A Population-Based Cohort Study of Effect of Maternal Risk Factors on Low Birthweight in Thailand

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**** The Prospective Cohort Study in Thai Children*

Objectives: *To determine the maternal risk factors of low birthweight (LBW) in Thailand and to address the possible activities to reduce the incidence of LBW.*
Material and Method: *The data were obtained from the Prospective Cohort Study in Thai Children (PCTC). Three thousand five hundred twenty two pregnancies initiated the follow-up in the year 2000 at four districts across Thailand. The birthweight was retrieved from the Delivery Summary Sheet of the hospitals. The babies born in the hospital were weighed within the first day of life. The babies born at home were weighed within 3 days after birth by the research assistants. Only singleton live births were included in the present study.*
Results: *Three thousand three hundred twenty two live births with birthweight data, 8.6% were LBW. Maternal factors affecting LBW with high attributable fraction (AF) and moderate population attributable risk (PAR) were maternal extreme age (AF = 45.96, PAR = 16.24) and weight gain during pregnancy less than 10 kg. (AF = 40.12, PAR = 16.05). The factors with moderate AF and PAR were first and more than two parities (AF = 21.9, PAR = 15.51) and less consultation to health personnel (AF = 20.96, PAR = 16.98).*
Conclusions: *Improving nutritional status of pregnant women is a potential activity to reduce the incidence of LBW. Pregnant women with extreme age, first and more than parity two and less consultation to health personnel should also be closely followed-up.*

Keywords: *Low birthweight, Cohort study, Population-based, Attributable fraction, Population attributable risk*

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In every pregnancy, parents expect to have a healthy child. However, an unwanted situation may occur such as low birthweight (LBW) baby, premature birth, baby with congenital anomaly or stillbirth. Infants with LBW will be susceptible to death and then bring grief to the families[1]. The babies who survive may have a greater risk of poor general health, behavioral problems, poor neuromotor ability, and cognitive and academic impairment[1-4].

A high incidence of LBW babies reflects poor maternal reproductive health, poor nutritional status of women, improper practices during pregnancy, and low socioeconomic status of pregnant women. Negative maternal reproductive health history such as previous stillbirth, abortion, early neonatal mortality, complication during pregnancy, the first birth, and high parity frequently associated with the delivery of LBW infants[5-8]. Maternal nutritional status such as maternal height and maternal weight gain during pregnancy are often related to the incidence of LBW infants[6-11]. The incidence of LBW babies is also influenced by maternal smoking[5,8,9,11,12], alcohol use[13], and early and frequent antenatal complications[7,13]. Furthermore, low social class[14], extreme maternal age[5,7,14-17], and less maternal education[12,14,15] play important roles on increasing the incidence of LBW babies.

The Ministry of Public Health, Thailand had set the target to reduce LBW babies to less than 7% by

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the year 2006[18]. Therefore, its risk factors should be carefully determined to set up proactive strategies to reduce this problem. The authors used the data of the Prospective Cohort Study in Thai Children (PCTC) Project to explore maternal risk factors that are attributed to the occurrence of LBW babies for proper resource allocation and priority of interventions.

Material and Method

The main study

The PCTC is a population-based birth cohort study. It was established to study the relation between prenatal factors, labor and delivery, and child development through to some years. All pregnant women in the late trimester of pregnancy, with an expected date of delivery within a 12 month period of recruitment, were followed. The 3,522 pregnancies initiated the follow-up in 2000 at four districts across Thailand. Each district is in the central, southern, northeastern, and northern parts of Thailand.

Outcome and outcome measurements

The birthweight was retrieved from the Delivery Summary Sheet of the hospitals. The babies born in the hospital were weighed within the first day of life. The babies born at home were weighed within 3 days after birth by trained research assistants. The LBW meant the birthweight less than 2,500 grams. Similar to many previous studies in developing countries where women could not recall LMP and the ultrasound service is not universal available, the separation of LBW between premature and small for gestational age babies was not possible. A total of 3,322 singleton babies and live births that had the birthweight were included in the analysis.

