ORIGINAL ARTICLE

Some Risk Factors for Low Birthweight Infants at Manado Hospital

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ABSTRACT The risk factors of low birthweight infants were assessed in a retrospective study covering 3607 singleton livebirth infants at Manado Hospital from January until December 1993. The analysis confirmed that patterns of risk birthweight below 2500 g associated with sex of the infant (p<0.01), maternal height (p<0.01), hypertension in pregnancy (p<0,01), maternal education (p<0,01), maternal age (p<0.05) and parity (p<0.01), marital status (p<0.01), history of abortion (p<0.05) and parity (p<0.01). Anemia in pregnancy was also associated with birtweight in low birthweight (p<0.05). Asymetric intra uterine growth retardation (Ponderal Index below 2.32) was found both in premature and term infants. **[Paediatr Indones 1995; 35:94-100]**

Introduction

Low birthweight (LBW) is associated with increased perinatal and infant mortality and morbidity, including adverse sequelae such as mental retardation and learning disabilities. The perinatal mortality for term low birthweight infants was 60.4 per mil whereas that for premature low birthweight infants was almost five times as great (287.8 per mil).[1] The infant mortality rate (IMR) in Sukabumi, Indonesia, in 1983/1984 for normal birthweight infants was 56.4 per mil whereas that for LBW infants was five times as great (283.6 per mil); accordingly, the neonatal mortality rate for normal birthweight was 19.3 per mil while for LBW infants was seven times as great (143.3 per mil).[2]

Low birthweight (LBW) has two component parts: preterm and intrauterine growth retardation (IUGR). Many previous studies have shown that some factors such as maternal, infant, and placental factors interacting with infant birthweight. Two thirds of the IUGR infants came from the population with risk factors and one third of the IUGR infants came from the population without risk factors. The perinatal mortality rate was higher in the IUGR group and particularly in the population with risk fac- tors.[3] Identification of specification of specific risk factor of intrauterine growth retardation and preterm delivery should aid in the development of strategies and programs to reduces the prevalence of these conditions.

The Dubowitz and Ballard examinations are inaccurate methods of assessing gestational age in preterm neonates with birthweight less than 1500 g[4] and because of this difficulty in determining an accurate gestational age, many previous studies that examined risk factors of LBW have not tried to distinguish preterm infants from those with IUGR.

The LBW category does not differentiate preterm from growth retarded infants. In contrast, the category small-for-gestational age (SGA) differentiates infants who are preterm but with adequate growth for their gestational ages from infants who are small for other reasons.

IUGR is diagnosed when an infant is small for gestational age (SGA), i.e., when weight is less than a specified percentile of an appropriate sex- and gestational age-specific birthweight standard. In fact, small size among SGA infants may be attributed to growth retardation but it may represent the lower limits of normal intrapopulation variability.

There are symmetric (proportional) and asymmetric (disproportional) type of IUGR infants. Asymmetric head sparing intrauterine growth retardation has its onset during the third trimester and leads to a weight below the 10th percentile and affects length to lesser degree. Asymmetric IUGR infants is characterized by wasting, the linear growth is relatively unaffected but there are deficits in fat and muscular tissue. This type will show evidence of varying degrees of intrauterine malnutrition at birth. In contrast, the onset of symmetric intrauterine growth retardation occurs prior to the third trimester and effects all organ and growth parameters symmetrically.

Rohrer's Index or Ponderal Index captures information about patterns of intrauterine growth, it may distinguish asymmetric from symmetric IUGR.[5]

We considered it is important to examine a number of factors previously reported to be associated with LBW in Manado. In this paper we examine the effects of maternal age, maternal height, marital status, history of abortion, parity, maternal education, and hypertension in pregnancy on infants born in Central General Gunung Wenang Hospital in Manado.

