัมพันธ์กับความแคระแกร็นของบุตร อีกทั้งยังพบว่าควรเพิ่มการลงทุนในด้านโภชนาการสำหรับเด็กเล็ก โดยเฉพาะอย่างยิ่งในเด็กที่มีอายุต่ำกว่า 2 ปี การส่งเสริมด้านโภชนาการควรมุ่งเน้นทั้งในมารดาและเด็กตั้งแต่วินิจฉัยตั้งครรภ์ นอกจากนี้ควร มีการจัดบริการและส่งเสริมการวางแผนครอบครัวให้กับมารดาในพื้นที่ดังกล่าว

**คำสำคัญ** : ภาวะแคระแกร็น, เด็กที่มีอายุช่วง 1,000 วัน, เขตแห้งแล้ง, ประเทศเมียนมาร์.

Under nutrition is leading to a global public health problem that is associated with child mortality and morbidity especially in low and middle income countries. <sup>(1)</sup> Under nutrition is caused by inadequate food intake, limiting of some others nutrients resources. <sup>(2)</sup> Globally, 155 million children suffer from growth stunting. <sup>(3)</sup> Nearly 170 million children worldwide do not get the opportunity to reach their full growth potential because of poor nutrition and lack of food in the earliest month of life. <sup>(4)</sup> According to World Health Organization 2016 report, 57 out of 129 countries have serious level of double malnutrition. <sup>(5)</sup> Asia leads the highest prevalence of stunting among young children, 10.5 million of children were stunted. <sup>(6)</sup> Southeast Asia has the second highest prevalence of under nutrition status, among 29.5 % (15.6 million) have growth stunted. <sup>(7)</sup>

Stunting was still high burden in Myanmar, 35.1 % of all children were stunting and 12.7 % were severe stunted according to Multiple Indicator Cluster Survey (MICS) 2009 - 2010. <sup>(8)</sup> Regarding the Myanmar Demographic and Health Survey (MDHS) 2015 - 2016, 29% of children were stunted. <sup>(9)</sup> The consequences of stunting are particularly severe and often irreversible among surviving malnourished children. The highest prevalence of stunting is occurred among children under 5 years of age. <sup>(1)</sup> There has been an increased investment and strategies by all sectors to force on nutrition interventions during the window of opportunity. These interventions are made to prevent malnutrition during the first 1,000 days from pregnancy through the child first 2 years of life. <sup>(7)</sup> The importance of the 1,000-day window of opportunity from the child's conception to their second birthday is one of the cycles to pay particular attention to pregnant and

breastfeeding mothers. <sup>(10)</sup> The right nutrition during this window, the impact of good nutrition are performed to encourage the growth of child's ability, learns and rises out of poverty. <sup>(4)</sup> It was found in Bangladesh, India, Ethiopia and Nigeria that significant factors of child stunting is related to maternal influences that include age, height, education, occupation and other socio-demographics. <sup>(11,12)</sup> Similarly study in Myanmar found that family income, maternal height, child's age and gestation aged were significant with stunted. <sup>(13)</sup>

Dry Zone is located in the central part of Myanmar, wherein the total population 14.5 million, that covers 13% of the country. <sup>(10)</sup> Prevalence of stunting was 27.5 % regarding to WFP 2014 survey. <sup>(14)</sup> The prevalence of stunting is higher than LIFT 2013 data. Children in large family and low education level of mothers are more likely to be stunted for under 2 years children. <sup>(15)</sup> Myanmar is still facing stunting problems where there are limited studies about 1,000-day period, especially in the Dry Zone in which there are most challenging improvements regarding child nutrition burdens.

This study aims to identify the prevalence and influencing factors on growth stunting among children within 1,000-day period in the rural area, the Dry Zone in Pakokku Township.

## Materials and Methods

A cross sectional community based study was conducted on 393 mothers with children under 2 years of age. Data were collected from March 25<sup>th</sup> to April 25<sup>th</sup> 2017. Multi-stage sampling technique was drawn to select respondents in Pakokku Township, Myanmar. The township has 7 Rural Health Centres (RHC), each of which has 4 to 5 Sub-rural Health

Centres (SRHC) and every SRHC covers averagely 5-10 villages. Firstly, 4 RHCs were randomly selected by cluster sampling and then 2 SRHCs were randomly selected by cluster sampling again from each RHC for totally 8 SRHCs. Twenty villages were selected through simple random sampling from 8 SRHCs. Finally 393 numbers of children under 2 years of age and their respondent mothers were recruited.

