Articles

Passive maternal smoking and pregnancy outcome in a Saudi population

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ABSTRACT

Objectives: A prospective study to investigate the effect of passive smoking on birth weight of infants born to women at the Department of Obstetrics and Gynecology, Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia.

Methods: The study group comprised of 868 singleton live births occurring during January to December 2001 at Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia. Following delivery, mothers were asked for details of whether they smoked or used tobacco in any other form and if they had exposure to passive smoke at home or in the workplace. The daily exposure time to tobacco smoke was divided into 2 groups; up to 4 hours and 5-8 hours. Obstetric and medical details of the mothers were recorded from case notes, as were the details of the baby. Data was analyzed using Stat Pack Gold Statistical Analysis Package using Student t-test to compare discrete and continuous variables. Stepwise multiple regression analysis was performed to adjust the odds ratio from the influence of confounding factors.

Results: Of the 868 women, 440 were passive smokers and 428 not exposed to tobacco smoke constituted the control group. Passive smokers were relatively younger with low parity and income. Passive smoking was significantly associated with a decrease in birth weight after adjusting for other factors (P=0.015) and an increase in the incidence of small for gestation age infants (P=0.0391). There was also no statistically significant difference in the birth weight between women exposed up to 4 hours of smoke and those exposed for 5-8 hours.

Conclusion: Passive maternal smoking was associated with a decrease in birth weight and an increase in small for gestation age infants. A dose-response relationship between passive maternal smoking and birth weight was not seen.

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Passive smoking is defined as an involuntary exposure to environmental tobacco smoke. Such an exposure carries a serious health risk and has been linked to chronic respiratory disease, lung cancer and ischemic heart disease.[1] In addition, passively inhaled smoke adversely affects the functioning of the oviduct and increases the risk of ectopic pregnancy in women.[2] There is strong evidence to indicate that active smoking during pregnancy is associated with increased risk of preterm labor, intrauterine growth retardation,[3] premature rupture of membranes,[4] placental abruption,[5] and placenta praevia.[6] All of which, carry a high risk of perinatal loss. Not only are most of the constituents of main stream smoke also present in the side stream smoke but some of the cytotoxic substances and poisonous gases such as nicotine, benz(a)pyrene, carbon monoxide and carbon dioxide are 2-10 times higher in the side stream smoke.[7-8] Which component of tobacco smoke contributes to the reduction in fetal birth weight is not clear but it is believed that nicotine and carbon monoxide cause uteroplacental vasoconstriction. In addition, carboxyhemoglobin (carbon monoxide having strong affinity for fetal hemoglobin) reduces the delivery of oxygen load to fetal tissue.

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Prior research on the association of passive smoking and fetal outcome, in populations where smoking among women is common, has produced conflicting results. Some studies have supported an adverse effect on fetal growth,[9-11] and others have not.[12-14] This inconsistency to some extent can be explained by the fact that these studies used different measures of exposure and a different design. The aim of our study was to investigate the effect of passive maternal smoking on birth weight in a group of women from a population hitherto not studied before.

Methods. The study group was a cohort of 868 singleton live births occurring in women who had received antenatal and intrapartum care in the Department of Obstetrics and Gynecology, Security Forces Hospital, Riyadh, Kingdom of Saudi Arabia (KSA), January to December 2001. Patients were divided into 3 social classes according to their monthly family income: Class I (>20000 Saudi Riyals SR), Class II (10000-20000 SR), Class III (<10000 SR). Mothers were interviewed by the principal investigator or a trained interpreter using a standard questionnaire. This interview was conducted after delivery in the post-natal ward before the mother was discharged home. Each mother was asked if she smoked or used tobacco in any other form and if there was anyone in the household or at the workplace who smoked tobacco. The duration of daily exposure to tobacco smoke was divided into 2 groups; up to 4 hours and from 5-8 hours. Obstetric and medical details of each mother were recorded from case notes as were the details of the baby such as birth weight, sex, Apgar score at one and 5 minutes and any inpatient care. The best estimate of gestation was obtained from the menstrual history as well as from the clinical and ultrasonographic examination.

Data analysis was carried out using Stat Pack Gold Statistical Analysis Package. Student t-test was used to compare discrete and continuous variables. Stepwise multiple regression analysis was performed in order to adjust the odds ratio from the influence of confounding factors.

