



## The Association Between Exposure to Environmental Tobacco Smoke (ETS) in Mother During Pregnancy with Low Birth Weight (LBW) Infants

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### Abstract

**Introduction:** Low birth weight (LBW) is a major contributing factor towards high infant mortality in developing countries. One of the most predominant causes of LBW is the mother's access to prenatal care; however exposure to environmental tobacco smoke (passive smoking) may have a modest adverse effect on birth weight.

**Methodology:** Two-hundred thirty postnatal mothers were participated as respondents in this study. A self-administered questionnaire was used. Data was collected by interviewing the postnatal mothers. A One Way Analyses Of Variance (ANOVA) and Chi-Square test were used. The differences were evaluated significant at  $p < 0.05$ .

**Results:** There was highly significant association between mother's exposure to environmental tobacco smoke (ETS) or passive smoking with birth weight ( $F = 15.200$ ,  $p = 0.000$ ). There is a significant association between the number of cigarettes per day father's smoke with birth weight ( $F = 4.970$ ,  $p = 0.003$ ). However, analysis by using Chi-Square shows that the exposure of smoke to other family members was not statistically significant ( $\chi^2 = 1.68$ ,  $p = 0.431$ ).

**Conclusion:** Therefore, the improved quality of antenatal care can reduce health complications with subsequent improvement in birth weight. On the other hand, early antenatal care is crucial to favorable pregnancy outcome.

**Keywords:** Environmental tobacco smoke (ETS), Pregnancy mothers, Low Birth Weight (LBW)

### Introduction

Birth weight is a powerful predictor of infant growth and survival. In Malaysia (1984) reported incidence of LBW (Low Birth Weight) infants were 10 % and the prevalence studies on LBW infants delivered in Hospital Universiti Sains Malaysia, Kelantan showed a rate of 6.3 % (Siti Arbaiyah *et al.*, 1999). The highest incidence of LBW occurs in the sub region of South-Central Asia, where 27 per cent of infants are LBW (The United Nations Children's Fund and World Health

Organization, 2004). The goal of reducing low birth weight incidence by at least one third between 2000 and 2010 is one of the major goals in 'A World Fit for Children,' the Declaration and Plan of Action adopted at the United Nations General Assembly Special Session on Children in 2002 (The United Nations Children's Fund and World Health Organization, 2004).

Risk factors associated with pre-term birth includes cigarette smoking during pregnancy,

prior pre-term birth, low pre-pregnancy weight, and maternal chronic diseases. The biological process that affect the fetus in uterus are related to the mother's physiology, including her nutrition mother's weight before pregnancy and history of having newborns with LBW, exercise, infections, and consumption of tobacco, alcohol and other drugs (Lynch & Kaplan, 2000). According to Djauzi (2005) the influence of smoking on pregnancy is very serious. Cigarettes can reduce blood flow to the placenta so the risk of inflicting impaired fetal growth. Cigarettes can also increase the risk miscarriage, low infant weight and respiratory tract disorders baby.

### Objective

To determine the association between smoking exposure to environmental tobacco smoke (ETS) in mother during pregnancy with Low Birth Weight (LBW) infants.

### Literature Review

#### Low birth weight (LBW)

The finding of the previous study by Arifeen (1997) shown that about 80% of all affected newborns with LBW are born in Asia. According to Goldenberg and Rouse (1998), on average the worldwide incidence of LBW is 17% per year, making LBW an important infant health problem in many populations. Morris *et al.* (1999) study reported that the average incidence of LBW in developing countries to be 17 % of all live births. The third target of World Health Organization (WHO) document "Health for All in 21<sup>st</sup> Century" has stated that "by the year 2020 all newborn babies, infants and preschool children in the region should have better health, ensuring a healthy start in life". The primary objective for the implementation of this target is to reduce the number of infants born below 2500 gram (WHO Regional Office for Europe, 1998).

LBW babies (<2500 g) contribute to majority (65-70%) of the neonatal mortality (United Nations Children's Fund and World Health Organization 2004; Nair, 2001). LBW refers only to infants born weighing less than 2500 g, regardless of gestational age and the cause of

LBW (WHO, 1992). Three categories that can be distinguished are as follows: Premature or preterm LBW babies (born before 37 complete weeks of gestation or with fewer than 259 days of gestation); term LBW, that is, born between 37 and 42 complete weeks of gestation, or between 259 and 293 days of gestation and Post term LBW, born after 42 weeks or 294 days of gestation. LBW infants can be further classified as "very low birth weight" (1000–1499 g) and "extremely low birth weight" (500–999 g). LBW are mainly related to uterus-placental insufficiency and poor energy substrate transfer, resulting in neonatal complications like birth asphyxia, hypothermia, meconium aspiration, polycythaemia, hypoglycemia, hypocalcemia and thrombocythaemia.

