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Effect of Low Birth Weight on Child Stunting among Adolescent Mothers

Wisit Chaveepojnkamjorn[1*], Sureeporn Songroop[2], Pratana Satitvipawee[3], Supachai Pitikultang[4], Suruchsawadee Thiengwiboonwong[5]

[1]Department of Epidemiology, Faculty of Public Health, Mahidol University, Bangkok, Thailand
[2]Sena District Public Health Office, Phra Nakhon Si Ayutthaya, Thailand
[3]Department of Biostatistics, Faculty of Public Health, Mahidol University, Bangkok, Thailand
[4]Department of Family Health, Faculty of Public Health, Mahidol University, Bangkok, Thailand
[5]Ratwithee Hospital, Bangkok, Thailand
Email: *wiziz.cha@mahidol.ac.th

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Abstract

Introduction: Child stunting and low birth weight are the global public health problems. The current study aimed to determine the prevalence of child stunting and its association with low birth weight among adolescent mothers. **Methodology:** A cross-sectional study was conducted in Phra Nakhon Si Ayutthaya province. Using multi-stage stratified sampling method, 250 participants were recruited. Data were collected using structured interview questionnaires from August 2016 to March 2017. Descriptive and analytic statistics were used to analyze data. **Results:** 16.4% of children were stunted. Univariable logistic regression disclosed factors significantly associated with stunting included age at delivery, educational level, family members, weight gain during pregnancy, birth weight, complete immunization, recent illness history, breast feeding and complementary feeding (p-value < 0.05). After adjusting multivariable logistic regression analysis for potential confounders, babies with low birth weight were 4.77 times at risk of stunting compared with those of normal weight (AOR = 4.77, 95% CI = 1.66 - 13.68). **Conclusion:** Efforts to reduce child stunting should include surveillance systems of stunting and associated factors which should be conducted accompanied by providing perspectives on maternal and child health care, implementing health literacy regarding breastfeeding among adolescent mothers and prevention programs to reduce and prevent child stunting.

Keywords

Low Birth Weight, Child Stunting, Adolescent Mothers, Teenage Mothers

1. Introduction

Stunting is an indicator of chronic malnutrition and the most prevalent form of child under-nutrition, a deficit of height to age relation, and it is responsible for delayed development including impaired cognitive function and increased susceptibility to infectious diseases among children (Müller & Jahn, 2009). It is one of the global health problems. The World Health Organization, 2017 is dedicated to supporting the achievement of the Global Nutrition Targets 2025 to reduce by 40% the number of children who are stunted. In 2010 globally, approximately 162 million children under 5 years were stunted (de Onis, Blssner, & Borghi, 2010). In developing countries, approximately 40% of children are stunted (World Health Organization, 2017), over 200 million young children. Stunting rates among children are unconscionably high in developing countries, because children's height or length can develop when they receive adequate nutrition since the beginning of life (World Health Organization, 2014; Chinn, Hughes, & Rona, 1998; Hughes, Li, Chinn, & Rona, 1997). In Thailand, 13.1% of children under 5 years were stunted, and 2.6% present severe stunting at risk of low intelligence (NSO & UNICEF, 2016). To optimally reduce stunting, there must be an understanding of stunting determinants.

In addition, low birth weight (LBW) is considered as a major public health and a significant predictor of infant mortality and also a significant determinant of infant and childhood morbidity such as mental retardation, poor language development and learning disabilities. Globally, it is estimated that 15% - 20% of all births worldwide are below the normal level of weight at their birth and 95% of these infants lived in developing countries (World Health Organization, 2014). In Thailand, 10.4% of live births was LBW (NSO & UNICEF, 2016). LBW rates are consequently regarded as the best proxy for maternal malnutrition in international health statistics. The first 1000 days of life are a critical period to intervene and prevent stunting in order to achieve short and long-term healthy growth (Stewart, Iannotti, Dewey, Michaelsen, & Onyango, 2013).

