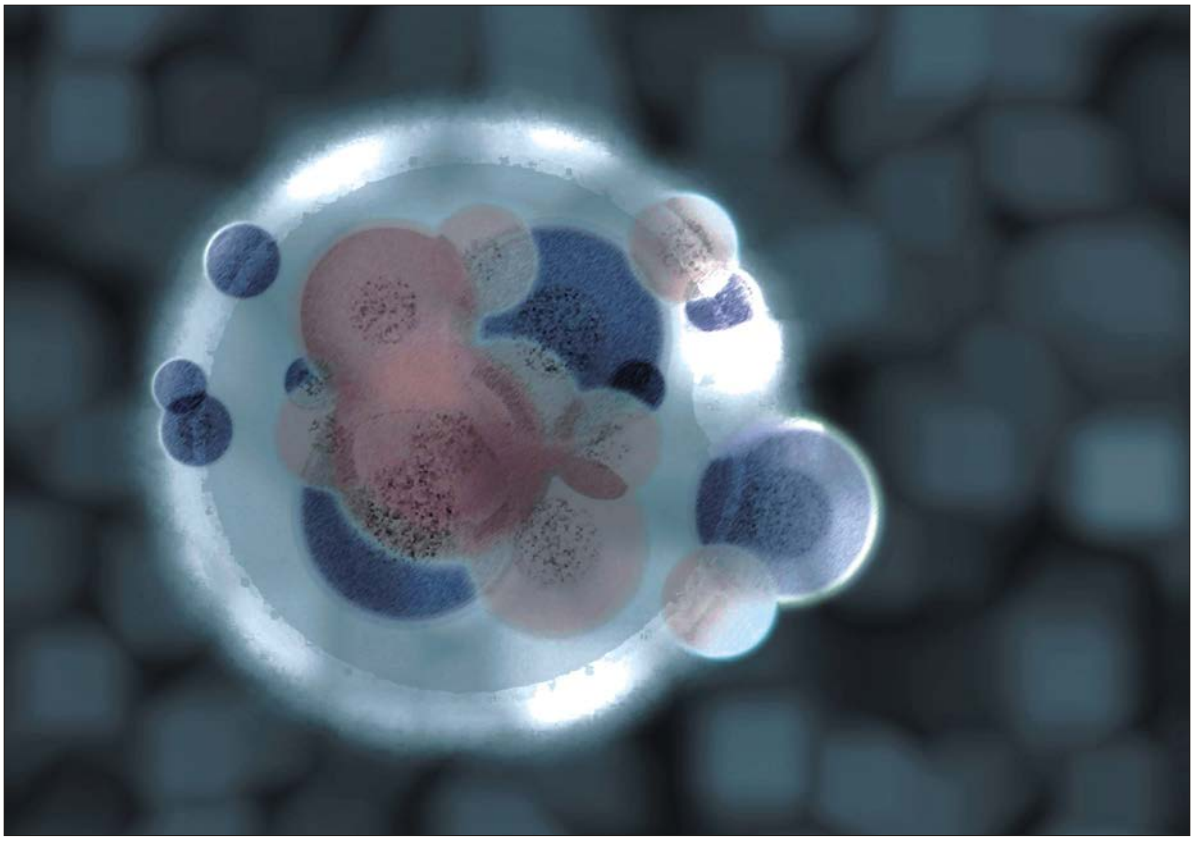

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Risk Factors Associated with Delivering Low Birth Weight Infants Among Pregnant Women: A Preliminary Study in Western Saudi Arabia

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Abstract: This study was maintained to identify the risk factors associated with delivering Low Birth Weight (LBW) infants among pregnant women in Makkah area. Two groups were recruited in this study; mothers who delivered LBW infants (MLBW) and mothers who delivered normal birth weight infants (MNBW). Participants were chosen from two hospitals in Makkah; Al-Noor Specialty Hospital and Children and Maternity Hospital. Mothers' ages were chosen between 20-40 years old. Data were collected from medical files and structured questionnaire from 183 delivered women (MNBW n = 92, MLBW n = 91). No significant differences were found in mother's age, weight, height, BMI, family income, mother's education and occupation between two groups. Also, chronic diseases, placenta problem, previous LBW, previous pregnancies and age at first pregnancy all didn't show any effect on LBW. MLBW showed significantly ($p<0.05$) lower fruits as well as milk and dairy products intake than MNBW. Also, tea intake of MLBW group was significantly ($p<0.05$) higher than the other group. The most probable risk factors associated with delivering LBW were related to multiple births as twins (OR = 6.47, (CI: 1.05-39.89), p = 0.044), smoking (OR = 5.73, (CI: 2.23-14.74), p = 0.040) and lower fruits intake than nutritional recommendation (OR = 0.30, (CI: 0.09-1.06), p = 0.042). Odds ration showed no significant results for high tea intake and low milk and dairy products intake. In conclusion, the main risk factors associated with delivering LBW infants in Makkah area were multiple births, smoking and low fruits intake.