The estimated sample size was calculated as following formula.

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Z = standard normal deviation set as 1.96 corresponding 95% confidence interval

P = Prevalence of under nutrition in WFP nutrition survey, 2013 in study area is 0.34

(33.9%)

$n = 344.84 \pm 10\% = 380$

According to the results from the formula, total estimated sample size was 380 subjects. After data collection, the total number of 393 registered under two years children and their mothers had the selected villages.

Mothers, together with their children under 2 years of age, who agreed to participate in the study with no physiological problems were recruited. The data were collected by face- to- face interview using the structured interview questionnaire and height board was used for measure the length of the children. Methods of measurement were used based on WHO's child growth standard guideline. The questionnaire was developed by using UNICEF model.<sup>(16)</sup> To verify

content validity we took recommendation from three technical experts and back translation was done for some variables to scrutinize the specificity of variable to measure and test transparency and relevance of the test. The questionnaire divided into six parts: 1) Socio-demographic factors; 2) maternal influences; 3) breast feeding; 4) complementary feeding; 5) biological factors; and, 6) child's characteristics. The study protocol was approved by the Ethical Review Board of Mahidol University (certificate of approval number: 2017/046.0703). Written informed consent was collected from each participant prior to the interview.

### Anthropometric measurements

For nutritional status assessment, an anthropometric smart software, Emergency Nutrition Assessment (ENA) based on WHO references was used to calculate child's length or height (HAZ). After getting the length scores of the children, all scores were converted into Z-score depend on gender. Stunting is assessed by comparing the length with age. In accordance with WHO standard Z-score, if Z-score is more than -2 SD, it means adequate or normal height or length. If Z score is between less than -2 SD and more than -3 SD, it implies stunting and if Z score is less than -3 SD, it indicates severe stunting.<sup>(17)</sup>

### Data analysis

Statistical analysis was carried out with SPSS version 22. Descriptive statistics were used for demographic analysis of baseline characteristics. Bivariate analysis was conducted to calculate the crude odds ratio (COR) with 95% CI to determine the association between factors associated with stunting

by using Chi-square. After then, all variables from bivariate analysis were included in multiple logistic regression analysis according to statistically significant and literature review. Adjusted Odds ratio (AOR) with 95% CI was used to determine the predictors of stunting after adjusted confounding factors.

## Results

**Table 1.** Number and percentage distribution of stunting status (n = 393).

Nutritional Status	Frequency	Percentage
Length for age (n = 393)		
Average length	335	85.2
Stunting	47	12.0
Severe stunting	11	2.8

Table 1 presents the prevalence of stunting (length for age). By using ENA smart 2011 software for child nutrition, the results showed that 14.8 % of respondents were stunted. In the total respondents (n = 393), 85.2 % from length for age was presented within average groups. In this case, the percentage of 2.8% indicated severe stunting in this study township.

**Table 2.** Frequency and percentage of respondents by socio-demographic factors and child's characteristics (n = 393).

Characteristics	Frequency	Percentage
Family income per month		
< 130,000 kyats	190	48.3
≥ 130,000 kyats	203	51.7
Median = 130,000, QD = 20,000, Min = 10,000, Max = 1,500,000		
No: of children in the family		
Less than or equal two children	249	63.4
More than two children	144	36.6
Age of the child		
< 6 months	93	23.7
6 to 9 months	92	23.4
10 to 12 months	46	11.7
13 to 24 months	162	41.2
Mean = 11.13, SD = 6.75, Min = 0, Max = 24		

**Table 2.** (Con) Frequency and percentage of respondents by socio-demographic factors and child's characteristics (n = 393).