Study factors

Maternal exposure factors were collected from pregnant women and prenatal record. They consisted of 1) socioeconomic conditions: education, occupation, family income, house ownership, marital status and religion, 2) health services utilization: prenatal care, consultation to health personnel and iron compliance and 3) reproductive health and biological conditions: past obstetric history, parity, planned pregnancy, maternal age, and height. Maternal outcomes during pregnancy consist of complications and weight gain during pregnancy. Smoking and alcohol consumption were excluded because very few pregnant women smoked or drank alcohol during pregnancy. The number of smoking and alcohol consumption cases was not enough for testing the risk. Past obstetric history included history of previous stillbirth, abortion, premature births, and twin pregnancy. Complications during pregnancy were hypertensive disorder, bleeding per vagina, proteinuria, and glycosuria.

Statistical methods

The incidence of LBW babies in each site was calculated per 100 live births. The risk was analyzed by risk ratio (RR), attributable fraction (AF), and population attributable risk (PAR). The RR is the ratio of the risk of occurrence of a disease among exposed people to that among the unexposed. The AF is determined by dividing the risk different by the rate of occurrence among the exposed population. The AF is a useful tool for assessing priorities for public health action. The PAR is the incidence of disease in a population that is associated with an exposure to a risk factor. It is the proportion by which the incidence rate of the outcome in the entire population would be reduced if exposure were eliminated[19].

Results

Magnitude of the outcome

Three thousand three hundred twenty two live births with birthweight data, 286 were LBW babies. Overall rate of LBW babies was 8.61%. The northeastern site had the highest rate of LBW babies, 10.41% (Table 1). Among LBW babies, 82.5% had a birthweight of 2,000-2,499 grams, 13.0% had a birthweight of 1,500-1,999 grams and only 4.5% had a birthweight less than 1,500 grams. Most of them or 83.8% were delivered by normal mode, 11.2% were delivered by cesarean section and the remaining 5% were by other means.

Risk factors

Table 2 shows the incidence of LBW babies regarding maternal outcome factors. The most important factor attributed to LBW with high AF and

Table 1. Incidence of LBW babies in four study sites

Sites	Total live births	Number of LBW	% LBW
Central	750	52	6.93
Southern	993	83	8.36
Northeastern	826	86	10.41
Northern	753	65	8.63
Total	3,322	286	8.61

Table 2. Incidence of LBW by maternal outcomes, risk ratio, attributable fraction, and population attributable risk

Maternal outcome		Pf (%)	Incidence of LBW		Ip %	RR (95%CI)	AF	PAR
			n	%				
Albumin in urine	(2892)							
Yes	(99)	3.4	11	11.11	8.3	1.36	26.19	1.2
No	(2793)	96.6	229	8.2		(0.77, 2.4)		
Sugar in urine	(2897)							
Yes	(11)	0.4	3	27.27	8.32	3.31	69.75	0.84
No	(2886)	99.6	238	8.25		(1.25, 8.75)		
Hypertensive disorder	(3123)							
Yes	(14)	0.4	5	35.71	8.2	4.42	77.4	1.59
No	(3109)	99.6	251	8.07		(2.17, 9.02)		
Bleeding	(3123)							
Yes	(41)	1.3	5	12.2	8.2	1.5	33.28	0.73
No	(3082)	98.7	251	8.14		(0.65, 3.43)		
Weight gain	(2221)							
< 10 kg	(636)	28.6	65	10.22	7.29	1.67	40.12	16.05
≥ 10 kg	(1585)	71.4	97	6.12		(1.24, 2.26)		

Note: Pf is the prevalence rate of maternal factor
Ip is the incidence rate of LBW in the total cases
RR is risk ratio, AF is attributable fraction, and PAR is population attributable risk
The first row of incidence rate of LBW in each factors is the incidence rate of LBW among exposed group (Ie) and the second row is among unexposed group (Iu)
Number in bracket in the first column is the valid cases

moderate PAR was weight gain during pregnancy of less than 10 kilograms (AF = 40.12, PAR = 16.05). Some factors gave high AF (more than 20%) such as hypertensive disorder, glycosuria, proteinuria, bleeding per vagina, maternal height and marital status, but the PAR was low (less than 10%) because of the low prevalence of such factors.

Table 3 shows the incidence of LBW babies regarding maternal exposure factors. The factors affecting LBW with high AF and moderate PAR was maternal age (AF = 45.96, PAR = 16.24). The moderate AF and PAR factors were parity (AF = 21.9, PAR = 15.51) and consultation to health personnel (AF = 20.96, PAR = 16.98). Pregnant women of extreme age, first and more than two parities and less consultation to health personnel are at higher risk of having LBW babies.

