ORIGINAL ARTICLE

Factors Affecting Low Birth Weight Incidence at Cipto Mangunkusumo Hospital, Jakarta

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ABSTRACT A case-control study was conducted during the period of April-July 1997 to determine factors affecting the incidence of low birth weight infants born at Cipto Mangunkusumo Hospital, Jakarta. Of the 300 singleton infants (150 LBW and 150 non-LBW) studied, five risk factors were determined: (1) maternal education (p = 0,027), (2) maternal weight gain during pregnancy (p < 0,0001), (3) interval between pregnancy intervals (p = 0,041), (4) history of previous LBW (p = 0,004), and (5) maternal health condition during pregnancy (p < 0,0001). The mean anthropometric measurements of male non-LBW were significantly greater than female non-LBW infants. **[Paediatr Indones 1998; 38:255-264]**

Introduction

Low birth weight (LBW) infants, that is infant weighing 2500 grams or less at birth, is associated with increased perinatal and infant mortality and morbidity.[1-4] The infant mortality rate is 17 times higher in the LBW group than that in the non-LBW group.[5] On the other hand, LBW infants are prone to have sequelae such as neurological disorders, delayed physical growth, mental retardation, and learning difficulties.[6-8] The incidence of LBW is still high, ranging from around 7% (in developed countries) to 19% (in developing countries). In Indonesia, until the end of the fifth Five Year Development Plan Program, the incidence of LBW was 15%.[9] It is hoped that at the end of the next 5 years, the incidence of LBW in Indonesia can be lowered down to 10%.[10] From the nutritional point of view, LBW can be divided into two categories: (1) intrauterine fetal

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growth retardation (IUGR), and (2) non-IUGR infants (i.e., preterm infants).[2] According to Villar,[11] and others,[3,12] the most common long-term complications of IUGR are abnormal weight and height gains. In developing countries, IUGR is the most common cause of LBW, whilst in Indonesia no such data have been reported.[13]

Causes of LBW are multifactorial.[3,11,12] From the maternal side, factors associated with LBW include age, height, weight gain, education, occupation, interval between pregnancy, unwanted pregnancy, history of abortion, history of LBW, socio-economic status, and the quantity and quality of antenatal care. From the infant's side, these factors are gender, race, and genetics. Some interesting aspects concerning these factors have been reported by some authors. Alisjahbana et al. found that the mean birth weight and chest circumference of male LBW were significantly greater than female LBW,[14] while Crosse reported that in a singleton birth the ratio of LBW female to male was 6:7.4.[3] The objective of this study is to find data of risk factors that play a role in the development of LBW, without differentiating whether the LBW belongs to the IUGR or non-IUGR category. The data can also be used to find the mean anthropometric measurements of male and female LBW and non-LBW infants.

Methods

This case-control study was conducted at the Division of Perinatology, Department of Child Health, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta. The criteria for inclusion were as follows: (1) all live-birth, singleton babies, born at Cipto Mangunkusumo Hospital during the period of April 1- July 31 1997; (2) no clinically detectable anomaly at birth. An infant was subject to be excluded from this study if the mother showed any of these exclusion criteria: (1) unconscious or in serious illness during labor, (2) refused to participate in this study, and (3) had no antenatal record. Successful study subjects were then divided into two groups: (1) LBW (Case) group, consisted of 150 singleton neonates born weighing less than 2500 grams who were consecutively recruited; (2) Non-LBW (Control) group, consisted of all singleton infants with the birth weight of 2500 grams or more. They were chosen randomly using random number table from all babies met the study criteria during the study period. One hundred and fifty non-LBW infants were selected and served as Control group.

All needed data were processed by using Epi-Info v. 5.01 program or SPSS for Windows v. 6. The following analyses were then performed. First, characteristics of both groups (LBW and non-LBW), i.e., gender, anthropometric measurements, and nutritional status were described. If the number of study subjects was large enough, odds ratio (OR) and its 95% confidence intervals and hypothesis testing were conducted in some of the characteristics. Secondly, risk factors for LBW were determined using bivariate and multivariate (logistic regression) analyses. In both analyses, infant's gender and maternal factors (age, education, employment, weight gain, parity, interval between pregnancy, wanted/unwanted pregnancy, history of previous abortion, history of previous LBW, health condition, antenatal care) as the independent variable, and the LBW as the dependent variable. OR, 95% confidence intervas (CI) and hypothesis test were then calculated/ conducted. The multivariate/logistic regression analysis were performed with the help of the SPSS v. 6.0 program, using forward stepwise selection with Wald statistical method.