Results. Of the 868 women, none used tobacco in any form, but 440 lived with smokers and were therefore considered passive smokers. The remaining 428 women were not exposed to environmental tobacco smoke and constituted the control group. The demographic characteristics of patients in the 2 groups are presented in **Table 1**. Whereas the 2 groups were comparable for the height, there were statistically significant differences between the groups for age, parity and monthly income. There were more passive smokers with low parity and low income, and also passive smokers were relatively younger. The mean birth weight of infants born to passive smokers was 3046.23 g (SD 520) and was on the average 136 g lower than the mean birth weight of infants born to control group (3172.29 g SD 437). The median gestation age was similar in both groups. The Apgar score at one and 5 minutes and early neonatal morbidity was comparable in the 2 groups. The mean time of exposure to smoke per day was 5.76 hours with a minimum of 2 hours and maximum of 8 hours. Patients exposed up to 4 hours (N=102) had a mean birth weight of 3073 g (SD 408) and those exposed from 5-8 hours (N=326) had a mean birth weight of 3037 g (SD 512). The incidence of small for gestation age infant was more in the passive smokers 56 (12.7%) infants as compared with 28 (6%) in the control group **Table 2.** There was no statistically significant difference between the 2 groups as regards infant sex, method of delivery and other antenatal obstetric complications. There were more cases of fetal distress in the control group (32 cases) as compared with the smokers group (8 cases), P=0.0448. The incidence of gestational diabetes mellitus was also similar in the 2 groups **Table 3**. The difference was not statistically significant. Birth weight was regressed against maternal age, height, gestation period, parity, sex of the baby (indirect variable) and passive smoking (direct variable) as there are potential confounding variables associated with small for gestation age birth. Passive smoking was significantly associated with a decrease of 130 g in birth weight after adjusting for other factors with a P value=0.015 **Table 4**. This was independently verified by multivariate regression analysis OR=3.21 (CI=1.06-9.67) with P value=0.0391.

Discussion. This is the first report of its kind on the effects of passive maternal smoking on birth weight in KSA, a society in which women smokers are uncommon. The passive smokers were identified as women who had been exposed to tobacco smoke for a minimum daily duration of 2 hours starting from the period at least just before conception (so as to include the possibility of harmful impact of smoke exposure in early pregnancy). Selection bias due to active smokers being classified as passive smokers is a possibility in studies where women smokers are common, but is unlikely to be significant in our study. The Security Forces Hospital serves a selective subset of population, namely the Ministry of Interior personnel and their families. A classification of social class similar to the United Kingdom Registrar General (ranging from professional to unskilled laborer) was therefore not possible. Instead, the socioeconomic status as a confounding variable in our study was based on the monthly family income. Our results show that passive maternal smoking was associated with a decrease of 130 g in birth weight. This association persisted even after allowing for other variables such as maternal age, maternal height, sex of the baby and gestational age. But what is the clinical relevance of these findings, as this may not necessarily mean an overall meaningful decrease in birth weight? The fact that it appears to operate at the lower end of birth weight distribution

Table 1 - Demographic features of the patients in 2 groups.

Variables	Smokers Mean ± SD	Control Mean ± SD	Significance *t* value	*P* value
Maternal age	28.00 ± 5.7	29.32 ± 6.1	2.41	0.0082
Maternal height	153.86 ± 5.7	154.12 ± 5.7	0.52	0.3001
Parity				
0-1	224	162	3.09	0.002 }
2-5	136	166	1.73	0.0844 } 0.0708
>5	70	100	1.81	0.0075 }
Social Class				
I	158	166	0.56	0.5724}
II	246	252	0.62	0.5329} 0.0041
III	36	10	2.88	0.0057}
Gestation age	39.6 ± 2.9	39.0 ± 3	0.62	0.520

Table 2 - Neonatal outcome in the 2 groups.

Variables	Smokers	Control	Significance *t* value	*P* value
Mean birth weight (g) ± SD	3046.23 ± 520	3172.29 ± 437	3.09	0.001
Mean birth weight (g) ± SD with 1-4 h exposure	3073 ± 408	-	0.45	0.3282
Mean birth weight (g) ± SD with 5-8 h exposure	3037 ± 512	-		
Apgar Score at 1 minute	8.6 ± 1.2	8.57 ± 1.1	0.34	0.305
Apgar Score at 5 minutes	9.39 ± 0.7	9.26 ± 1.2	1.41	0.0797
Neonatal admission n ± SD	36 ± 24	24 ± 20.7	0.57	0.5001
Babies <2.5 kg in weight n (%)	56 (12.7)	26 (6)	2.31	0.004*

* Multivariate analysis results - OR 3.21, CI 1.06-9.67, *P* value 0.0391

Table 3 - Obstetrics outcome in the 2 groups.