Discussion

Maternal weight gain during pregnancy is a sensitive indicator of fetal growth and easy to monitor. Pregnancy weight gain is contributed by increasing fetal weight, enlargement of uterus, increasing of amniotic fluid and development of placenta. The fetal weight is constituted of one fourth of the total weightgain. Poor pregnancy weight gain is a potentially correctable factor of LBW through a good quality of prenatal care and food supplementation to pregnant women. Presently, up to 80% of pregnant women in Thailand attend prenatal care units. All pregnant women should be educated for self-assessment of pregnancy weight gain and consult with health personnel if improper weight gain occurs. Other studies also show a significant linkage between LBW and pregnancy weight gain[8-11,20,21]. By correcting this factor, the current incidence of LBW will be reduced to 7.23%. Although hypertensive disorder and glycosuria gave a high RR and AF, the prevalence of those events were very low to attribute to the reduction of LBW. Good quality of prenatal care may help to reduce the LBW incidence in these groups.

The proportional incidence of LBW can be attributed to an extreme age of the mother for 13.36%. Teenage mothers are more likely to be psychosocially disadvantaged and biologically immature. Older mothers suffer from some pregnancy complications including LBW more than the mothers at 20-30 years old. It may be age-related biological changes or a proxy factor for an increasing amount of cumulative

Table 3. Incidence of LBW by maternal factors, risk ratio, attributable fraction and population attributable risk

Maternal factor		Pf (%)	Incidence of LBW		Ip %	RR (95%CI)	AF	PAR
			n	%				
1) Socioeconomic status								
1.1 Maternal education	(3294)							
Grade 6 and lower	(1983)	60.2	171	8.62	8.62	1.0	0	0
Grade 7 and upper	(1311)	39.8	113	8.62		(0.80, 1.26)		
1.2 Maternal occupation	(3310)							
Non professional	(3178)	96.0	275	8.65	8.61	1.14	12.37	11.96
Professional	(132)	4.0	10	7.58		(0.62, 2.09)		
1.3 Family income	(3269)							
Not enough	(961)	29.4	92	9.57	8.6	1.17	14.42	4.77
Enough	(2308)	70.6	189	8.19		(0.92, 1.48)		
1.4 House ownership	(3306)							
No	(2096)	63.4	192	9.16	8.62	1.19	16.05	10.79
Yes	(1210)	36.6	93	7.69		(0.94, 1.51)		
1.5 Marital status	(3306)							
Single parent	(80)	2.4	9	11.25	8.62	1.31	23.91	0.70
Live together	(3226)	97.6	276	8.56		(0.70, 2.46)		
1.6 Religion	(3179)							
Islam	(671)	21.1	58	8.64	8.62	1.0	0.35	0.12
Buddhism	(2508)	78.9	216	8.61		(0.76, 1.32)		
2) Health service utilization								
2.1 Prenatal care	(2957)							
Seldom	(107)	3.6	9	8.41	7.95	1.06	5.71	0.25
Often	(2850)	96.4	226	7.93		(0.56, 2.01)		
2.2 Consultation	(2957)							
Seldom	(2275)	76.9	190	8.35	7.95	1.27	20.96	16.98
Often	(682)	23.1	45	6.6		(0.93, 1.73)		
2.3 Iron intake	(2956)							
Seldom	(549)	18.6	45	8.2	7.95	1.04	3.78	0.75
Often	(2407)	81.4	190	7.89		(0.76, 1.42)		
3) Reproductive health and biological characteristics								
3.1 Maternal age	(3306)							
< 20 and > 35 yrs	(756)	22.9	101	13.36	8.62	1.85	45.96	16.24
20-35 yrs	(2550)	77.1	184	7.22		(1.47, 2.33)		
3.2 Parity	(2965)							
First, third and more	(1937)	65.3	169	8.72	8.06	1.26	21.9	15.51
Second	(1028)	34.7	70	6.81		(0.98, 1.68)		
3.3 Planned pregnancy	(2985)							
No	(956)	32.0	85	8.89	8.07	1.16	13.5	4.71
Yes	(2029)	68.0	156	7.69		(0.90, 1.49)		
3.4 Past abnormal obstetric history	(3292)							
Yes	(670)	20.4	58	8.66	8.63	1.0	0.46	0.12
No	(2622)	79.6	226	8.62		(0.76, 1.32)		
3.5 Maternal height	(3118)							
< 145 cm	(141)	4.5	25	17.73	8.18	2.29	56.4	5.5
≥ 145 cm	(2977)	95.5	230	7.73		(1.57, 3.34)		

Note: See Table 2

exposure[22]. Birth spacing for adolescents and birth control for older women should be more emphasized. If this factor is controlled, the current incidence of LBW will be reduced to 7.21%. The first and more than two parity pregnancies should receive close follow-up. The health service utilization and reproductive health and biological factors can be improved by continuous and effective maternal and child health program. However,

the socioeconomic factors are hardly involved by health personnel. Overall improving quality of life of people may be helpful.

