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FACTORS ASSOCIATED WITH BIRTH WEIGHTS AMONG INFANTS

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ABSTRACT

Introduction: Birth weight is the single most important factor which determines infant morbidity and mortality. Birth weight of the newborn is believed to be influenced by several factors. Therefore, it is important to understand the possible factors that influence birth weight.

Methodology: The respondents were 230 postnatal mothers who participated in this study. A self-administered questionnaire was used for interviewing the postnatal mothers. One Way Analysis of Variance (ANOVA), Chi-square tests and the independent *t*-test were used. Statistically significant data were those that had a *p*- value < 0.05.

Results: The mean birth weight was 3080.02±400.61g. The incidence of low birth weight (LBW) was 12.6%. By using One-Way ANOVA test, the factors that were found to be significantly associated with birth weight ($p<0.05$) were maternal age, family size, antenatal booking, parity and gestational age at delivery.

Conclusion: Several factors were found to significantly influence birth weight of infants in this sample. Improved quality of antenatal care can reduce health complications with subsequent improvement in birth weight.

Keywords: Infants, Birth weight, Antenatal care

INTRODUCTION

Birth weight is one of the most important variables in the epidemiology of infant mortality and survival (Wilcox, 2001). The association between birth weight and prenatal mortality has been confirmed repeatedly and to a lesser degree, with developmental problems in childhood (Breslau *et al.*, 2006). The relationship between small size at birth and neonatal death has been well-recognized. Low birth weight (LBW) is a major factor contributing towards high infant mortality in developing countries. Birth weight of the newborn is believed to be influenced by a number of factors. Therefore, it is important to understand the possible factors that influence birth weight. Furthermore, there are socio-demographic and socio-economic factors that are known to affect birth weight (Voigt *et al.*, 2004). Therefore, it is important to determine the factors associated with birth weight among infants.

Objective:

To determine factors associated with birth weights among infants delivered in maternity ward, Hospital Tumpat, Kelantan.

LITERATURE REVIEW

Mondol (2000) showed that socio-cultural variables like maternal education, hard manual labor, and place of residence have significant effects on birth

weight. Recent studies have found some significant differences in birth weight among different social and economic groups; the more disadvantaged groups experience lower mean birth weights (Dickute *et al.*, 2004; Radhakrishnan *et al.*, 2000). Prenatal care is an important factor in influencing birth outcomes and became vital part of records in many countries. In recent years, a number of studies have found a positive relation between prenatal care and birth weight. Better antenatal care with special attention to elderly women (>=35) also reduces the incidence of low birth weight babies (Nair *et al.*, 2000). It supports the findings studied by Ann *et al.*, (2007) that have the same conclusion that increasing maternal age is associated with low birth weight delivery. Nevertheless, others finding from Roth *et al.*, (1998), have described the interplay of these factors as crucial in higher incidence of preterm and LBW infants born to adolescent mothers.

RESEARCH METHODOLOGY

This study was carried out in Hospital Tumpat, Kelantan. Universal sampling method was used where all infants who fulfilled inclusion criteria were selected. The sample size was 230 infants based on Department Statistic Malaysia about Crude Birth Rate (2007), proportion birth rate is 18.0%. Statistical Package for Social Sciences (SPSS) version 16 for Windows was used. Descriptive statistics were applied to compute the mean, frequency, standard deviation and other measures of central tendency. One Way Analysis of Variance (ANOVA), Chi-square tests and the independent *t*-test were use. Statistically significant data were considered to be those having a *p*- value < 0.05.

Study ethics

Before carrying out this research project, an approval letter was sent to the Hospital Tumpat administration to get the consent.

RESULTS

Socio demographic characteristics of the respondents

A total of 230 respondents participated in this study giving a response rate of 100%. The age of the respondents ranged from 16-45 years old and the mean was 29.62±6.877. The majority of respondents belonged to the age group of 26-35 years with 48.3%. The ethnic composition of the study population was Malays were 224(97.4%). Majority of the respondents had secondary education 186 (80.9%). Most of the respondents were house wife, 198 (86.0%). Majority of the respondents have family income < RM1000 about 145 (63%). The mean of family sizes was 4.67±4.67. Most of the respondents have family size between 2-5 were 161 (70.0%).