Characteristics	Frequency	Percentage
<b>Gender of the child</b>		
Boy	190	48.3
Girl	203	51.7
<b>Immunization</b>		
Complete	304	77.4
Not complete	89	22.7
<b>Child weight at birth</b>		
Normal Birth weight ( $\geq 2.5$ kg)	358	91.1
Low Birth weight ( $< 2.5$ kg)	35	8.9

Remark: 1 USD = 1,370 kyats (Current exchange rate - June, 2017)

Table 2 summarizes the socio-demographic factors such as family income, total number of children in a family, child's age, gender of the child, immunization, child weight at birth. Over half of the respondents, 51.7% earned more than 130,000 kyats per month and 48.3% of respondents were earned lower than 130,000 kyats per month. There were 63.4% of the households had one or two children; and, 36.6% were more than two children. According to child's characteristics, from the Table, 23.7% of children were under six months; 23.4% were between six to nine months; and 11.7% were between 10 to 12 months; the remaining of 41.2% were 13 to 24 months. In this study, 51.7% of the children were female and 48.3% were male. With regard to the immunization, 77.4% were vaccinated with complete immunization; 22.7% did not have completed immunization. The immunization data were taken from child immunization card. Almost 91.1% of children were born with normal birth weight means 2.5 kg and above; other 8.9% were born with low birth weight.

Table 3 presents the frequency and percentage distribution of maternal influences; 80.4% of mothers were between 20 and 35 years aged; 1.0% was less than 20 years; and 18.6% of the mothers were over 35 years, a high risk group. Approximately, 98.0% of the mothers were married and only 1.8% was others; others mean widow or divorced women. About 60.8% had primary education or lower than primary level; and 39.2% had higher than primary education level. With regard to occupation of the mothers, 47.1% of the mothers were dependents (housewife); 17.3% were farmer; 16.8% ran their own business; 5.6% were government officers; 13.2% were daily pay worker. Almost 74.3% of the children were born in the normal gestational age (more than 37 weeks). Regarding the maternal height, 94.7% of the respondent mothers were within normal height (145 cm and above) and the remaining of 5.3% are within the high risk group. Nearly 41.5% of the mothers took ANC visits for more than 4 times and above. However, only 33.1% of the respondents took FeSO<sub>4</sub>



during pregnancy with throughout the month. Due to the lack of health knowledge, most of the mother do not take FeSO<sub>4</sub> during pregnancy. As for exclusive feeding, 77.1% were received exclusively breastfeeding for six months. In this study, 94.9% of

the respondents were covered by health workers because the health volunteers were trained by organizations that are working for child's nutritional program in this area.

**Table 3.** Frequency and percentage distribution of respondents by maternal factors.

Maternal factors	Frequency	Percentage
<b>Mother age</b>		
Less than 20 years	4	1
20 to 35 years	316	80.4
More than 35 years	73	18.6
Mean = 30.40, SD = 5.74, Min = 18, Max = 45		
<b>Marital status</b>		
Married	385	98
Divorced	7	1.8
Widow	1	0.2
<b>Education level of mother</b>		
Less than or equal to Primary Level	239	60.8
Higher than Primary Level	154	39.2
<b>Occupation of mother</b>		
Dependent (Housewife)	185	47.1
Farmer	68	17.3
Own Business	66	16.8
Government staff	22	5.6
Daily pay worker	52	13.2
<b>Gestation period</b>		
< 37 weeks	101	25.7
≥ 37 weeks	292	74.3
<b>Maternal height</b>		
High risk group (< 145 cm)	21	5.3
Normal group (≥ 145 cm)	372	94.7
<b>AN care visit</b>		
Less than 4 times	226	57.5
≥ 4 times	163	41.5
Don't remember	4	1.0
<b>Taking FeSO<sub>4</sub></b>		
Yes	130	33.1
No (< 180 tablets)	263	66.9
<b>Duration of exclusive breast feeding</b>		
Less than 6 months	90	22.9
≥ 6 months	303	77.1
<b>Mothers who covered by health worker</b>		
Yes	373	94.9
No	20	5.1