Key words: Low-birth-weight, risk factors, pregnant women, Makkah

INTRODUCTION

Birth weight is the first weight of the fetus or newborn obtained after birth. For live births, birth weight should ideally be measured within the first hour of life before significant postnatal weight loss occurs (WHO, 2012). Infants born weighing less than 5.5 pounds (2,500 g) are considered Low Birth Weight (LBW). LBW infants are at increased risk for serious health problems as newborns, lasting disabilities and even death (Syed and Kamathi, 2012). LBW may be attributable to a shortened period of gestation, prematurity, or a retarded intrauterine growth rate, which make the infant small for gestational age (Anderson, 2008). An inverse relationship exists between birth weight and infant mortality rate. The risk for infant death for those who weight 1500 to 2499 g is six times higher than for infants who weight more than 2500 g; for infants who weight 1500 g and lower, the risk is 100 times higher (MacDorman *et al*., 2005).

Many risk factors associated with delivering LBW infants; some related to maternal pregnancy, health and socioeconomical status (Hashim and Moawed, 2000) and other related to nutritional status of pregnant women (Ramakrishnan, 2004). In brief, the main risk factors are; demographic characteristics (Valero De Bernabe *et al*., 2004), low socioeconomic status (Li and Sung, 2008), pregnancy medical risks (Jafari *et al*., 2010), adequacy of antenatal care and pregnancy complications (Hashim and Moawed, 2000), placental problems (Field *et al*., 2006), blood pressure (Yadav and Lee, 2013), genetic factors (Rice and Thapar, 2010), chronic diseases like diabetes, heart defects, anemia, or kidney disease (Valero De Bernabe *et al*., 2004; Kidanto *et al*., 2009), multiple pregnancies (Shinwell, 2002), multiple births (Anderson, 2008), smoking (Ness *et al*.,1999), stress and depression (Benute *et al*., 2010), maternal weight during pregnancy (Maddah *et al*., 2005), low stature and Body Mass Index (BMI) (Syed and Kamathi, 2012), caffeine intake more than 300 mg day^{-1} (Konje, 2008) and finally inadequate nutrition during pregnancy (Kramer, 1993).

In Saudi Arabia, no detailed studies on the risk factors that influence birth weight and only one research was done by Hashim and Moawed (2000) in Riyadh (Capital of Saudi Arabia) is found without determining the effect of dietary intake on LBW. Therefore, this study was aiming to identify socioeconomical, health and dietary risk factors for pregnant women associated with delivering LBW infants in Makkah area (Western Province of Saudi Arabia).

MATERIALS AND METHODS

Materials: The study design was cross-sectional comparative study. The study population comprised from 183 newly delivered pregnant women. Two groups were enrolled in this study; mothers who delivered low birth weight infants (MLBW, n = 91), and mothers who delivered normal birth weight infants (MNBW, n = 92). The exclusion criteria were mother's age higher than 40 years old and gestational age less than 37 weeks. Infants considered LBW when their birth weight less than 2500 g. Participants were collected from two hospitals in Makkah; Al-Noor Specialty Hospital as well as Children and Maternity Hospital.

Data collection: Data were achieved through two ways: (1) medical files for recording infant's weight, and mother's diseases and (2) structured questionnaire for collecting mother's general information (pre-pregnancy weight and height), socioeconomical status, health status, disease history and nutritional data. Face-to-face interview with mothers was done to fill the questionnaires. Nutritional information were covered after nutritional education for mothers about their daily requirement and recommended intake from each food group during pregnant. Nutritional education was done by expert maternity nutritionists.

Statistical analysis: Statistical analysis was performed by using SPSS software (Centers for Disease Control and Prevention, 2004) version 17. Chi square test was used to determine the significances between groups and p-value less than 0.05 was considered statistically significant. In addition, binary logistic regression was used to determine the Odds Ratio (OR) and 95% Confidence Interval (CI) for the significant variables that could be potential independent predictors of LBW infants.

RESULTS

Table 1 shows the descriptive results of the sample study. No significant differences were found in mother's age, weight, height and BMI between groups. As expected, newborn's weight showed significant difference ($p<0.05$). The mean infant weight (kg) after birth was 3.16 and 1.95 for MNBW and MLBW, respectively.