One of the risk groups is adolescent mothers. Adolescent girls account for 11% of all births (UNFPA, 2005). Teen birth rates vary between a low of 29/1000 in Europe, 58/1000 in Asia and 130/1000 in Africa (UNFPA, 2005). Adolescents who have unintended pregnancy face a number of challenges, including increased adverse pregnancy outcomes and children born to adolescents are more likely to have low birth weight (Cherry, Byers, & Dillion, 2009). They were associated with child stunting, because of being young and lack of maturity and nutritional knowledge to take care of their child. In addition, they had unplanned pregnancy, and might not have been aware of food consumption since becoming pregnant (Abdullah, Malek, Faruque, Salam, & Ahmed, 2007; Begum, 1999). Moreover, 14.1% of married women were the adolescent girls and trends of stunting among children under 6 months were higher but lower when they aged up to 36 months (NSO & UNICEF, 2016). Hence, the main purpose of the study aimed to determine the prevalence of stunting and its association with LBW among children aged 6 - 36 months of adolescent mothers in Phra Nakhon Si Ayutthaya

Province. The author selected Phra Nakhon Si Ayutthaya province as the area of study because of its characteristics as a proxy of central provinces of Thailand with an area of about 2557 km^2. It lies around 70 km north of Bangkok, the capital of Thailand containing a population of 817,441 and density 320/km^2 in 2018. In addition, average adolescent birth rate (56.2/1000) in Phra Nakhon Si Ayutthaya Province was higher than that of provinces under the Regional Heath Office 4 (51.5/1000) and Thailand (51.2/1000) in 2013 (Bureau of Reproductive Health, Department of Health, Ministry of Public Health, 2014).

2. Methodology

2.1. Design and Setting

The analytical cross-sectional study was conducted from August 2016 to March 2017 to explore prevalence of child stunting and determine the association between LBW and stunting occurrence among children aged 6 - 36 months of adolescent mothers in Phra Nakhon Si Ayutthaya Province, Thailand.

2.2. Sample Size and Sampling Technique

The sample size was calculated using a formula with specified absolute precision (Lwanga & Lemeshow, 1991) according to the following assumptions: 10.48% of stunting among children (P) (Uengarporn, 2013) with 95% confidence interval and 5% specified absolute precision (d). As a multistage sampling technique was employed to identify study subjects, a design effect of 1.5 was used. The calculated sample size was at least 218. Also, approximately 10% was added to adjust for non-responses. Thus, the final sample size was at least 250.

2.3. Data Collection Tools and Data Collection

Information was obtained by interviewing the study subjects by the researcher and trained research assistants. The structured questionnaire comprised demographic characteristics, factors of low birth weight and stunting of study subjects, and it was modified and revised by the authors and the experts. Then the questionnaire was tried out among 30 teenage mothers at baby clinic to clarify the question items and time duration needed. Stunting was evaluated using the definition of WHO (WHO Multicentre Growth Reference Study Group & de Onis, 2006).

2.4. Operational Definition

Low birth weight is defined by the World Health Organizaion (WHO) as a child weighted below 2500 g at birth was termed as low birth weight baby. In addition, Newborns with LBW can be classified as LBW (<2500 g), very LBW (<1500 g) and extremely low birth weight (<1000 g) (AAP, 2007; Ricci, & Kyle, 2009).

Child Stunting is a chronic restriction of a child's potential growth and development. A child aged 0 to 59 months is classified as stunted when her/his height for age falls below the −2 standard deviations from the median height for age

determined by the WHO Child Growth Standards 2006 (de Onis & Branca, 2016).

Adolescent Mother means the mother whose age at delivery is less than 20 years.

2.5. Measurement

The data were analyzed using the statistical package. Categorical variables were given as frequency and percent, crude odds ratio (COR), 95% CI of OR and *p*-value. Moreover, numerical variables were expressed as mean, median, minimum and maximum, standard deviation. Univariate analysis was performed using the univariable logistic regression to differentiate proportional exposures between stunted and normal children for categorical variables. Adjusted odds ratio (AOR) and 95% CI of OR were calculated from the multivariable logistic regression to examine associations between low birth weight and stunting occurrence, adjusted for potential confounders. All statistical analyses were performed using two-sided tests and a *p*-value of <0.05 was judged to be statistically significant.

