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Research Article

Relation of Second Hand Smoker and Effect on Pregnancy Outcome and Newborns Parameters

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Abstract

Background: exposure to environmental tobacco smoke is a major health problem in worldwide. Few studies have examined the relationship between passive smoking and its effects on neonatal complications, but the results obtained, were not significant. The aim of this study is to determine the effects of cigarette smoking on pregnant women, who are exposed to it, on some neonatal complications and maternal outcomes.

Materials and Methods: this study was a cross sectional study, and it was conducted on 1500 non smoker pregnant women, who referred to shohadaye karegar hospital of Yazd, for singleton delivery, from march 2012 to march 2014. They were interviewed after delivery using a structured check list. The samples, based on exposure to cigarette smoking, were divided into two groups: passive smoking-exposed and control groups. Then, the outcomes of maternal and neonatal complications, in two groups were compared.

Results: 213 pregnant women (14.2%), of the subjects, were exposed to cigarette smoke. Mothers, after delivery, were examined, based on: gestational age, premature rupture of membranes, preterm delivery, weight, length, head circumferences and fetal mortality. Our results showed that the mean of weight and length and head circumferences of the newborns and the delivery age of mothers who are exposed was decreased but premature rupture of membranes and preterm labor was increased.

Conclusion: these results, indicate that exposure to environmental cigarette smoke, during pregnancy is associated with increased fetal complications.

Keywords: Neonatal complications, Passive smoking

Introduction

Tobacco smoking is one of the greatest cause of preventable death in worldwide [1], and cigarette tobacco smoking, has been studied more widely than other type of consumption [2]. In a study that conducted by Ng M and et al. Since 1980, the prevalence of smoking in the world is significantly reduced, but due to the increase population in world, the number of smokers has increased [3]. In Iran, according to the latest survey, which was conducted in 2007, prevalence of smoking in the population of 15 to 69 years old was 14.2% (27, 2% of men and 3.4% of women). The prevalence of daily cigarette consumption in Iran is 24.3% in men and 2.9% in women, and it has not risen during the past decade. However, because of growing population, smoking will likely increase in the future [4]. There are about 4000 compounds in Cigarette smoke and most of them are toxic, such as: aromatic amines, cyanide, heavy metals (cobalt, cadmium or Cd, lead) and so on [5]. Numerous studies, demonstrated that, these compound, can affect on development of follicles in ovaries. In a study, was revealed that, human granulose cell culture at high dose of cadmium, or exposure to low – dose, but longer time, they began to separate and abnormality occurs in their nuclei [6]. The effects of smoking are serious and it leads to the most common disease in the lungs, liver, and heart. Also it affects on areas such as feet and hands and it is a main risk factor for types of cancer, principally lung cancer [7].

Also, cigarette smoking is connected with reproductive life destruction for example it leads to earlier menopause [8], increase of infertility [9], and decrease of IVF success [10-12]. Several studies, have shown, the deleterious effects of cigarette smoking on steps of IVF procedures such as: ovarian sensitivity [13], the number of oocytes that can be obtained [12-14], fertilization between sperm and oocyte [15], even it has adverse effect on implantation [15]. In the other study revealed exposure to high doses of

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cadmium causes to necrosis in these cells [16]. Cigarette smoking throughout pregnancy is connected with spontaneous abortions [17], ectopic pregnancies [18], placenta previa and premature rupture of membranes. Research shows that genetic changes occur, in infants who are exposed to cigarette smoke, and they concluded that genetic changes associated with exposure to SHS, almost identical with the mother smoking, during pregnancy [19]. In addition, pregnant women that expose to a high level of environmental tobacco smoke, are associated with improved risk for preterm birth [20,21].

Passive smoke or Second Hand Smoke (SHS), also called environmental tobacco smoke (ETS), is the product released into the surrounding when somebody is smoking exhales. Several of the compounds in tobacco smoke, are present in Second hand smoke, and pregnant women who don't smoke, can also be at hazard, from passive smoking in their environment such as: the work place, home and others. Like to smoking, through the pregnancy, being exposed to passive smoking, results in serious risks for both, the mother and the embryo.