Methods

Data on 3607 singleton babies born alive in RSUP Manado during January 1993 until December 1993 were evaluated. Data were taken from medical record at Pediatric and Obstetric-Gynecological Department of the Central General Hospital Manado, Indonesia.

In this paper, low birthweight (LBW)

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refers to infants with birthweight below 2500 g, and preterm to infants born before 37 weeks gestation, as measured from the first day of the last menstrual period.

The infant weight was measured and recorded soon after birth (within the first half hour) with a scale that recorded weight to the nearest 20 g (Yamato infant Scale, Nakamura Medical Industry, Japan). Infant length was measured using length-measuring board.

Gestational age was determined from the date of the mother's last menstrual period. If mother's last menstrual period data were missing or obviously inaccurate, the Dubowitz method was used to assess gestational age.

Ponderal index was used to assess the infant's quality of nutrition at birth. Ponderal indices between 2.32 and 2.85 represented the 10th and 90th percentiles, respectively, and were based on Rohrer's formula (weight divided by length cubed). A Ponderal Index of <2.26 indicated severe malnutrition; 2.26 to 2.31 indicated moderate malnutrition; 2.32 to 2.85 indicated symmetric or proportional or normal nutritional infants.[6] Infants with Ponderal Index below 2.32 indicated asymmetric intrauterine growth retardation.

$$\text{Ponderal Index} = \frac{\text{Birthweight in grams} \times 100}{(\text{Crown - heel length in cm})^3}$$

Infant with congenital anomalies were excluded.

The EPI INFO 5 statistical package was used for data processing and analyzing. When significant results were obtained at variables having a cutoff point, the relative risk was calculated.

Results

Of all livebirths, 8.5% (307) were low birthweight, consisting of 149 (48.2%) female and 160 (51.8%) male (Table 1). The relative risk of female LBW infants was 1.12. There were 173 (4.8%) mothers whose height was below 145 cm. LBW infants from mothers whose height below 145 cm were (15%); the relative risk for mothers below 145 cm to have LBW infants was 1.89 (Table 2).

Table 1. Distribution of infants 'birth weight and infants' sex

Birth Weight	Infants' Sex		Total
	Female	Male	
< 2500 g	158	151	309
≥ 2500 g	1418	1880	3298
Total	1576	2031	3,607

$X^2 = 7.60$ df = 1 $p < 0.01$ Relative Risk = 1.12

Table 2. Distribution of infants 'birthweight and mothers' height

Birth Weight	Mothers' Height		Total
	< 145 cm	≥ 145 cm	
< 2500 g	26	283	309
≥ 2500 g	147	3151	3298
Total	173	3434	3607

$X^2 = 9.69$ df = 1 $p < 0.01$ Relative Risk = 1.39

There were 147 (4,07%) mothers with systolic blood pressure above 140 mmHg or diastolic blood pressure above 90 mmHg. LBW infants from these mothers were 35 (23.8%). The relative risk for mothers with blood pressure above 140/90 mmHg was 3.34 (Table 3).

Table 3. Distribution of infants' birth weight and mothers' blood pressure

Birth Weight	Mothers' blood pressure		Total
	≥ 140/90	< 140/90	
< 2500 g	35	274	309
≥ 2500 g	112	3186	3298
Total	147	3460	3607

$X^2 = 45,46$ df = 1 $p < 0.01$ Relative Risk = 3.34

The number of mothers with formal education of not more than 6 years was 285 (7.9%). LBW infants from low educated mothers were 54 (18.9%), with the relative risk of 2.50 (Table 4).

Table 5 shows the age distribution of mothers. It shows that the odds ratios for mothers 15-19 years old and 36-45 years old to have LBW infant were 1.07 (Table 5).