Birth characteristics of the infants

Table 1 shows that the overall mean birth weight was 3080.02±400.61gram; males (mean weight 3130.48±408.99 gram) ware heavier than females (mean weight 3022.00±384.49 gram). By using the WHO classification of infant's birth weight, the birth weight was divided into three categories. Results show that birth weight <2500 gram (LBW) was 29 (12.6%), 2500-4000 gram (AGA) 195 (84.8%) and birth weight >4000 gram (LGA) was only 6 (2.6%). The gestational age at delivery was divided into three categories: < 37 weeks gestation (preterm) was 8 (3.5%), between 37-42 weeks (term) gestation was 207 (90%) and above 42 weeks (post term) gestation were 15 (6.5%).

Table 1: Distribution of Infants' Birth Characteristic (n=230)

Variables	n	%	Mean BW ± SD
Sex			
Male	123	53.5	3130.48±408.99gram
Female	107	46.5	3022.00±384.49gram
Length (cm)			51.73±2.17cm
Male			51.84±2.08cm
Female			51.59±2.27cm
Circumference of head (COH) (cm)			33.01±1.15cm
Male			33.19±1.12cm
Female			32.79±1.16cm
Weight (gram)			3080.02± 400.61gram
<2500 (LBW)	29	12.6	2531.03±346.25
2500 -4000 (AGA)	195	84.8	3130.02±306.71
>4000 (LGA)	6	2.6	4083.33±75.27
Gestational age during delivery			
Preterm	8	3.5	
Term	207	90.0	
Post term	15	6.5	

Low Birth Weight (LBW)
Appropriate for Gestational Age (AGA)
Large Gestational Age (LGA)

Prenatal Care Characteristic of the Mothers

Table 2 shows the descriptive prenatal care characteristic of the study population (n=230). It showed the distribution of mother's gestational age at the first booking, which formed into three trimesters: 1st trimesters (1-12 weeks) were 187 (81.3%), 2nd trimesters (13-27 weeks) were 39 (17.0%) and 3rd trimester (28-40 weeks) were 4 (1.7%). The overall mean of parity mothers was 3.5261±2.470. By using the WHO classification, the parity was divided into three categories: primigravida (1) were 58 (25.2%), multigravida (2-5) was 128 (55.7%) and grand multipara (above 5) was 44 (19.1%).

Table 2: Distribution of Respondents According to Prenatal Care Characteristic (n=230)

Variables	n	(%)	Mean ±SD
Gestational age at first booking			
1st trimester (1-12weeks)	187	81.3	
2nd trimester (13 to 27weeks)	39	17.0	
3rd trimester (28-40 weeks)	4	1.7	
Number of visits			
0-4 visits	9	3.9	
5-7 visits	51	22.2	
Above 7 visits	170	73.9	
Parity			3.52 ± 2.47
1	58	25.2	
2-5	128	55.7	
Above 5	44	19.1	
Gestational age during delivery			
<37 weeks	8	3.5	
>37 - 42 weeks	207	90.0	
>42 weeks	15	6.5	
Regularly attended routine antenatal check up			
Yes	222	96.5	
No	7	3.0	
Not sure	1	0.4	

Table 3 shows the distribution of respondents on use of nutritional supplements intake. Most of the intake of the nutritional supplements were taken on the 1st trimester (1-12 weeks), that were 180 (78.3%) for iron and folic acid, 89 (38.7%) for multivitamin while only 2 (0.9%) on other supplements.

Table 3: Distribution of Respondents on Use of Nutritional Supplements Intake

Variables	Nutritional supplements							
	Iron		Folic acid		Multivitamin		Others	
	n	%	n	%	n	%	n	%
1st trimester (1-12 weeks)	180	78.3	180	78.3	89	38.7%	2	0.9
2nd trimester (13-27 weeks)	47	20.4	47	20.4	13	5.7	11	4.8
3rd trimester (28-40 weeks)	3	1.3	3	1.3	3	1.3	-	-
Total	**230**	**100**	**230**	**100**	**105**	**45.7**	**13**	**5.7**

Others = Tablet Pramilet and Orbimin

Association between socio demographic factors and birth weight

Table 4 displays the association of socio demographic factors on birth weight. The one-way ANOVA test was used to test the variable as stated below. The distribution of mean birth weight according to age of the mothers shows that the mean birth weight increased at the age of the mother (F=7.405, p=0.001). Maternal age group 16-25 years had lowest mean birth weight than those mothers older than 25 years old (2944.73±390.05). Tukey Post hoc shows mean birth weight for maternal age group 16 -25, 26-35 years and 36-45 years were significantly different (p<0.05), meanwhile, mean birth weight for maternal family sizes for group between 2-5 and 6-10 were significantly different (p<0.05).