There is a theory that, expose the mother to products of cigarette smoking during pregnancy, can be harm for baby as her mother smoking during pregnancy [22].

Nicotine in body degrades to cotinine, which it is a good marker of exposure to SHS, before birth. We can measured it, in umbilical cord blood, urine, amniotic fluid and meconium. Biomarkers in umbilical cord blood, can be detected in a few days after birth, whereas meconium biomarker of exposure to tobacco smoke, can be shown in several months [23,24]. In Iran, 29.3% of pregnant women expose to passive smoke, and 0.7% smoke cigarette, that it is lower than pregnant women in United States (10%) [25,26]. Several chemical compounds in passive smoke, can be passed through the placenta in pregnant women to the embryo [26,27]. For example, Nicotine in the blood of these women can reduce the blood flow to the fetus and it has adverse effect on embryo's lung, heart, central nervous system, and digestive system, and also, Carbon monoxide, cause to low birth weight [28].

The goal of our study is to examine the relationship between pregnant women who expose to SHS, and some neonatal complications.

Material and Method

In this cross sectional study, 1500 non smoker pregnant women with gestational ages of 20 to 42 weeks, referred to Yazd shohadaye kargar hospital, for singleton delivery, from march 2012 to march 2014, were interviewed, after delivery using a structured check list. Other information, including weight, length and circumference of baby were obtained from birth records.

Low birth was defined as a neonate weight-less than 2,500 g at birth- and live born infants, also, delivered before 37 weeks from the 1st day of the last menstrual period (LMP), were termed premature.

In addition, pregnant women with history of chronic and systemic disease such as; diabetes, hypertension, heart respiratory and kidney disease, also addicted mothers and mothers who smoke, were excluded from study and non-random simple method was used as sampling procedure.

The samples, based on exposure to cigarette smoking, were divided into two groups: passive smoking-exposed and control groups and outcomes of maternal and neonatal complications, (Preterm Delivery, gestational age, rupture of membranes before the onset of labor, or up to 37 weeks of gestation (PROM), Stillbirth, Baby's head circumference, birth weight and length) in two groups were compared.

After data collection (tables and indexes), through SPSS 17 software and using independent t-test, chi – square and Fisher Exact test data analysis have shown the significant level of $P<0.05$ in our study.

Results

In this study, 1500 non-smoker pregnant women were examined, based on exposure to cigarette smoking and complications during childbirth and neonatal complications were evaluated. The mean age of mothers, was 27.38±5.5 years (range from 13 to 45 years). The mean number of pregnancies was 1.91 ± 0.99 (range from 1 to 5). The mean parity was 1.77 ± 0.84 (range from 0 to 5). 14.2% (213) of women were SHS exposure during pregnancy and 85.8% (1287) were not. In SHS exposure group. The mean number of cigarettes smoked by the partners of pregnant women was 12.5 ± 7.7 (range from 5 to 40 cigarettes per day).

The gestational age, in SHS exposure group, on average was 38.14 weeks (SD = ± 1.55) and in non-SHS exposure group, was 38.85 weeks (SD = ± 1.32). This difference was statistically significant (p- value < 0.001). This means, exposure to cigarette smoke effects on gestational age (Table 1).

The mean length of infants, in SHS exposure group was 48.69 ± 1.88 and in non-SHS exposure group, was 49.42 ± 213. This difference was statistically significant (p- value < 0.001). This means, exposure to cigarette smoke effects on baby's length (Table 2).

The mean head circumference of newborns, in SHS exposure

Factor	Passive smoker	Non-exposed	P value
Preterm Delivery	27.2	11.3	<0.001
Mean G.A	38.13 ± 1.54	38.84 ± 1.31	<0.001
PROM	28.6	5.7	<0.001
Stillbirth	0.00	0.3	1.00

Table 1: Outcome of pregnancy

G.A: Gestational Age, PROM: Rupture of membranes before the onset of labor, or up to 37 weeks of gestation.
Differences among proven smokers and nonsmokers presented as mean±SD with p-values obtained from Independent- Samples t test; Categorical data presented as n (%) with p-value Obtained from Chi-Square test. indicates that differences in these percentages across categories are statistically significant (P ≤ 0.05).