Table 2 demonstrates the socioeconomical data of the study groups. Family income, mother's education and occupation all were not associated with LBW. Interestingly, smoking showed significant difference ($p<0.05$) between two groups. The percentage of smokers in MLBW (28.6%) almost fourfold that of those in MNBW (6.5%).

Table 1: Mothers characteristics according to their newborn weight (Mean±SD)

	Groups		
Variables	MNBW	MLBW	p-value
Mother's age (year)	28.39±5.65	30.51±7.72	0.157
Mother's weight (kg)	63.65±11.30	65.14±12.12	0.570
Mother's height (m)	1.58±5.68	1.57±5.59	0.747
Mother's BMI (kg m^{-2})	25.41±4.13	26.17±4.70	0.443
Newborn's weight (kg)	3.16±0.52	1.95±0.50	<0.0001

p-values were calculated according to t-test, MNBW: Mothers who delivered normal birth weight (n = 92), MLBW: Mothers who delivered low birth weight (n = 91)

Table 2: Mothers socioeconomic data according to their newborn weight

	Groups				
	MLBW		MNBW		
Variables	No.	%	No.	%	p-value
Level of family income					
Less than 10.000 RS	81	88.00	83	91.20	
More than 10.000 RS	11	12.00	8	8.80	0.984
Mother's education					
Not educated	8	8.70	5	5.50	
Educated	84	91.30	86	94.50	0.612
Mother's occupation					
Working	8	8.70	18	20.00	
Not working	84	91.30	73	80.00	0.141
Mother's smoking					
No	86	93.50	65	71.40	
Yes	6	6.50	26	28.60	0.007

p-values were calculated according to Chi square test, MNBW: Mothers who delivered normal birth weight (n = 92), MLBW: Mothers who delivered low birth weight (n = 91)

Table 3: Mothers health status according to their newborn weight

	Groups				
	MLBW		MNBW		
Variables	No.	%	No.	%	p-value
Diabetes					
Yes	6	6.50	13	14.30	
No	86	93.50	78	85.70	0.246
Hypertension					
Yes	6	6.50	11	12.10	
No	86	93.50	8	87.90	0.246
Anemia					
Yes	13	14.10	9	9.90	
No	79	85.90	82	90.10	0.427
Placental problems					
Yes	9	9.80	8	8.80	
No	83	90.20	83	91.20	0.731
Previous LBW					
Yes	7	7.70	8	8.80	
No	85	92.30	83	91.20	0.984
Birth					
Singleton	88	95.70	65	71.40	
Twins	4	4.30	26	28.60	0.002
Previous pregnancies					
Yes	70	76.10	57	62.60	
No	22	23.90	34	37.40	0.196
Mother's age in 1st pregnancy					
<18 years	14	15.20	13	14.30	
>18 years	78	84.80	78	85.70	0.907

p-values were calculated according to Chi square test, MNBW: Mothers who delivered normal birth weight (n = 92), MLBW: Mothers who delivered low birth weight (n = 91)

Table 4: Mothers food intake during pregnancy according to their newborn weight

	Groups				
	MLBW		MNBW		
Variables	No.	%	No.	%	p-value
Fruits intake (3-4 servings day^{-1})					
Yes	79	85.90	54	59.30	
No	13	14.10	37	40.70	0.012
Vegetables intake (4-5 servings day^{-1})					
Yes	78	84.80	62	68.10	
No	14	15.20	29	31.90	0.071
Meat and legumes intake (3 servings day^{-1})					
Yes	82	89.10	68	74.70	
No	10	10.90	23	25.30	0.073
Milk and dairy products intake (3-4 servings day^{-1})					
Yes	76	82.60	51	56.00	
No	16	17.40	4	44.00	0.012
Bread and rice intake (7-11 servings day^{-1})					
Yes	88	95.70	75	82.40	
No	4	4.30	16	17.60	0.063
Coffee intake (>2 cups day^{-1})					
Yes	38	41.30	31	34.10	
No	54	58.70	60	65.90	0.341
Tea intake (>4 cups day^{-1})					
Yes	28	30.40	46	50.50	
No	64	69.60	45	49.50	0.046
Chocolate intake (>28 parts day^{-1})					
Yes	30	32.60	42	45.20	
No	62	67.40	49	54.80	0.166
Soft drinks intake (>3 cans day^{-1})					
Yes	14	15.20	23	25.30	
No	78	84.80	68	74.70	0.186

p-values were calculated according to Chi square test, MNBW: Mothers who delivered normal birth weight (n = 92), MLBW: Mothers who delivered low birth weight (n = 91)

Table 5: Binary logistic regression for the significant variables: potential predictors of LBW infants