This study shows that family size >10 had the lowest mean birth weight (2971.42 ± 292.77). Meanwhile, the differences of mean birth weight by maternal education, income of family and occupations of mother were not statistically significant (p>0.05). Analysis by using t test found that there is no association between occupations of father with birth weight (t=1.922, p= 0.056).

Table 4: Association Between Socio Demographic Factors and Birth Weight(n=230)

Variable	n	Mean BW ± SD	F		*p*- value
Age (years)			**7.405** 16-25	 26-35	**0.001*** 36-45
16-25	75	2942.73 ± 390.05	-	**0.006***	**0.002***
26-35	111	3123.87 ± 380.83	**0.006***	-	0.518
36-45	44	3200.00 ±412.59	**0.002***	0.518	-
Education			**0.328** Primary	 Secondary	**0.805** Tertiary
Illiterate	11	3181.81± 366.24	0.808	0.829	0.988
Primary	23	3050.00± 288.01	-	0.992	0.961
Secondary	186	3075.29± 417.07	0.992	-	0.981
Tertiary	10	3125.00± 372.11	0.961	0.981	-
Occupation (Mother)			**0.074** Professional	Non professional	**0.929** House wife
Professional	13	3053.84±556.20	-	1.0	0.963
Non professional	19	3055.26±286.20	1.0	-	0.952
House wife	198	3084.11± 400.13	0.963	0.952	-
Estimation of family income			**0.557** <RM1000	 RM1000-RM2000	**0.574** >RM2000
<RM1000	145	3059.00± 396.84	-	0.558	0.908
RM1000-RM2000	66	3120.45± 404.49	0.558	-	0.979
>RM2000	19	3100.00± 425.57	0.908	0.979	-
Family size			**3.639** 2-5	 6-10	**0.028*** >10
2-5	161	3040.71 ± 403.38	-	**0.027***	0.893
6-10	62	3194.35 ± 385.40	**0.027***	-	0.337
>10	7	2971.42 ± 292.77	0.893	0.337	-
Occupation (father)			***t*= 1.922**		***p*= 0.056**
Professional	35	2960.00± 365.17			
Non professional	195	3101.56±403.74			

**Significant P<0.05*

Association between maternal prenatal care factors and birth weight

Table 5 shows characteristic of the association between mother's prenatal care factors to birth weight. The mean birth weight according to parity of the mothers shows that the mean birth weight was lowest in primipara (2863.79±360.77) and highest in grand multipara (3167.04±382.45). Birth weight of the infants was increased statistically significantly with parity of the mothers (f=12.469, p=0.000). The mean birth weight according to antenatal booking shows that the mean birth weight was highest in 1st trimester booking (3057.24± 85.60) compared to 3rd trimester booking (2812.50± 440.40). The result shows that there was significant association between antenatal booking with infant's birth weight (F=3.547, p=0.030). The mean birth weight increased with increase in gestational age during delivery where gestational age <37 weeks was lowest (2637.50±370.08) compared to gestational age >37-42 (3064.27 ± 382.34) and gestational age > 42 weeks (3523.33 ± 300.51). It shows that there was significant association between gestational age with infant's birth weight (f=14.956, p = 0.000).

Table 5: Association Between Maternal Prenatal Care and Birth Weight (n=230)

Variables	n	Mean BW ± SD	F		*P*-value
Gestational age at first booking			**3.547** **1st trimester**	**2nd trimester**	**0.030*** **3rd trimester**
1st trimester (1-12 weeks)	187	3057.24± 85.60	-	**0.049***	0.445
2nd trimester (13-27 weeks)	39	3216.66±441.33	**0.049***	-	0.129
3rd trimester (28-40 weeks)	4	2812.50±440.40	0.445	0.129	-
Number of visits Range			**2.556** **0-4**	**5-7**	**0.080** **>7**
0-4 visits	9	2994.44±359.20	-	0.367	0.907
5-7 visits	51	3189.21±390.68	0.367	-	0.080
Above 7 visits	170	3051.79±401.76	0.907	0.080	-
Parity Range			**12.469** 1	**2-5**	**0.000*** **>5**
1	58	2863.79± 360.77	-	**0.000***	**0.000***
2-5	128	3148.08± 390.89	**0.000***	-	0.957
Above 5	44	3167.04± 382.45	**0.000***	0.957	-
Gestational age during delivery			**14.956** **<37**	**>37 - 42**	**0.000*** **>42**
<37 weeks	8	2637.50± 370.08	-	**0.005***	**0.000***
>37 - 42 weeks	207	3064.27± 382.34	**0.005***	-	**0.000***
>42 weeks	15	3523.33± 300.51	**0.000***	**0.000***	-