Since the number was too small, we excluded maternal height and history of stillbirth from the study (6 mothers with height of less than 145 cm compared to 294 mothers with height of 145 cm or more; 4 mothers with history of still-birth compared to 296 mothers without history of stillbirth). Socio-economy status was also excluded due to lack of sufficient data.

Results

1. Characteristics of the infants

During the period of April 1 - July 31 1997, from 1043 infants delivered at the Division of Perinatology, Department of Child Health, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta, 266 (19.0%) weighed less than 2.500 grams. One hundred and sixteen LBW was then excluded from the LBW group because of stillbirths (38), twins (34) and insufficient maternal data (44).

Table 1 shows that female births were insignificantly greater in the LBW group (52.3%) than the non-LBW group. (Table 1)

Table 1. Relation of gender to LBW and non-LBW

Gender	LBW	%	Non-LBW	%	Total	%
Male	71	47.7	78	52.3	149	100.0
Female	79	52.3	72	47.7	151	100.0

OR=0.83 95% confidence interval 0.51;1.35 x^2 =0.65 df=1p=0.420

Male infants of the non-LBW group revealed greater anthropometric measurements of birth-weight, birth-length, head circumference and chest circumference significantly. In the LBW group, female infants showed greater anthropometric measurements insignificantly (Tables 2 and 3). From the 150 LBW infants, 57 (38.0%) were of IUGR-LBW type and 93 (62.0%) of premature/non-IUGR LBW type. See Table 4.

Table 2. Mean anthropometric measurements, non-LBW group, by gender

Anthropometric meas.	Male (n=78)	Female (n=72)	p*
Birth weight (g)	3239.9 (SD498.38)	3085.4 (SD 432.95)	0.045
Birth length (cm)	48.7 (SD 1.85)	48.0 (SD 1.68)	0.020
Head circumerence (cm)	34.1 (SD 1.11)	33.7 (SD 1.05)	0.023
Chest circumerence (cm)	32.4 (SD 1.73)	31.6 (SD 2.91)	0.032

* student's t-test

Table 3. Mean anthropometric measurements, LBW group, by gender

Anthropometric meas.	Male (n=71)	Female (n=79)	p*
Birth weight (g)	2065.6 (SD390.45)	2084.6 (SD 309.72)	0.741
Birth length (cm)	43.4 (SD 4.19)	43.6 (SD 2.66)	0.760
Head circumerence (cm)	31.2 (SD 1.72)	31.3 (SD 2.12)	0.756
Chest circumerence (cm)	28.1 (SD 2.43)	28.3 (SD 2.29)	0.521

*student's t-test

Table 4. Relation of nutritional status to LBW and non-LBW

Group	SGA (%)	AGA (%)	LGA (%)	Total (%)
LBW	57 (38.0)	93 (62.0)	0 (0.0)	150 (100.0)
Non-LBW	1 (0.7)	134 (89.3)	15 (10.0)	150 (100.0)

x^2=76.47; df=2; p<0.0001. SGA=small for gestational age; AGA=appropriate for gestational age; LGA=large for gestational age.

2. Risk Factors of LBW

Table 5 shows the results of bivariate analyses revealed that risk factors to LBW were maternal age, maternal education, maternal weight gain during pregnancy, interval between pregnancy, wanted/unwanted pregnancy, history of previous abortion, history of previous LBW, maternal health condition during pregnancy, and quality of antenatal care.

On logistic regression analysis, it shows that risk factors of LBW were maternal weight gain during pregnancy, maternal education, history of previous LBW, interval between pregnancy, maternal health, and quality of antenatal care. See Table 6.