#### Association between smoking habits and LBW

Maternal smoking in pregnancy is associated with adverse pregnancy outcomes, including an increased risk for pre-term birth, placental abruption, placenta previa, and low birth weight (Burguet *et al.*, 2004). Some studies have been conducted based on the influence of tobacco smoke on birth weight. Smoking pregnant women have been associated with numerous pregnancy and fetal outcomes. Second, hand smoke also adds a risk to pregnancy. Exposure to environmental tobacco smoke (passive smoking) may have a modest adverse effect on birth weight. There is increased risk of ectopic pregnancy as well as spontaneous abortion, placenta previa, premature rupture of the membranes pre-term delivery. The babies delivered have higher risks of perinatal mortality, sudden infant death syndrome and LBW.

According to Lightwood *et al.* (1999), concluded that an annual decrease of 1 % of the prevalence of smoking among pregnant women, over a period of 7 years, would reduce the number of LBW infants by 57000 and would save RM 572 million. Smoking has been implicated in the etiology of abruption placenta, placenta previa, spontaneous abortion, premature delivery, and stillbirth. Intrauterine growth retardation is the most strongly documented adverse effect of smoking during pregnancy.

Smoking cessation in pregnancy is strongly affected by socio-economic status (SES), with women of lower education, income and employment status far more likely to continue smoking than women from higher SES groups (Graham & Der, 1999). Similar finding by Lumley (2001), found that despite extensive knowledge about lower rates of cessation and higher rates of low birth weight among lower SES women, review level evidence does not address the features of effective interventions that might increase smoking cessation in these groups.

Study done by Magee, Hattis & Kivel (2004), reported that when stratifying for the effect of smoking, the rate of LBW was 6.38% among nonsmokers, 9.5% (RR 1.48, 1.38-1.61) among light smokers, 11.67% (RR 1.82, 1.63-2.05) among moderate smokers and 11.72% (RR 1.84, 1.33-2.54) among heavy smokers. Sixty percent of the overall population effect of smoking on LBW was in the category of light smokers. This study shows that the amount of LBW attributable to smoking was 6.4% in this sample. Among those who smoked, LBW was 58% more likely than among nonsmokers, and 60% of the overall population effect of smoking on LBW was noted among light smokers.

### Methodology

This study was carried out in Hospital Tumpat, Kelantan. Universal sampling method was used where all infants who fulfill inclusion

criteria selected. The sample size was 230 infants. It 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. A One Way Analyses of Variance (ANOVA) and Chi-Square test were use. Statistically significant data were considered to be those had 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. The researcher explained the aim and procedure of study to the respondents. The researcher also explained to the respondents that their answers were confidential and only used for the purpose of academic research. Written informed consent of all participants was being acquired.

### Results

Table I showed the distribution of respondents on exposure tobacco smoke. All the respondents were non-smoker. Result showed that there were 125(54.3%) husband smoke, 101(43.9%) non-smoker and only 4(1.7%) were past smoking but stopped.

**Table I:** Distribution of respondents on exposure tobacco smoke (ETS) (N=230)

Variables	n	Percentage (%)
Mother's smoking		
Yes	-	-
No	100	100
Father's smoke		
Yes	125	54.3
No	101	43.9
Past smoking but stopped	4	1.7
Cigarettes per day does he smoke		
1-4 cigarettes	51	22.2
5-9 cigarettes	56	24.3
10-14 cigarettes	16	7.0
>14 cigarettes	2	0.9
Total	125	54.3
Exposure to other family		
#Yes	36	15.7
No	194	84.3

# Cigarettes smoked by father, father in law, brother- in law.

**Association between maternal exposure to tobacco smoke (ETS) and birth weight**

Table II shows the association between maternal exposed tobacco smokes and birth weight. In this study, all the respondents were non-smoker. The mean birth weight of smoking by father were lowest (2957.24±342.29) compared to the non-smoking father (3235.14±411.12). There was statistically significant association between

father's smoke with birth weight (F = 15.200, p = 0.00). The number of cigarettes per day father's smoke were also statistically significant (F = 4.970, p = 0.003). However, analysis by using Chi-Square shows that the exposure of smoke to other family members was not statistically significant ( $\chi^2= 1.68$ , p = 0.431).