** Significant p<0.05*

Tukey Post hoc shows mean birth weight between maternal parity 1, maternal parity 2-5 and parity > 5 were significantly different ($p< 0.05$). Meanwhile, gestational age during delivery <37 weeks, maternal gestational age >37-42 weeks and>42 weeks were significantly different ($p<0.05$).

Association between nutritional supplements and birth weight

Table 6 shows the association between nutritional supplements and birth weight. The differences in birth weight distribution by the type of nutritional supplement intake according to trimester were not statistically significant ($p>0.05$).

Table 6: The Association Between Nutritional Supplement Intake and Birth Weight (n=230)

Variable	≤2500		>2500		χ^2	*p*-value
	n	%	n	%		
Iron					0.680	0.712
1st trimester	22	12.2	158	87.8		
2nd trimester	7	14.9	40	85.1		
3rd trimester	0	0	3	100		
Total	29	12.6	201	87.4		
Folic acid					0.680	0.712
1st trimester	22	12.2	158	87.8		
2nd trimester	7	14.9	40	85.1		
3rd trimester	0	0	3	100		
Total	29	12.6	201	87.4		
Multivitamin					0.787	0.675
1st trimester	12	13.5	77	86.5		
2nd trimester	1	7.7	12	92.3		
3rd trimester	0	0	3	100		
Total	13	12.4	92	87.6		
Others					2.176	0.140
1st trimester	1	50.0	1	50.0		
2nd trimester	1	9.1	10	90.9		
Total	2	15.4	11	84.6		

Others = Tablet Pramilet and Orbimin

Association between gender of baby and birth weight

Table 7 gives the number of single live births and their distribution according to categories of birth weight and sex. By using the WHO classification, the overall incidence of low birth weight (less than 2500 gram) in this study population is 12.6%. The incidence of LBW is 6.1% in male births and 6.5% in female births. There is a significantly higher proportion of LBW in female than male babies. The table also shows that the percentage of babies with weight 4000 gram or more are much higher among male babies (1.7%) than female (0.9%). Result shows that gender of baby was also found to be statistically significant (t=2.035, p = 0.043).

Table 7: Gender distribution of birth weights

Birth weight (gram)	Male		Female			
	n	(%)	n	(%)	*t*	*p*- value
					2.035	**0.043***
< 2500	14	6.1	15	6.5		
2500 - 4000	105	45.7	90	39.1		
> 4000	4	1.7	2	0.9		
Total	**123**		**107**			

** Significant p<0.05*

DISCUSSION

In this study the researcher found that the mean birth weight of 3080.022 ± 400.612. There are 123 male infants with mean birth weight of 3129.26 g ± 410.66 and 107 female infants with mean birth weight 3022.00 g ± 384.49. This finding showed that the male babies were generally heavier than the female babies. This finding was similar to study done by Mondol, (1998). The incidence of LBW was 12.6%. This percentage is lower than that study done by Som *et al.*, (2004), who studied the effect of socio-economic and biological variables on birth weight in Madhya Pradesh, India, where prevalence of LBW was 17.39%. However, the result finding in this study was higher than the study by Osman & Hanafiah, (1994), in their study on factors influencing birth weight among pregnant mothers in Sarikei, Sarawak, whereby the prevalence of LBW was 10.2%.

In this study result showed that gender of baby was also found to be statistically significant (t=2.035, p=0.043). The association between fetal sex and various outcomes of pregnancy and labor have been well documented in western populations (Ingemarsson, 2003). On average, the weight of a male fetus is 150g higher than that of a female fetus.

Socio demographic factors and infant's birth weight

Result shows that the effect of socio demographic to birth weight in maternal age of the respondents ranged from 16-45 years old and the mean was 2944.73 ± 390.05 years. The majority of respondents belonged to the age group of 26-35 years with 48.3%. There was a significant association between maternal age factors with birth weight (f =7.405, p =0.001). This finding of the result is similar to study done by Som *et al*., (2004). Younger mothers have comparatively lower birth weight children than the older mothers. According to Joyce *et al.*, (2002), the rate of LBW babies among teen mothers was 35 percent higher than that among mothers aged twenty to twenty-nine (9.6% as against 7.1%).