Discussion

The 19.0% incidence rate of LBW found in this study was comparable to the 12-20% rate found by Ministry of Health, RI, at some teaching hospitals until the year 1994.[7] This finding was higher than the 2.1-17.7% field study reported by Alisjahbana et al. at 7 rural areas in West Java.[15,16] According to Alisjahbana, the high incidence rate in hospital cases was due to the fact that most of the subjects were referral cases.[15,16]

The chance of delivering LBW in this study were insignificantly greater in female rather than male infants, with a ratio of 79:71 or 1,1:1. (Table 1). This finding differs from the report of Crosse, where the male to female ratio was of 7.4:6.[3] So far, this difference can not be explained. A hormonal influence may play a role.[17]

The study of Alisjahbana et al. at 14 teaching hospitals in Indonesia comprising 5844 infants of various gestation ages concluded that anthropometric measurements of birth-weight, birth-length, head circumference, and chest circumference of male infants were greater that female infants, but only the birth-weight and chest circumference were significantly different.[18] In this study similar measurement differences were found, but none were significant. (Data not supplied). Moreover, the non-LBW group showed a greater measuring size for male rather than female infants significantly (Table 2). On the other side, in the LBW group, female showed greater measurements than male infants insignificantly (Tabel 3). To define the cause of this phenomenon, further studies are imperatively needed.

LBW can be categorized into true premature/appropriate for gestational age (AGA), small for gestational age (SGA)/IUGR, and large for gestational age (LGA) infants.[3,4] Table 4 shows that incidence of SGA/IUGR infants among LBW was 38.0%. This result was higher than the 24.1% incidence rate found by Rohimi at the same hospital (1996).[19] Meanwhile, Alisjahbana et al. found an incidence rate of 60% at Hasan Sadikin Hospital (Bandung).[20] But officially, the national incidence rate of IUGR amongst LBW has not been reported. The great discrepancies of SGA/IUGR incidence rate amongst LBW at both hospitals may be caused by differences in the number of referral cases sent to each hospital. Moreover, the incidence of SGA/IUGR amongst LBW found in field survey was greater than at the hospitals. With similar birth-weights, LBW-SGA has longer gestational age than true premature/AGA infants. This condition helps the LBW-SGA infants to adapt better to extrauterine environment, and to be less referred to the hospital. Alisjahbana et al. found that 70% LBW infants born in Tandjungsari village were SGA.[20]

Through the logistic regression analysis, maternal risk factors found in this study were education, interval between pregnancy, weight gain during pregnancy, history of previous LBW, health condition during pregnancy, and adequate antenatal care. Other maternal factors (age, unwanted pregnancy, and history of previous abortion) did not appear in the multivariat analysis, but emerged in the bivariate analysis. Theimportance of the 3 maternal factors in bivariate analysis was caused by an additional factors that supported their roles as risk factors of LBW. This factor is called as a positive role factor. For example, an addition of age factor of the high risk mother to low education can lead to a definite risk factor of LBW. On the contrary, a high risk pregnant woman or woman bearing unwanted child or pregnant women with history of previous abortion can still have low risk of LBW if she has a good education, good health condition, or has interval between pregnancy of less than 12 months, or has no bad history on her previous pregnancy, or she utilizes antenatal care adequately.

This study reveals that maternal occupation did not play an important role both in the bivariate and multivariate analyses. This phenomenon can be caused by the fact that the term *maternal occupation* did not specify body position at work, time/duration of work, weight of workload, etc. Table 6 reveals that factor that had the lowest OR was history of previous LBW (OR = 0.25), while the highest OR was maternal health during pregnancy (OR = 5.27), followed by antenatal care quality (OR = 3.85) and interval between pregnancy (3.25). As far as OR is concerned, maternal education and antenatal care quality were risk factors that had the least OR.

Similar study conducted by Wibowo in Ciawi village (Bogor),[21] and Alexander et al. at Hawaii,[22] revealed that - besides the maternal education factor - a good paternal education level also played important role in lowering incidence of LBW, and vice-versa. In a paternalistic country such as Indonesia, the role of father as the head of the family automatically give him the authority to be the decision maker. This condition should be evaluated in any objective of lowering incidence of LBW. Education is an agent of changing that can change the value and norms of a family. By education, one can receive more information and expand their way of thinking. This will help one to make decision more wisely. Mother and/or father with low education level will have difficulties to receive innovation. Most of them will also be unable to raise their family's welfare, hard to understand the importance of antenatal care, hard to receive the importance of family planning which will naturally be followed by a raise of the risk factors of LBW. Adding the paternal education factor to a similar study in the future, hopefully can reveal better contribution toward lowering risk factor of LBW.