Variables	Smokers (N=428)		Control (N=440)		Significance *t* value	*P* value
Gestational Diabetes Mellitus	16	(3.7)	20	(4.5)	0.64	0.5247
Hypertension	2	(0.4)	4	(0.9)	0.00	0.9999
Pre-eclamptic toxemia	0	(0)	0	(0)	NA	NA
Cesarean sections	48	(11.2)	41	(9.3)	0.63	0.5308
Instrumental deliveries	14	(3.3)	16	(3.6)	0.47	0.6352
Abruptio placenta	14	(3.3)	15	(3.4)	0.64	0.5247
Cervical impotence	4	(0.9)	2	(0.4)	0.85	0.3963
Leaking liquor	8	(1.9)	10	(2.3)	0.65	0.5218
Premature labor	24	(5.6)	20	(4.5)	0.63	0.5147
Fetal distress	16	(3.7)	32	(7.3)	2.01	0.0448

Table 4 - Effects on birth weight of each variable in the regression analysis.

Variables	Coefficient	Standard error of coefficient	Significance
Gestation age	3.40069	20.1705	0.000
Maternal age	9.07203	2.9144	0.003
Parity	34.123	23.396	0.1619
Maternal height	11.103	4.6973	0.0218
Social class	129.23	83.701	0.1377
Sex of the baby	-100.9650	35.2419	0.0021
Passive smoking	-130.01	45.972	0.015
Constant	1488.44300	3522.173	0.006

increases the risk that the infant will weigh less than 2500 g and will be low in weight in relation to the gestation age. A dose response relationship between passive maternal smoking and birth weight was not evident from our results since there was no significant difference in birth weights between the groups exposed up to 4 hours smoke per day and those exposed up to 8 hours per day. Previous studies investigating the quantitative effect of cigarettes smoked by the father on the birth weight of baby reported a non significant decrease of 12-30 g in the mean birth weight[11,15] However, it is possible that these fathers may not have necessarily smoked all the cigarettes at home. A statistically significant decrease in birth weight of 6 g for every passively smoked cigarette by the father in a day has also been reported.[16] Since no objective assessment of the tobacco smoke exposure was conducted, there is the possibility of misclassification of exposure time due to recall bias by the patient. In order to overcome the difficulty in precisely estimating the duration and intensity of exposure, it would be desirable to measure the dose by assaying a biochemical marker for tobacco smoke, for example, serum or urine cotinine levels. Cotinine is a major metabolite of nicotine and has been satisfactorily used to assess and monitor cigarette smoking in pregnancy.[17]

Our study showed that there were significantly more small for gestation age infants in the passive smoking group (56%) compared with the control group (26%). This result is consistent with the hypothesis that exposure to passive smoking during pregnancy increases the risk of having a small for gestation age infants as observed with direct smoking. Small for gestation age infants are not only at increased risk of perinatal death[18] but also prone to long term health problems such as cardiovascular disease, hypertension, raised cholesterol and non-insulin dependent diabetes.[19-21] Birth weight is an easily measurable outcome of maternal smoking whether active or passive, but there may also be long term implications of maternal passive smoking on the neurological development of that child, which have not been measured. There is a strong relationship between maternal smoking in pregnancy and lower educational attainment among young children. Children of mothers who smoke in pregnancy perform at significantly lower levels of psychological tests of cognitive function relative to the children of non-smokers after adjustment for other potentially confounding variables.[22] Furthermore, fetuses and infants have incompletely formed blood brain barriers that may allow the passage of carcinogenic tobacco metabolites into the central nervous system and initiates the formation of neural tumors. Passive smoking during pregnancy has been found to be associated with childhood brain tumors.[23] Most of the studies, including our own, carried out to see the effect of passive maternal smoking on birth weight of babies have a potential design problem. Some of the births in the control group classified as unexposed to tobacco smoke could actually have been exposed. This would result in artificially low birth weights in the control group consequently diluting the difference between the 2 groups of infants. Further studies need to be carried out, therefore, with more detailed measurements of exposure level amongst the study and control groups using biological markers. Although our study was on a relatively small sample size, it does provide vital additional information on the health consequences of exposure to passive smoking in pregnancy. This could be important in shaping future governmental health and social policies.

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Source: Saudi Med J 1991; Vol. 12 (5): 354-360

Abstract

In recent years, many studies have observed a positive association between involuntary smoking and health problems in adults and children. Though the effects of passive smoke on the bronchopulmonary function of people with healthy lungs has not yet been unequivocally answered, its link with respiratory diseases (bronchitis, pneumonia) in children and lung cancer in adults has been more convincing. Data is now emerging on the cardiovascular effects of passive smoking but results obtained so far are more provocative than definitive, thus requiring further investigation, major deficiencies in studies on passive smoking have been identified in this paper as a guideline for future research. Suggestions are also made for health education and enforcement of public health regulations in saudi arabia to prevent smoke-related diseases.