2.6. Ethic Approval and Consent to Participate

This study was reviewed and approved by the Ethics Committee for Research in Human Subjects of the Faculty of Public Health, Mahidol University (Committee's reference number: MUPH 2016-096 on 7th July 2016) and agreed with the Declaration of Helsinki, All participants participated in this study on a voluntary basis. Informed consent to participate in the study was obtained from participants after informing them the details of study. The participant's responses were strictly confidential and were unused for any other purpose. The decision to participate or not did not rely on any other person apart from the participants themselves. Participants' names were unidentified in questionnaires, confidentiality was conducted throughout the study using anonymous techniques and the results were analyzed as a whole group.

3. Results

3.1. Maternal Characteristics

A total of 250 adolescent mothers participated in the present study. The majority were aged 16 to 17 years (67.82%); mean age was 16.83 ± 1.45 years, most obtained junior high school level education (44.40%), normal level of BMI before pregnancy (66%), ≤5 family members (79.20%), weight gain < 10 kg (80%), first order of parity (91.6%), living with husband (77.20%), monthly family income 10,001 to 15,000 THB (26%), mostly without complications during pregnancy (94.80%), antenatal care visit ≥ 5 times (78%) the first antenatal care visit > 12 weeks (65.20%), and having iron and folic acid supplements (80.80%) (**Table 1**).

3.2. Child Characteristics

Two hundred and fifty young children of adolescent mothers were selected for

Table 1. Demographic maternal characteristics.

Characteristics	Number (%)
Age at delivery (years)	
<16	48 (19.20)
16 - 17	106 (42.40)
≥18	96 (38.40)
Mean (SD)	16.83 (1.45)
Min - Max	13 - 19
Education level	
Primary school	22 (8.80)
Junior high school	111 (44.40)
Senior high school	62 (24.80)
Vocational school	55 (22.00)
BMI before pregnancy (kg/m²)	
Normal (18.5 - 24.9)	165 (66.00)
Underweight (16.0 - 18.4)	73 (29.20)
Very underweight (<16.0)	12 (4.80)
Family members	
≤5	198 (79.20)
>5	52 (20.80)
Mean (SD)	5.03 (1.16)
Min - Max	3 - 9
Weight gain during pregnancy (kg)	
≥10	50 (20.00)
<10	200 (80.00)
Mean (SD)	11.52 (2.57)
Min - Max	6 - 20
Number of parity	
First	229 (91.6)
Second	21 (8.40)
Marital status	
Lived with husband	193 (77.20)
Widowed/divorced	14 (5.60)
Separated	43 (17.20)
Monthly family income (THB)	
≤10,000	61 (24.40)

Continued

10,001 - 15,000	65 (26.00)
15,001 - 20,000	55 (22.00)
20,001 - 25,000	31 (12.40)
>25,000	38 (15.20)
Mean (SD)	18000.00 (8433.06)
Min-Max	6000 - 45,000
Complications during pregnancy	
No	237 (94.80)
Yes	13 (5.20)
First antenatal care visit (weeks)	
≤12	87 (34.80)
>12	163 (65.20)
Frequencies of antenatal care visits	
≥5	195 (78.00)
<5	55 (22.00)
Mean (SD)	6.95 (2.77)
Min - Max	2 - 14
Daily iron and folic supplements during pregnancy	
Yes	202 (80.80)
No	48 (19.20)

SD, Standard deviation; Min, Minimum; Max, Maximum.

the present study. The majority were aged 24 - 35 months (43.20%), male (50.80%), birth weight ≥ 3000 grams (32.80%), mostly no preterm birth (88.80%) no underlying diseases (96.40%), complete immunization (92%), no recent illness (85.60%), breastfeeding < 4 months (45.20%) and having complementary feeding ≥ 6 months (51.60%). Comparison between boys and girls, there was no significant difference except the underlying diseases and the complete immunization (Table 2).

Of 250 children with adolescent mothers, prevalence of stunting was 16.4%. Using univariable logistic regression, associated demographic factors of mothers and children included age at delivery, education, family members, weight gain, birth weight, immunization, recent illness, breastfeeding and complementary feeding ($p < 0.05$) (Table 3).

Multivariable logistic regression, association between LBW and stunting among young children (adjusted for potential confounders), babies with birth weight < 2500 grams were 4.77 and 1.80 times at risk compared with those of birth weight ≥ 3000 grams and 2500 - 2999 grams, respectively (Table 4).