Table 4. Distribution of infants 'birth weight and mothers' education

Birth Weight	Mothers' Education		Total
	≤ 6 years	> 6 years	
< 2500 g	54	255	309
≥ 2500 g	231	3067	3298
Total	285	3322	3607

$X^2 = 42.57$ df = 1 $p < 0.01$ Relative Risk = 2.50

Table 5. Distribution of infants' birth weight and mothers' age

Birth Weight	Mothers' Age (years)			Total
	15 - 19	20 - 35	36 - 45	
< 2500 g	46	237	26	309
≥ 2500 g	287	2849	162	3298
Total	333	3086	188	3607

$^2 = 28.81$; df = 2; $p < 0.01$; odds ratios: 20-35 years : 1.00; 15-19 years : 1.07; 36-45 years: 1.07

The role of marital status is shown in Table 6. There were 133 (3.7%) mothers with unmarried status; the relative risk for unmarried mothers to have LBW infants was 2.50.

Table 6. Distribution of infants' birth weight and marital status

Birth Weight	Marital Status		Total
	Unmarried	Married	
< 2500 g	27	282	309
≥ 2500 g	106	3192	3298
Total	133	3484	3607

$X^2 = 22.62$ df = 1 $p < 0.01$ Relative Risk = 2.50

Table 7 shows the distribution of mothers according to history of previous abortion. The odds ratio for mothers with a history of one abortion was 1.03 and while for those with two or more abortion was 1.05 (Table 7).

The distribution of mothers according to their parity is shown in Table 8. There anly a small increase of risk to have LBW with increasing parity; the odds ratios for mothers with parity 1-3 and more than 4 to have LBW infants were 1.05 and 1.08, respectively.

Table 7. Distribution of infants 'birth weight and mothers' history of abortion

Birth Weight	Mothers' History of Abortion			Total
	0	1	≥ 2	
< 2500 g	258	42	9	309
≥ 2500 g	2920	314	64	3298
Total	3178	356	73	3607

$X^2 = 6.88$ df = 2 $p < 0.05$ odds ratio : 0 times : 1.00 1 times : 1.04 ≥ 2 times : 1.05

Premature infants were 93 (30.1%) and term infants were 216 (69.9%) from total LBW infants. There were 18 (19.4%) premature infants with Ponderal Index below 2.32 and 32 (14.9%) term infants with Ponderal index below 2.32 (Table 9).

Mothers with hemoglobin concentration below 10 g/dl were 19 (19.6%) from 97 mothers with complete data hemoglobin concentration. Among these mothers, odds ratios to have infants with birth weight below 1500 g was 1.10 and birth weight 1500-1999 g was 1.75 (Table 10).

Table 8. Distribution of infants' birth weight and parity

Birth Weight	Parity			Total
	0	1 - 3	≥ 4	
< 2500 g	194	103	12	309
≥ 2500 g	1635	1581	84	3298
Total	1829	1684	94	3607

$X^2 = 24.22$ df = 2 $p < 0.01$ odds ratios : Parity 1: 1.00 Parity 1-3: 1.05 Parity ≥ 4 : 1.08

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Table 9. Distribution of Ponderal index in premature and term infants

Maturity	Ponderal Index			Total
	≤ 2.26	2.26-2.31	2.32-2.85	
Premature	15	3	75	93
Term	18	14	184	216
Total	33	17	259	309

$X^2 = 5.11$ df = 4 $p < 0.05$

Table 10. Distribution of mothers' hemoglobin in low birth weight infants

Birth Weight (gram)	Mothers' Haemoglobin (g/dl)		Total
	< 10	≥ 10	
< 1500	6	6	12
1500 - 1999	6	23	29
2000 - 2499	7	49	56
Total	19	78	97

$X^2 = 8.85$ df = 2 $p < 0.05$; odds Ratios : 2000-2499 g: 1.00; 1500-1999 g: 1.75; < 1500 g: 1.10

Discussion

This study supports the findings of previous studies which associated LBW and pregnancy with certain risk factors.

Female infants experienced increased risk of low birthweight. The relative risk for female infants to be LBW was 1.12 (Table 1). Pickering[7] showed male LBW infants and female LBW infants were 17 and 26% respectively (the odds ratios were 1.11-1.24).