Variables	OR	95% CI	p-value
Birth (twins)	6.47	1.05-39.89	0.044
Mother's smoking (yes)	5.73	2.23-14.74	0.040
Fruits intake (3-4 servings day^{-1})	0.30	0.09-1.06	0.420
Tea intake (>4 cups day^{-1})	0.99	0.65-6.19	0.057
Milk and dairy products intake (3-4 servings day^{-1})	0.39	0.11-1.36	0.139

Dependant variable: Birth weight, OR: Odds ratio, CI: Confidence interval

Table 3 reveals the main diseases, pregnancy and delivery status of study groups. Chronic diseases (diabetes and hypertension), anemia, placenta problem, previous LBW, previous pregnancies and age at first pregnancy all didn't show any effect on LBW. Regarding multiple births as twins, the percentage of mothers who delivered twins in MLBW (28.6%) nearby six times higher than those of MNBW (4.3%). This difference between groups was statistically significant ($p<0.05$).

Dietary intake of each food group is displayed in Table 4. Also, same table shows caffeine intake from main food sources that are: coffee, tea, chocolate and soft drinks. MLBW showed significantly ($p<0.05$) lower fruits as well as milk and dairy products intake than MNBW. Also, tea intake of MLBW group was significantly ($p<0.05$) higher than the other group.

Odds rations and their confidence intervals for significant variables are found in Table 5. The most probable risk factors associated with delivering LBW were related to multiple births (OR = 6.47, (CI: 1.05-39.89), p = 0.044), smoking (OR = 5.73, (CI: 2.23-14.74), p = 0.040) and lower fruits intake than nutritional recommendation (OR = 0.30, (CI: 0.09-1.06), p = 0.042). Binary logistic regression showed no significant results for high tea intake and low milk and dairy products intake as predicted risk factors for LBW.

DISCUSSION

This study is the first that determined the risk factors associated with delivering LBW infants in Makkah area. The principal risk factors were multiple births as twins, smoking and low fruits intake. Hashim and Moawed (2000) reported that Saudi women from Riyadh who had an increasing amount of stress during pregnancy, underweight and short stature have an increased risk of having LBW babies. However, previous results were not in line with study results because mother's weight, height and BMI showed no significant differences, while Hashim and Moawed (2000) study concluded that short stature and BMI was a risk factor for LBW. A recent study conducted by Syed and Kamathi (2012) confirmed the association of maternal short stature with LBW of new births. There was direct relationship between the short stature of the mother and the LBW. On the other hand, overweight and obese women had an increased risk of having an infant of very low birth weight or extremely low birth weight. The heavier women had the higher risk of having an extremely low birth weight infant (McDonald *et al*., 2010; Thame *et al*., 2004). Although, maternal psychological stress was not measured in this study, but it's one of the risk factors associated with delivering LBW in KSA (Hashim and Moawed, 2000) and other countries (Benute *et al*., 2010).

Multiple births as twins were the leading risk factor for LBW in this study. Anderson (2008) reported that more than 50% of twins and other multiple gestations were LBW. This result is in accordance with study result. Regarding smoking, mother's smoking was the second risk factor. This could be due to different compounds including carbon monoxide, hydrogen cyanide, carcinogens and trace elements such as lead, nickel and cadmium. The two main compounds suspected of causing the harmful effects on the developing fetus during pregnancy are carbon monoxide and nicotine (Ness *et al*.,1999). Carbon monoxide has a higher affinity for hemoglobin than oxygen, quickly forming the compound carboxyhemoglobin which is unable to carry oxygen. The formation of this molecule leads to a

potential for decreased oxygen delivery to the fetus and fetal hypoxia (Vna Meur, 1999). According to the US Centers for Disease Control and Prevention (2004), pregnant women smoking during pregnancy have double the risk of LBW babies compared to non smoking expecting women.

Poor nutrition is a known cause of LBW, especially in developing countries. Ramakrishnan (2004) reported that maternal nutritional factors both before and during pregnancy account for more than 50% of cases of LBW in many developing countries. Nutritional risk factors might be related to anthropometric measures and the adequacy of energy and protein intakes during pregnancy (Kramer, 1993). In this study, low fruits intake was one of the dietary risk factors of LBW. This could be due to vitamin C deficiency as fruits intake decreased during pregnancy. Lee *et al.* (2004) found that maternal serum vitamin C levels during the second trimester were positively correlated with birth weight and length in full-term babies.

CONCLUSION

This study demonstrated that the main risk factors associated with delivering LBW infants in Makkah area were multiple births as twins, smoking and lower fruits intake than nutritional recommendation. Further cohort studies are needed to determine other risk factors not studied like stress, upper arm circumference and blood pressure, as well as to find any possible risk factor that could be significant if studied in large number, such as underweight, short stature, LBW, age, caffeine intake, education and occupation.

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