Table 2. Demographic child characteristics.

Characteristics	Total	Male	Female
	Number (%)	Number (%)	Number (%)
Age (months)			
6 - 11	33 (13.20)	20 (15.74)	13 (10.57)
12 - 23	86 (34.40)	43 (33.86)	43 (34.96)
24 - 35	108 (43.20)	51 (40.16)	57 (46.34)
36	23 (9.20)	13 (10.24)	10 (8.13)
Mean (SD)	23.09 (9.27)	22.59 (9.55)	23.61 (8.99)
Min - Max	6 - 36	6 - 36	6 - 36
Gender			
Male	127 (50.80)		
Female	123 (49.20)		
Birth weight (grams)			
<2500	69 (27.60)	36 (28.35)	33 (26.83)
2500 - 2999	99 (39.60)	49 (38.58)	50 (40.65)
≥3000	82 (32.80)	42 (33.07)	40 (32.52)
Mean (SD)	2,740.80 (493.49)	2,737.79 (492.95)	2,743.90 (496.03)
Min-Max	1,350-3,900	1,350-3,800	1,600-3,900
Preterm birth			
No	222 (88.80)	111 (87.40)	111 (90.24)
Yes	28 (11.20)	16 (12.60)	12 (9.76)
Underlying diseases			
No	241 (96.40)	121 (95.33)	120 (97.56)
Yes	9 (3.60)	6 (4.67)	3 (2.44)
Complete immunization			
Yes	230 (92.00)	110 (86.61)	120 (97.56)
No	20 (8.00)	17 (13.39)	3 (2.44)
Recent illness history			
No	214 (85.60)	110 (86.61)	104 (84.55)
Yes	36 (14.40)	17 (13.39)	17 (15.45)
Breast feeding (months)			
≥6	56 (22.40)	26 (20.47)	30 (24.39)
4 - 5	81 (32.40	42 (33.07)	39 (31.71
<4	113 (45.20)	59 (46.46)	54 (43.90)

Continued

Complementary feeding (months)			
≥6	129 (51.60)	66 (51.60)	63 (51.60)
4 - 5	96 (38.40)	50 (36.80)	46 (36.80)
<4	25 (10.00_	11 (10.00_	14 (10.00_

SD: standard deviation; Min: minimum; Max: maximum.

Table 3. Univariable logistic regression analysis to identify factors associated with child stunting among adolescent mothers.

Variable	Stunting/total	%	COR	95%CI	*p*-value
Maternal characteristics					
Age at delivery (years)					
≥18	7/96	7.29	1		
16 - 17	23/106	21.69	3.52	1.44 - 8.64	0.006*
<16	11/48	22.92	3.78	1.36 - 10.51	0.011*
Educational level					
Vocational school or higher	5/55	9.09	1		
Senior high school	6/62	9.68	1.07	0.31 - 3.73	0.914
Junior high school	24/111	21.62	2.76	0.99 - 7.68	0.052
Primary school	6/22	27.27	3.75	1.01 - 13.95	0.049*
BMI before pregnancy (kg/m^2)					
Normal (18.5 - 24.9)	25/165	15.15	1		
Underweight (16.0 - 18.4)	12/73	16.44	1.10	0.52 - 2.33	0.801
Very underweight (<16.0)	4/12/	33.33	2.80	0.78 - 10.01	0.113
Family members					
≤5	26/198	13.13	1		
>5	15/52	28.85	2.68	1.29 - 5.55	0.008
Weight gain during pregnancy (kg)					
≥10	26/200	13.00	1		
<10	15/50	30.00	2.87	1.38 - 5.96	0.005
Number of parity					
First	39/229	17.03	1		
Second	2/21	9.52	0.51	0.12 - 2.30	0.382
Marital status					
Lived with husband	30/193	15.54	1		