**Table 4.** Association between factors and stunting of the children.

Factors	Stunting				Crude OR (95%CI)	P - value
	Yes		No			
	N	%	N	%		
<b>Family income per month</b>						
< 130,000 kyats	19	10.0	171	90.0	1	
≥ 130,000 kyats	39	19.5	164	80.5	2.18 (1.21 - 3.93)	0.010*
<b>No: of children in family</b>						
≤ 2 children	31	12.4	218	87.6	1	
> 2 children	27	18.8	117	81.3	1.62 (0.92 - 2.85)	0.092
<b>Child age</b>						
< 6 months	10	10.8	83	89.2	1	
Six to 12 months	13	9.4	125	90.6	0.86 (0.36 - 2.06)	0.74
13 to 24 months	37	22.8	125	77.2	2.46 (1.16 - 5.21)	0.019*
<b>Gender of the child</b>						
Girl	20	9.9	183	90.1	1	
Boy	40	21.1	150	78.9	2.44 (1.37 - 4.35)	0.003*
<b>Child weight at birth</b>						
Normal (≥ 2.5 kg)	46	12.8	312	87.2	1	
Low birth weight (<2.5 kg)	12	34.3	23	65.7	3.54 (1.65 - 7.59)	0.001*
<b>Immunization</b>						
Completed	48	15.8	256	84.2	1	
Not complete	10	11.9	74	88.1	1.39 (0.67 - 2.88)	0.378
<b>Mother age</b>						
> 30 years	26	13.5	166	86.5	1	
≤ 30 years	32	15.9	169	84.1	1.21 (0.69 - 2.12)	0.507
<b>Education level of mother</b>						
Above primary level	21	13.6	133	86.4	1	
Less than or equal Primary level	37	15.5	202	84.5	1.16 (0.65 - 2.07)	0.615
<b>Occupation of mother</b>						
Housewife	23	12.4	162	87.6	1	
Others	35	16.8	173	83.2	1.42 (0.81 - 2.51)	0.222
<b>Maternal Height</b>						
Normal (≥ 145cm)	51	13.7	321	86.3	1	
High risk group (< 145 cm)	7	33.3	14	66.7	3.15 (1.21 - 8.17)	0.019*
<b>Marital status</b>						
Married	56	14.5	329	85.5	1	
Others	2	25	6	75	1.96 (0.39 - 9.95)	0.418

**Table 4.** (Con) Association between factors and stunting of the children.

Factors	Stunting				Crude OR (95%CI)	P - value
	Yes		No			
	N	%	N	%		
<b>Gestational period</b>						
≥ 37 weeks	36	12.4	254	87.6	1	
< 37 weeks	22	21.8	79	78.2	1.96 (1.09 - 3.53)	0.024*
<b>AN care visit</b>						
≥ 4 times	21	12.9	142	87.1	1	
< 4 times	37	16.4	189	83.6	1.32 (0.74 - 2.36)	0.342
<b>Taking FeSO<sub>4</sub></b>						
Yes	25	19.2	105	80.8	1	
No (< 180 tables)	31	12	232	88	1.74 (0.98 - 3.10)	0.058
<b>Duration exclusive breast feeding</b>						
< 6 months	42	13.9	261	86.1	1	
≥ 6 months	16	17.8	74	82.2	1.34 (0.71 - 2.53)	0.359

\*P - value <0.05

Table 4 shows the association between stunting and factors including family income, child's age, gender of the child and child weight at birth, maternal height and gestational period were had a significant association with stunting status. On the other hand, the number of the children in a family, child immunization, mother's age, mother education, occupation of mother, marital status, ANC visit, taking FeSO<sub>4</sub> during pregnancy and duration of exclusive breastfeeding were not associated with stunting status in COR.

The significant factors identified by the chi-square test and other factors according to literature reviews further tested by multiple logistics regression

to determine the highest predictor of stunting after adjusted confounding factors as shown in table 5. Stunting was significantly associated with large number of children in a family (> 2 children) had double the risk of being stunted. Regarding the child age, those between 13 to 24 months were 4.5 times more likely to be stunted and those who were born with low birth weight were 3 times more likely to be stunted. Regarding the maternal factors, children who were born from mothers with shorter height (< 145 cm) were 3.8 times more likely to be stunted; also those who were born with short gestation age (< 37 weeks) were 2.7 times more likely to be stunted.

**Table 5.** Predictors of stunting of the children.

Independent variables	Stunting	P - value
	Adjusted OR <sup>†</sup> (95% CI)	
<b>Family income</b>		
> 130,000 kyats	1	
≤ 130,000 kyats	1.90 (0.98 - 3.67)	0.055
<b>No. of children in a family</b>		
≤ 2 children	1	
> 2 children	2.13 (1.05 - 4.31)	0.036*
<b>Child age</b>		
< 6 months	1	
Six to 12 months	1.31 (0.49 - 3.46)	
13 to 24 months	4.52 (1.20 - 16.9)	0.026*
<b>Gender of the child</b>		
Girl	1	
Boy	1.49 (0.78 - 2.84)	0.225
<b>Child weight at birth</b>		
≥ 2.5 kg	1	
< 2.5 kg	3.26 (1.34 - 7.95)	0.009*
<b>Immunization of child</b>		
Complete	1	
Incomplete	1.94 (0.85 - 4.44)	0.118
<b>Maternal age</b>		
> 30 years	1	
≤ 30 years	1.61 (0.80 - 3.24)	0.182
<b>Maternal occupation</b>		
Housewife	1	
Others	1.38 (0.73-2.62)	0.318
<b>Maternal height</b>		
Normal (≥ 145 cm)	1	
High risk group (< 145 cm)	3.84 (0.73 - 2.62)	0.016*
<b>Gestational period</b>		
≥ 37 weeks	1	
< 37 weeks	2.67 (1.33 - 5.43)	0.006*
<b>Taking FeSO<sub>4</sub></b>		
Yes	1	
No	1.65 (0.87 - 3.15)	0.127