The relative risk for mother with height below 145 cm to have LBW was 1.39 (Table 2). Gazali and Sukadi[8] showed the relative risk of 4.8-12.7 for mother below 145 cm and Pickering[7] showed odds ratios of 2.21 for mothers with height below 150 cm to have LBW infants.

Hypertension in pregnancy caused decreased blood flow and nutrition supplementation for infant and is associated with increased risk for LBW infants. The relative risk for mother with systolic blood pressuree above 140 mmHg or diastolic pressure above 90 mmHg to have LBW infants was 3.34 (Table 3). Gazali and Sukadi[8] showed the relative risk of 3.7-9.3 for mothers with blood pressure 140/90 to have LBW infants.

Achievement of at least elementary school graduation was associated with improved outcome in LBW infants. The relative risk for maternal education under 6 years was 2.50 (Table 4). Eisner et al[9] showed strong association between maternal education under 12 years of schooling and birthweight below both 1501 and 2501 grams. Mother's education is an important component of all preterm birth prevention programs.[9] Informal education using videotape and nurse discussion session have been demonstrated to have an independent contribution to prenatal care as and important component of preterm birth prevention programs.[10]

Analysis of maternal age show a higher risk for 15-19 years and 36-45 years compared to 20-35 years. In this study the odds ratio was 1.07 (Table 5). Eisner et al[9] showed primigravida over 35 years had substantially increased risk of low birthweight compared to mothers aged 18-34; multigravida over 35 years of age also had increased risk but not so great as for primigravida. Maternal age under 18 years was a substantial risk factor for multigravida but was not an important factors for primigravida when other factors were held constant. Gozali and Sukadi[8] showed that the risk factors were increased for maternal age 15-19 years and 31-45 years. Sanjose and Roman[11] showed that the LBW percentages were highest in those under 20 years and over 34 years of age.

The relative risk for unmarried woman to have LBW infants was 2.50 (Table 6). This increased risk for unmarried woman was associated with lack of prenatal care because they were ashamed to use health service and disposed to have minimal antenatal care. Not having prenatal care is the greatest risk factors for low birthweight.[9] Sanjose and Roman[11] showed that the relative risk for mothers with marital status "single" was 1.3 and for "previously married" was 1.5.

The odds ratio for mothers with history of abortion once was 1.04 and twice or more was 1.05 (Table 7). Pickering[7] showed in Scotland 1980-2: primiparae or multiparae with a history of one

spontaneous abortion had increased in the risk of having LBW infants; a history of induced abortions was also associated with increased risk of birthweight below the lower cutoff points.

Mothers with parity of 0 and 4 show increased risk of LBW infants (odds ratios were 1.05 and 1.08 respectively). Eisner et al[9] observed the lowest percent LBW for birth orders two to four.

In this study, asymmetric IUGR infants were found in premature and term baby (Table 9). The difference was not significant. Small for gestational age can be found in premature, term, and postmature infants. Although asymmetric/disproportional IUGR infants experience higher neonatal mortality and morbidity, specifically, acidosis, hypothermia, and hypoglycemia, they are more likely to show postnatal catch-up growth. Adair[5] showed that infants who had and adequate Rohrer's Index, i.e., were proportioned at birth, were smaller at 12 months age than infants who had a low Rohrer's Index, i.e., had weight deficits relative to their lengths at birth.

Gazali and Sukadi[8] showed that mothers with hemoglobin concentration less than 10 g/dl had a relative risk of 6.4-14.9 to have LBW infants. In this study we evaluate contribution of mothers hemoglobin concentration with birthweight < 1500 g, 1500-1999 g and 2000-2499 g (Table 10). The difference was also significant ($p<0.05$).

The expression of risks as odds ratio allows an estimate of individual risk by multiplying the odds ratio for each risk-factor borne by the individual.

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