Continued

Separated	9/43	20.93	1.44	0.63 - 3.30	0.392
Widowed, divorced	2/14	14.29	0.91	0.19 - 4.25	0.900
Monthly family income (THB)					
≥15,000	30/164	18.29	1		
<15,000	11/86	12.79	0.66	0.31 - 1.32	0.267
First antenatal care visit (weeks)					
≤12	10/87	11.49	1		
>12	31/163	19.02	1.81	0.84 - 3.89	0.130
Frequencies of antenatal care visits					
≥5	28/195	14.36	1		
<5	13/55	23.64	1.85	0.88 - 3.87	0.104
Daily iron and folic acid supplements during pregnancy					
Yes	32/202	15.84	1		
No	9/48	18.75	1.23	0.54 - 2.78	0.625
Child characteristics					
Age (months)					
36	4/23	17.39	1		
24 - 35	18/108	16.67	0.95	0.27 - 4.29	0.933
12 - 23	15/86	17.44	1.00	0.27 - 4.64	0.995
6 - 11	4/33	12.12	0.66	0.11 - 4.00	0.579
Gender					
Male	22/127	17.32	1		
Female	19/123	15.45	1.15	0.57 - 2.24	0.818
Birth weight (grams)					
3000 - 4000	10/82	12.19	1		
2500 - 2999	13/99	13.13	1.09	0.45 - 2.63	0.851
<2500	18/69	26.09	2.54	1.08 - 5.96	0.032*
Preterm birth					
No	33/222	14.86	1		
Yes	8/28	28.57	2.29	0.80 - 5.97	0.098
Underlying diseases					
No	39/241	16.18	1		
Yes	2/9	22.22	1.48	0.12 - 6.92	0.644

Continued

Complete immunization					
Yes	34/230	14.78	1		
No	7/20	35.00	3.10	1.16 - 8.34	0.025*
Recent illness history					
No	28/214	13.08	1		
Yes	13/36	36.11	3.76	1.71 - 8.25	0.001*
Breast feeding (months)					
≥6	5/56	8.93	1		
4 - 5	9/81	11.11	1.28	0.40 - 4.03	0.679
<4	27/113	23.89	3.20	1.16 - 8.84	0.025*
Complementary feeding (months)					
≥6	14/129	10.85	1		
4 - 5	20/96	20.83	2.16	1.03 - 4.54	0.042*
<4	7/25	28.00	3.19	1.14 - 8.99	0.028*

COR: crude odds ratio; CI = confidence interval. *Statistically significant ($p < 0.05$).

Table 4. Multivariable logistic regression analysis of birth weight and child stunting among adolescent mothers.

Variable	COR	95% CI	AOR	95%CI	*p*-value
Birth weight (grams)					
3000 - 4000	1		1		
2500 - 2999	1.09	0.45 - 2.63	1.80	0.61 - 5.28	0.283
<2500	2.54	1.08 - 5.96	4.77	1.66 - 13.68	0.004

COR: Crude Odds Ratio; CI: Confidence Interval; AOR: Adjusted Odds Ratio for age at delivery, educational level, family members, complete immunization, recent illness history, breast feeding and complementary feeding.

4. Discussion

The findings showed that the prevalence of child stunting was approximately 16.4% higher than related studies conducted in Thailand and evidence from related studies on stunting showed the prevalence of stunting was approximately 10.5% (de Onis, Onyango, Borghi et al., 2012). Nutritional deficiencies in adolescent girls contribute to problems in pregnancy and childbirth (Lule & Rosen, 2009). Teenage mothers often have less structural resources, less educated, and lack financial independence as compared to adult mothers (Le Roux, Christodoulou, Stansert-Katzen, Dippenaar, Laurenzi, le Roux et al., 2019). Therefore maternal malnutrition is a significant factor of foetal growth in poorer popula-

tion groups, and pregnant adolescents are at even higher risk. Our investigation indicated a serious health problem among teenage mothers, possibly stemming from unwanted pregnancy, poverty, low education and other unsuitable maternal socio-economic factors. Several studies have shown that adolescent mothers were too young, too immature and lacked sufficient nutritional knowledge to take appropriate care of their child. In addition, teenage mothers with unplanned pregnancy might be unaware of food consumption needed to support embryo growth and development. This would create a continuing effect on her nutritional status throughout the pregnancy. Their nutritional status during the time they became pregnant was also an important factor that influenced the health of the fetus, as well as long term health of the infant (Abdullah, Malek, Faruque, Salam, & Ahmed, 2007; Begum, 1999). Approximately one in four newborns are reported as underweight.