\**P* < 0.05, \*\**P* < 0.001†Adjusted for family income, no. of children in a family, child age, gender of the child, child weight at birth, immunization of child, maternal age, maternal occupation, maternal height, gestation period, taking FeSO<sub>4</sub>

## Discussion

Child stunting is continued to be a major problem in developing countries including Myanmar. With regard to this study, it was found that prevalence of stunting (height for age) was 14.8 %. According to WFP *et al.*, who surveyed the Dry Zone in 2014 reported the prevalence of stunting was 27.5%.<sup>(14)</sup> A study in the Dry Zone of Myanmar showed the prevalence of stunting that was 23.8 %.<sup>(13)</sup> The prevalence of stunting was slightly reduced compared with a previous study owing to the government and other organizations are working for child nutrition program in this area, however, the child nutrition status in the Dry Zone is still need to be improved. A study in Thailand showed that 9.5% of children under two years were stunted; therefore, the prevalence of stunting in Myanmar should be higher than in Thailand.<sup>(18)</sup> Moreover, nutrition promotion should be done continuously in Myanmar.

In this study, most families had more than two children (large family size). Most of the respondent's mothers had low educational level; mostly 60.8% were below primary level. Almost 47.1% of the subjects were dependent (housewife). Divorcee mothers or widows were more likely to have stunted children. Most families had their income less than 120 \$ (130,000 kyats), some families earn very low income 10 \$ (10,000 kyats). According to the survey of children in 2014,<sup>(4)</sup> the Dry Zone was characterized by medium rates of stunting and high rates of low birth weight.

After eliminating the insignificant variables, Backward Wald method was chosen for selecting variables in the final model to determine the significant predictors for stunting of the children. The result of

adjusting other variables in the model showed, five variables significantly associated with growth stunting, namely, number of children in a family, child's age, child weight at birth, maternal height and gestation period. This study showed similar result with findings of previous studies that already approved the significant association between numbers of the children in a family and stunting. Large family member (with more than 2 children) were 2.13 times (AOR = 2.13, 95% CI 1.0 - 4.31) more likely to have stunted children. The similar result in Ethiopia supported that large family size with high number of children were associated with the child stunting status.<sup>(13, 19, 20)</sup> Larger household size (large number of children) tends to increase the food competition and become a major constraint in low economic status. Children aged between 13 to 24 months were 4.52 times (AOR 4.52, 95% CI 1.20-16.9) more likely to be stunted than younger age group. Similar results from other studies showed that child age was associated with stunting, children above one year were more likely to be stunted.<sup>(13, 21)</sup> Birthweight is associated with child's stunting in this study, children who were born with low birth weight (< 2.5 kg) were 3.26 times (AOR = 3.26, 95% CI 1.34 - 7.95) more likely to be stunted compared with children born with normal weight. One study supported the current study that low birth weight children were more likely to be stunted.<sup>(22)</sup> Children who were born from mothers who were less than 145 cm in height were 3.84 times (AOR = 3.84, 95% CI 1.29 - 11.43) more likely to be stunted compared with those whose mothers were at least 160 cm in height. Similar result showed that maternal height is associated with child stunting.<sup>(13, 23, 24)</sup> Gestation period is associated with child stunting in this study. Children who were born

with short gestation period (< 37 weeks) were 2.67 times (AOR = 2.67, 95% CI 1.33 - 5.43) more likely to be stunted. Other studies supported that children who were born with short gestation period were more likely to be stunted.<sup>(13,25)</sup> Maternal education and occupation were very low and most of families that earned low income in this area, child growth was totally depended on the maternal and family conditions that needs improvement of nutritional status in this area. Therefore, nutrition investment should be focused continuously for both mothers and children to reduce stunting problem in this area.