To address the reduction of the incidence of LBW babies the authors should consider four issues: the prevalence of those risk factors, their priority for public health action, the extents attributable to problem reduction, and the feasibility of prevention of those factors. Maternal weight gain during pregnancy is the most feasible and potential factor because it is a direct factor contributed to LBW that can be improved by health personnel during prenatal care and had high AF and PAR. In addition, the prevalence of less weight gain during pregnancy was 28.6%. Maternal age during pregnancy is another possible factor to intervene because it had high AF and PAR and the prevalence of maternal extreme age during pregnancy was 22.9%. However, this factor has to be involved before pregnancy and depends on individual practice. Other factors do not meet all criteria.

Conclusion

The incidence of LBW babies in the present study was 8.6%. Maternal factors affecting LBW with high AF and PAR were weight gain during pregnancy and maternal age. Improving nutritional status of pregnant women is a potential and feasible activity to reduce the incidence of LBW.

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ปัจจัยเสี่ยงของมารดาที่มีผลต่อทารกน้ำหนักแรกเกิดน้อยในประเทศไทย โดยการศึกษาไปข้างหน้า

ศิริกุล อิศรานุรักษ์, ลัดดา เหมาะสุวรรณ, จันทร์เพ็ญ ชูประภาวรรณ

วัตถุประสงค์*: เพื่อทราบปัจจัยเสี่ยงของมารดาที่มีผลต่อทารกน้ำหนักแรกเกิดน้อยในประเทศไทยและเสนอแนวทางที่มีความเป็นไปได้ในการลดอุบัติการณ์ของทารกน้ำหนักแรกเกิดน้อย*

วัสดุและวิธีการ*: ใช้ข้อมูลจากโครงการวิจัยระยะยาวในเด็กไทย ซึ่งติดตามหญิงตั้งครรภ์ จำนวน 3,522 ราย ตั้งแต่ พ.ศ. 2543 ใน 4 อำเภอ กระจายทั่วประเทศ น้ำหนักแรกเกิดของทารกได้จากใบย่อคลอด ซึ่งจะชั่งเด็กภายใน 24 ชั่วโมง ส่วนเด็กที่คลอดที่บ้านจะได้รับการชั่งภายใน 3 วันหลังคลอด โดยผู้ช่วยวิจัย การศึกษานี้ครอบคลุมเฉพาะทารกครรภ์เดี่ยวและมีชีวิตเท่านั้น*

ผลการศึกษา*: มีทารกจำนวน 3,322 ราย ที่มีข้อมูลน้ำหนักแรกเกิด ในจำนวนนี้เป็นทารกน้ำหนักแรกเกิดน้อย ร้อยละ 8.6 ปัจจัยเสี่ยงของมารดาที่มีค่า Attributable fraction (AF) สูงและ Population attributable risk (PAR) ปานกลาง ได้แก่อายุของมารดา (AF = 45.96, PAR = 16.24), น้ำหนักที่เพิ่มขึ้นระหว่างตั้งครรภ์ (AF = 40.12, PAR = 16.05) ปัจจัยเสี่ยงของมารดาที่มีค่า AFและPAR ปานกลาง ได้แก่ ลำดับครรภ์ (AF = 21.9, PAR = 15.51), การปรึกษากับเจ้าหน้าที่สาธารณสุข (AF = 20.96, PAR = 16.98)*

สรุป*: การปรับปรุงภาวะโภชนาการของหญิงตั้งครรภ์เป็นสิ่งที่มีความเป็นไปได้และมีผลมากต่อการลดอัตราทารกน้ำหนักแรกเกิดน้อย หญิงตั้งครรภ์ที่มีอายุน้อยหรือมากเกินไป ครรภ์แรกหรือลำดับครรภ์ที่ 3 ขึ้นไป ไม่ค่อยได้ปรึกษาหารือกับเจ้าหน้าที่สาธารณสุข ควรได้รับการติดตามเอาใจใส่อย่างใกล้ชิด*