This study analyzed the impact of LBW on the child stunting. Our findings showed significant associated with LBW and child stunting. This finding is consistent with similar studies conducted in other parts of the world. Study shows that the LBW is significantly associated with long-term child stunting (Khadija, Mahmood, Ainee, Quddoos, Ahmad, Khadija et al., 2022; Vonaesch, Djorie, Kandou, Rakotondrainipiana, Schaeffer, Andriatsalama et al., 2021; Abbas, Kumar, Mahmood, & Somrongthong, 2021; Woldeamanuel & Tesfaye, 2019; Berhe, Seid, Gebremariam, Berhe, & Etsay, 2019; Khan, Zaheer, & Safdar, 2019; Nshimyiryo, Hedt-Gauthier, Mutaganzwa, Kirk, Beck, Ndayisaba et al., 2019; Abeway, Gebremichael, Murugan, Assefa, & Adinew, 2018). WHO goal is to achieve a 30% reduction in the number of infants born with a weight lower than 2,500 grams by the year 2025 (World Health Organization, 2014). Due to LBW was a predisposing factor of child growth development. Surveillance system among teenage mothers with LBW should be monitoring continually and they should be promoting optimal nutritional skills for preventing from undernutrition. With regard to breastfeeding, a consensus has been reached that 6 months is the recommended duration of exclusive breastfeeding (Müller & Jahn, 2009). Several studies showed breastfeeding's benefits in reduction of child under-nutrition (Harding, Aguayo, & Webb, 2018; Danaei, Andrews, Sudfeld, Fink, McCoy, Peet et al., 2016; Cruz, Azpeitia, Súarez, Rodríguez, Ferrer, & Serra-Majem, 2017; Khan, & Islam, 2017). Percentage of living children according to continued breastfeeding at 2 years of children aged 20-23 months and percentage of infants under 6 months of age who exclusively breastfed were only 15.6 and 23.1 respectively (NSO & UNICEF, 2016). Breastfeeding was beneficial compared with formula feeding among infants according to the study of Dimnjakovic, Poljicanin, & Svajda (2020). The WHO and United Nations Children's Fund recommend that breastfeeding a child up to 2 years of age is essential for proper growth and development, in addition among health infants introducing complementary feeding should be delayed until 6 months of exclusive breastfeeding to confer several benefits to the infant and mother (Müller & Jahn, 2009). Critical view to reduce

the child health problems and child mortality, adolescent-focused activities should be preventing high-risk pregnancies to young mothers and reducing adolescent malnutrition (Lule & Rosen, 2009; Bhan, 2019; Goudet, Bogin, Madise, & Griffiths, 2019; Black & Heidkamp, 2018).

Therefore, adolescent mothers should be provided maternal and child health care services through the health literacy program and appropriate intervention programs on nutrition during pregnancy and after delivery. In addition, local health centers should be revised the community nutritional program of pregnant mothers for preventing child stunting and promoting health status among risk groups.

5. Limitations

This study encountered a few limitations that need to be addressed. First, the cross-sectional survey reduced the ability to make direct causal inferences, we couldn't rule out reverse causation or assess the temporal relationship of some factors preceding child stunting. Second, these data apply only to those teenage mothers in a rural area; therefore, they could not represent all teenage mothers. Third, this study used only height for age for stunting and might not include all stunting. Finally, all data were collected from teenage mothers. Most had mental health problems, such as depression and stress disorder. In addition teenage mothers were also more likely to reside in communities and families that were socially and economically disadvantaged. These circumstances could have adversely affected outcomes for their children.

6. Conclusion

Our results suggest that efforts to prevent and reduce child stunting should include the surveillance system of stunting and campaign of healthy diet and basic techniques for healthy lifestyles among risk groups should be established along with knowledge sharing programs about associated factors of stunting among adolescent mothers during pregnancy to minimize and reduce risks of child stunting.

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Data Availability Statement

The data used in this study was obtained from a structured questionnaire administered to selected adolescent mothers in Phra Nakorn Si Ayutthaya, Thailand.

Conflicts of Interest

The authors declare no conflicts of interest with respect to the research, author-

ship, and/or publication of this article.

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