The strength of the present study is that this study is the first study ever of stunting in children within 1,000-day period in the Dry Zone of Myanmar. The first 1,000-day period in this study, covers the first 24 months from the mother's pregnancy throughout her child's second birthday, a critical window of opportunity for the prevention of growth impairment which began, at the time of child's brain and body were developing and growing rapidly. Good nutrition during the first 1,000-day period is the crucial for healthy and productive future and help reduce stunting. In terms of limitations, this study focused on child stunting that was influenced by maternal factors; therefore, parental and other caregiver factors were not concerned. Moreover, other influencing factors such as environment factors, and immediate factors and food security conditions were not included in this study. The information regarding mother feeding practice during pregnancy, complementary feeding for children collected from the mothers were in recall as a result a chance getting the recall bias is high. Lastly, this study applied UNICEF child health and nutrition model to be used for constructed conceptual framework.

## Conclusion

Stunting is still the remaining problem in Dry Zone area. This study shows that the prevalence of stunting and associated factors include number of the children in family, child age and child weight at birth maternal height and gestational period were the main predictors for stunting especially in young-age groups. Mothers are the focal key players for child nutrition within the 1,000-day period. Children with low birth weight and large family size were more likely to be stunted. Therefore, policy makers should make nutrition interventions since mothers are pregnant and family planning service should be provided to mothers who have more than two children. In summary, this study was shows that maternal factors are the main predictors for growth stunting especially in younger-age of children.

## Recommendation

This study showed that number of the children in a family, child age and child weight at birth were associated with stunting in this area. Maternal factors such as maternal height and gestation period influenced child nutrition status especially those of younger age. The results pointed out that policy makers and health care providers should emphasize for the following points: 1) nutrition programs need to prioritize for the children earliest life; 2) policy makers should work and strengthen child nutrition activities in collaboration with other NGOs working for child health and nutrition program; 3) health care provider should focus on nutrition promotion activities for both mother and children within 1,000-day period which and should be started from the beginning of pregnancy; 4) health care providers should be provided family

planning service to mothers who have a large number of children (above 2 children); and, 5) health care providers should do regular child weight measuring on immunization days and provided measurement tools to all health facilities.

#### **What is already known to this topic?**

1. Under-nutrition is still the cause of child mortality and morbidity in Myanmar and there are some research on under nutrition for children under 2 years of age but still limited study on 1,000 days period nutrition for children and stunting in Myanmar.

2. Dry zone of Myanmar is the burden of child nutrition, the prevalence of children to be stunted in this area was 27.5% according to national survey in 2014.

#### **What this study adds?**

1. Stunting prevalence among children under 2 years of age in Dry Zone was shown.

2. The importance of 1,000 days was expressed and influencing factors that affect child nutrition especially stunting within 1,000 days was found.

3. The predictor contribution on stunting among children under 2 years of age in Dry Zone of Myanmar was given.

#### **Acknowledgements**

The investigators would like to convey our gratitude to District Medical Officers, Staff members of the Township Health Department and respective Basic Health Staff members, Save the Children Organization and MNMA staff members for their assistance in the entire data collecting process.

#### **References**

1. World Food Program. WFP in Myanmar: Looking forward 2013 - 2017. Yangon, Myanmar: World Food Program Myanmar; 2012.
2. Shetty P. Malnutrition and undernutrition. *Medicine* 2003;31:18-22.
3. World Health Organization. Malnutrition [Internet]. 2017 [cited 2017 Jan 4]. Available from: <http://www.who.int/mediacentre/factsheets/malnutrition/en/>.
4. Save the Children. Nutrition in the first 1,000 days: State of the world's mothers 2012. New Hampshire, United States: Johnson & Johnson, Mattel Brookstone; 2012.
5. International Food Policy Research Institute. Global nutrition report 2016: From promise to impact: Ending malnutrition by 2030 [Internet]. Washington, DC: International Food Policy Research Institute; 2016 [cited 2016 Nov 2]. Available from: <http://dx.doi.org/10.2499/9780896295841>.
6. Victora CG, de Onis M, Hallal PC, Blössner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. *Pediatrics* 2010;125:e473-8.
7. Chaparro C, Oot L, Sethuraman K. Overview of the nutrition situation in seven countries in Southeast Asia. Washington, DC: Food And Nutrition Technological Assistance III project and FHI 360; 2014.
8. United Nations Children's Fund. Monitoring the situation of women and children, Multiple Indicator Cluster Survey 2009 - 2010. New York: UNICEF; 2011.
9. Sport MoHa. Myanmar demographic and health