Based on the finding in this study, most of the respondent's family income is < RM 1000 was 63%. It is supported by Pusat Maklumat Negeri Kelantan, (2005) stated that in the year 2001, Tumpat district had the second highest number of head of household income of less than RM340/month, that indicates that Tumpat is one of the poorest districts in Malaysia. It shows that the family income had no significant association with birth weight ($\chi^2 = 0.557, p = 0.574$).

In this study it is found that there is no significant association between educational of mothers and infant's birth weight (F=0.328, p = 0.805). However, contrast finding by Som *et al.*, (2004), there is a close relationship between status and birth weight, maternal education, in other words the level of education of the mother affects the baby's birth weight. This statement is supported by Gate & Therriault, (1998), found that mothers who are educated have got information about antenatal care and precautions to be taken during childbirth, which is obviously having a good impact on the weight of the newborn.

There was no significant association between mother's occupation and birth weight (F=0.070, p= 0.933). This study also found that there was no significant association between father's occupation with birth weight (t=1.922, p=0.056). However, contrast finding study done by Moris *et al.*, (1999) stated that family income was a strong indicator of birth outcomes as related to weight. This assertion is supported by Memon *et al.*, (2005),, their study showed that the lower

social classes are at risk of adverse pregnancy outcomes, including harms of prenatal death, premature birth and LBW.

There was significant association between family size and birth weight (F =3.639, $p = 0.028$). The finding describes that low income had relationship with family size, because bigger the family size lower the household income. This may cause poor maternal nutritional intake because of poverty. Therefore, the family size affects the birth weight.

Prenatal cares of mother and infant's birth weight

This study shows that the mean birth weight was considerably lower for primigravida 2863.79± 360.77, compared to parity > 5 was 3167.04± 382.45. There was highly statistically significant difference between parity of mothers with birth weight (F= 12.469, p=0.000). The major determinant of birth weight in this study was gestational age. This study indicated that there was association between gestational age during delivery with birth weight (F = 14.956, p=0.000). It is supported by Shajari *et al.*, (2006), found that gestational age was found to be strong independent predictor of birth weight.

Most of the gestational age at first booking among respondents were at 1st trimester (81.3%). In this study, there was statistically significant association between antenatal booking with birth weight (F=3.547, p=0.030). These results were similar to the results studied by Taiye & Lartey (2008), he found that if mothers get prenatal care during the 3rd month of pregnancy, on average, 3.2 times (95% CI: 1.9 to 5.2, p<0.0001) better opportunities to produce babies of normal weight is possible. Mwenesi, Harpham & Snow, (1995), reported that only 9.9% booked for the ANC in the first trimester of pregnancy, these events may contribute to the high prevalence of anemia.

There was no significant association found between maternal antenatal visit with birth weight (F= 2.556, p = 0.080). Many studies have established a link between these factors and LBW, such as study done by Letamo & Majelantle, (2001), found that there is a strong relationship if the first visit is delayed or if the number of visits is smaller than normal (<80%), which can affect birth weight outcomes. Another study by Memon *et al.*, (2005), found that there was significant association of lack of regular antenatal visit with LBW baby.

There was no significant association between nutritional supplements with birth weight. For the iron (χ^2=0.680, p= 0.712), folic acid (χ^2 = 0.680, p=0.712), multivitamin (χ^2=0.787, p=0.675) and other nutritional supplements (Tablet Obimin and Pramilet) (χ^2=2.176, p= 0.140). However, this finding contrast with the study done by Hess *et al.*, (2001), stated that intake of iron supplements during pregnancy have a protective effect with respect to LBW. According to Tayie & Lartey (2008), pregnant women who received antenatal care and were on multivitamin and mineral supplements for more than 5 months had infants who weighed better than those who received care for lesser duration (3.04±0.44 vs 2.88±0.55 kg), respectively p-value < 0.0001.

CONCLUSION

In conclusion, this study has provided information on factors associated with birth weight. Improved quality of antenatal care can reduce health complications with subsequent improvement in birth weight. Maternal risk factors could be reduced by improving antenatal care practices and the effectiveness of existing maternal nutrition programs and services to improve nutritional status of mothers. Therefore, early preventive measures are better, especially during early pregnant mothers to address the risk of LBW that can lead to perinatal death. All of maternal risk factors might be reduced by improving antenatal care practice.

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