**Table II:** The association between maternal exposed tobacco smokes and birth weight (n=230)

Variable	n	Mean BW± SD	F		p- value	
Father's smoke			15.200		0.001*	
			Yes	No	Past smoking but stopped	
Yes	125	2957.24±342.29	-	0.000*	0.973	
No	101	3235.14±411.12	0.000*	-	0.442	
Past smoking but stopped	4	3000.00±571.54	0.973	0.442	-	
The number cigarettes per day does father smoke			4.869		0.003*	
			1-4	5-9	10-14	>14
1-4 cigarettes	51	3013.82±304.80	-	0.077	0.96	0.109
5-9 cigarettes	56	2856.25±318.09	0.077	-	0.14	0.021*
10-14 cigarettes	16	3056.25±425.78	0.963	0.144	-	0.192
>14 cigarettes	2	3550.00±70.7	0.109	0.021*	0.19	-
Total	125	2957.24±342.29			2	
Exposure to other family	n	%	$\chi^2= 1.681$		0.431	
# Yes	36	15.7				
No	194	84.3				
Total	230	100				

# Cigarettes smoked by father, father in law, brother in law.

\* Significant p <0.05

Tukey Post hoc shows maternal exposed tobacco smokes was significantly different from non-maternal exposed tobacco smokes (p<0.05) and the number of cigarettes per day father smoke group 5-9 cigarettes was significantly different from group > 14 cigarettes per day(p<0.05).

**Discussion**

Second hand smoke also adds a risk to pregnancy. Exposure to environmental tobacco smoke (passive smoking) may have a modest adverse effect on birth weight. In this study, all the mothers were non-smoker, however, this study found that there was highly significant associations between mother's exposure to environmental tobacco smoke (ETS) or passive smoking with birth weight (F = 15.200, p = 0.001). It also found

that there was a significant association between the number cigarettes per day does husband smoke with birth weight (F=4.970, p = 0.003).

Bernstein, Mongeon, Badger, Solomon, Heil, Higgins (2005), reported that maternal smoking during the third trimester was the strongest predictor of birth weight after adjusting for gestational age. Each cigarette

smoked per day during the third trimester is estimated to contribute to a 27-g reduction in the birth weight of the infant. Maternal smoking affects the fetus during all stages of pregnancy, the most significant effect on the birth weight of the offspring occurs during late pregnancy, especially in the case of mothers who are heavy smokers (>8–10 cigarettes/day) (Horta, *et al.*1997; Jaddoe *et al.* 2008).

This is consistent with Goel *et al.* (2004) study. The study was proven that, exposure to environmental tobacco smoke (ETS) during pregnancy was significantly associated with a higher risk of small for gestational babies during the antenatal period. There is a significant between the reduction in tobacco use will increase the birth weight, hence decreases the incidence of LBW. It is supported by Spravue *et al.* (1999) in their study, reported that the interaction between maternal smoking and pregnancy outcomes, self-reported maternal smoking during the second trimester is associated with fetal growth restrictions in a dose response manner.

According to Kramer *et al.* (2000), from their analysis found that for effective public health intervention in relation to the prevention of low birth weight are interventions to promote smoking cessation and nutrition intervention among pregnant mother. Smoking is the major modifiable risk factor that contributes to low birth weight. Babies born to women who smoke weight on average 200g less than babies born to non-smokers. It is supported by Messecar (2001) study. It found that the incidence of low birth weight is twice as high among smokers as non-smokers. During the antenatal period, a study showed that exposure to environmental tobacco smoke (ETS), during pregnancy was significantly associated with a higher risk of small for gestational babies (Goel *et al.*, 2004). According to Djauzi's opinion (2005) the influence of cigarettes on pregnancy is very serious. Cigarettes can reduce blood flow to placenta so risky against interference growth of the fetus. Cigarettes can increase risk miscarriage, low infant weight and respiratory tract disorders baby.

Furthermore, the carbon monoxide effect contained in cigarette smoke will disrupt the distribution of nutrients and oxygen to the fetus (Oktavianis, 2011). In addition to carbon monoxide, the resulting nicotine of cigarette smoke active smokers then inhaled by pregnant women also can decrease perfusion placenta. Nicotine coming in into the mother's blood can pass through placenta and some affect organs of the fetus the influence of these substances is baby growth below normal. Nicotine, the most important component of tobacco, is present in the placenta at 15% higher concentration than in maternal blood. Nicotine causes uterine vasoconstriction by inducing maternal catecholamine release (Lambers, D.S., & Clark, 1996).

### Conclusion

Prevention of LBW and other adverse birth outcomes have for years focused only on prenatal care. It is because one of the most predominant causes of LBW is the mother's access to prenatal care. However quality prenatal care is still crucial to improve birth outcomes, if the mothers during pregnancy exposure to environmental tobacco smoke (ETS). It is now clear that prenatal care alone is not sufficient.

On the other hand, early antenatal care is crucial to favorable pregnancy outcome. All pregnant women should be encouraged to enter prenatal care early in their pregnancies to facilitate early identification of risk factors, whereby, all pregnant women should be assessed during their first prenatal care visit to identify risks for adverse pregnancy outcome, including health history, pregnancy history, nutritional status, screening for alcohol, tobacco and other drug use, psychosocial history, including stress, depression, anxiety, and domestic violence. Therefore, women at high risk for low birth weight need close monitoring and tracking by a qualified prenatal care provider with possible referral to a high risk obstetrical specialist and /or referral for case management and social support.

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