- survey (2016-2017) [Internet]. 2017 [cited 2016 Dec 12]. Available from: [http://mohs.gov.mm/cat/MDHS%20\(2015-16\)](http://mohs.gov.mm/cat/MDHS%20(2015-16)).
10. Sibson V. A Nutrition and food security assessment of the dry zone of Myanmar. Save the Children, World Food Program and the Ministry of Livestock, Fisheries and Rural Development [Internet]. 2014 [cited 2017 Jan 3]. Available from: <http://reliefweb.int/report/myanmar/nutrition-and-food-security-assessment-dry-zone-myanmar-june-and-july-2013>.
  11. Christian P, Lee SE, Donahue Angel M, Adair LS, Arifeen SE, Ashorn P, et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. *Int J Epidemiol* 2013;42: 1340-55.
  12. Chatterjee K, Sinha RK, Kundu AK, Shankar D, Gope R, Nair N, et al. Social determinants of inequities in under-nutrition (weight-for-age) among under-5 children: a cross sectional study in Gumla district of Jharkhand, India. *Int J Equity Health* 2016;15:104.
  13. Phyo SW, Keiwekarnka B, Mongkolchat A. Factors related to stunting status of children aged under two years in Magway township, Myanmar. *J Public Health Dev* 2014;12:3-15.
  14. Undernutrition in Myanmar. Part 1: A critical review of literature. Yangon, Myanmar: Livelihoods and Food Security Trust Fund (LIFT); 2016.
  15. Win Z, Cashin J. Undernutrition in Myanmar: Part 2: A secondary analysis of LIFT 2013 household survey data. Yangon, Myanmar: Leveraging Essential Nutrition Actions to Reduce Malnutrition (LEARN) programme and Livelihoods and Food Security Trust Fund; 2016.
  16. United Nations Children's Fund (UNICEF). The achievable imperative for global progress. Improving Child Nutrition. New York: UNICEF; 2013.
  17. United Nations Children's Fund (UNICEF), World Health Organization, World Bank. Joint child malnutrition estimates -levels and trends. New York: United Nations International Children's Emergency Fund; 2016.
  18. Beniko M, Mongkolchat A, Chompikul J, Phuphaibul R. Relationship between child rearing and child nutritional status during the first year of life in Thailand. *J Pub Health Dev* 2016; 14:3-19.
  19. Alemu ZA, Ahmed AA, Yalew AW, Birhanu BS, Zaitchik BF. Individual and community level factors with a significant role in determining child height-for-age Z score in East Gojjam Zone, Amhara Regional State, Ethiopia: a multilevel analysis. *Arch Public Health* 2017; 75:27.
  20. Cruz LMG, Azpeitia GG, Suárez DR, Rodriguez AS, Ferrer JFL, Serra-Majem L. Factors associated with stunting among children aged 0 to 59 months from the Central Region of Mozambique. *Nutrients* 2017;9:E491.
  21. Mutua RN, Keriko J, Mutai J. Factors associated with stunting, wasting and underweight among children aged 2-5 years in early childhood development and education center in MASINGA sub country, MACHAKOS country. *Eur J Health Sci* 2017;1:44-69.



22. Strauss RS, Dietz WH. Growth and development of term children born with low birth weight: effects of genetic and environmental factors. *J Pediatr* 1998;133:67-72.
23. Subramanian S, Acherson LK, Smith GD, John NA. Association of maternal height with child mortality, anthropometric failure, and anemia in India. *JAMA* 2009;301:1691-701.
24. Mongkolchat A, Thinkhamrop B, Mo-Suwan L, Chittchang U, Choprapawon C. Prevalence and incidence of child stunting from birth to two years of life in Thai children: based on the Prospective Cohort Study of Thai Children (PCTC). *J Med Assoc Thai* 2010; 93:1368-78.
25. Oddo VM, Christian P, Katz J, Liu L, Kozuki N, Black RE, et al. Stunting Mediates the Association between Small-for-Gestational-Age and Postneonatal mortality. *J Nutr* 2016; 146:2383-7.