This study bears some limitations. Firstly, several possible biases should be considered, i.e., recall bias and interviewer biases. Both forms of bias have been cautiously considered in the measurments. Recall bias was reduced by use of antenatal record data. Interviewer bias was possible since the study was not blinded; however, since the study did not involve any preferences, the bias was not considered serious.

Furthermore, the results of this study could not directly inferred into the general population, considering the very obvious difference between the characteristics of the

Table 5. Bivariate analysis, risk factors of LBW

Independent Variable		Dependent Variable LBW n	LBW %	Non-LBW n	Non-LBW %	OR	95%	CI	p
Infant's gender	male	71	47.7	78	52.3	0.83	0.51	1.35	0.420
	female	79	52.3	72	47.7				
Maternal age	<20 years	11	78.6	3	21.4	4.25	1.06	19.96	0.007
	20-35 yrs	118	46.3	137	53.7	1.00			
	>35 years	21	67.7	10	32.3	2.44	1.03	5.85	
Maternal education	<6 years	47	59.5	32	41.5	1.68	0.96	2.95	0.066
	>6 years	103	46.6	118	53.4				
Maternal occupation	informal	13	56.5	10	43.5	1.4	0.54	3.64	0.573
	civil serv/prvt	31	54.5	26	45.6	1.28	0.68	2.41	
	house wife	106	48.2	114	51.8	1.00			
weight gain	<9 kg	109	95.6	5	4.4	57.91	20.14	179.7	<0.001
	9-11 kg	32	27.4	85	72.6	1.00			
	>11 kg	9	13.0	60	87.0	0.74	0.28	1.96	
Parity	1	109	52.0	101	48.0	1.00			0.558
	2-3	26	44.0	33	56.0	0.73	0.39	1.36	
	>4	15	48.4	16	51.6	0.87	0.38	1.98	
Interval btw Pregn	<12 mo	85	56.0	67	44.0	1.62	1.00	2.64	0.041
	>12mo	65	44.0	83	56.0				
Wanted pregnancy	No	38	69.1	17	30.9	2.65	1.36	5.24	0.002
	Yes	112	45.7	133	54.3				
History of abortion	Yes	30	71.4	12	28.6	2.88	1.33	6.29	0.003
	No	120	46.5	138	53.5				
History of LBW	Yes	20	77.0	6	23.0	3.69	1.34	10.72	0.004
	No	130	47.4	144	52.6				
Maternal health	Not healthy	83	67.0	41	33.0	3.29	1.97	5.52	<0.001
	Healthy	67	38.0	109	62.0				
Antenatal care	Not adequate	46	76.7	14	23.3	4.30	2.14	8.75	<0.001
	Adequate	104	43.3	136	56.7				

Table 6. Logistic regression analysis to determine role of independen variables on the incidence of LBW birth

Independent Variable	B	SE	WALD	df	SIG	EXP (B)
Weight gain during pregnancy	0.3811	0.0481	62.8647	1	0.0000	0.6831
Maternal education	0.3244	0.1499	4.6812	1	0.0305	1.3832
History of LBW	-1.3744	0.4900	7.8678	1	0.0050	0.2530
Illness during pregnancy	1.6617	0.3352	24.5702	1	0.0000	5.2682
Antenatal care quality	1.3490	0.4299	9.8491	1	0.0017	3.8538
Interval between pregnancy	1.1782	0.3321	12.5844	1	0.0004	3.2486
Constant	-1.9630	0.6845	8.2247	1	0.0041	

subjects in this study, which were mostly referred patients that usually comprised mothers with high risk pregnancy.

In conclusion, in this hospital-based case control study, we have found that maternal health, history of low birth weight, quality of antenatal care, interval between pregnancy, weight gain during pregnancy, and maternal education are important predictors for LBW birth. Although results of the study could not be inferred directly to the population in general, it is reasonable that those factors should be seriously considered in preventing LBW birth in population in general.

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