	Passive smoker	Non passive smoker	P value
Baby's head circumference(cm)	34.42 ± 1.23	34.88 ± 1.45	<0.001
birth weight (g)	2886.19 ± 354.35	3136.46 ± 413.32	<0.001
Birth length(cm)	48.69 ± 1.88	49.42 ± 2.13	<0.001

Table 2: Newborns parameters

Differences among proven smokers and nonsmokers on newborns presented as mean ± SD with p-values obtained from Independent- Samples test; Categorical data presented as n (%) with p-value Obtained from Chi-Square test. Indicates that differences in these percentages across categories are statistically significant (P ≤ 0.05).

group was 34.43 ± 1.24 and in non-SHS exposure group, was 34.89 ± 1.45. This difference was statistically significant (p- value < 0.001). This means, exposure to SHS, affects on baby's head circumference (Table 2).

The mean infant's weight in SHS exposure group was 2885.20 ± 354.35 gr, and in non-SHS exposure group, was 3136.46 ± 413.32. This difference was statistically significant (p- value < 0.001). This means, exposure to SHS, effects on infant's weight (Table 2).

28.6% of the participants, in SHS exposure group, had 28.6% PROM, and non-SHS exposure group had 5.7%. This difference was statistically significant (p- value < 0.001). We were found that (using the odds ratio) the risk of PROM in SHS exposure group was 6.6 times more than those who are in non-SHS exposure group (Table 1).

Pre-mature birth, in SHS exposure group, was 14.1% and in non-SHS exposure group was 2%. This difference was statistically significant (p- value < 0.001). We were found that (using the odds ratio) the risk of pre-mature birth in SHS exposure group was 7.95 times more than those who are in non-SHS exposure group (Table 1).

Frequency of stillbirth in SHS exposure group was zero, and in non-SHS exposure group, was 4. This relation with Fisher exact test and p- value #1.000 was not statistically significant. This means, exposure to SHS, did not effect on stillbirth (Table 1).

Discussion

Passive smoker

The results of our study indicated an adverse effect of SHS exposure on length, weight, baby's head circumference, PROM and pre–mature birth. However, SHS exposure in mothers during pregnancy causes to decrease of birth weight, length, baby's head circumference but, increase the risk of PROM and pre-mature birth.

In this study, 14.2% of mothers were in SHS exposure during pregnancy. But in numerous studies this percentage, has been reported, 35.9% in Brazil [29], 13% in U.K [30], 24.4% in Indian and 69.1% in China [31].

Birth weight

Interest in the subject of relationship between maternal exposure to SHS and low birth weight developed in the 1980s when, relationship between active maternal smoking during pregnancy and LBW has been recognized [32].

Several studies have shown that, maternal exposure to SHS, cause to decrease in birth weight. This reduction is variable, from 1g [33], to 253g [34]. In one study, have been reported that mean birth weight among newborns with fathers who smoked, is 3 g less than infants of nonsmoking fathers [35] and in one similar study, this reduction was 42g [36].

Leonardi, et al. in a review article (a review of 58 studies), demonstrated that, exposure to ETS leads to reduction in mean birth weight ranged from 33 to 40 g. also there are several other studies that have shown significant reduction in birth weight in maternal exposure to SHS [21,37-41].

Numerous comprehensive reviews about relationship between maternal exposure to SHS and birth weight reported that there is a small increase in risk for low birth weight and maternal exposure to SHS [42-44]. A few studies expressed that, there is a dose-response relation between birth weight and SHS exposure [45,46].

A study conducted by Borlee and colleagues, revealed that, the mean birth weight of infants of nonsmoking mothers and smoking fathers was 228 g lower than, when, both parents were non-smokers [47]. Also in present study, our results showed, infant's weight of maternal exposure to SHS during pregnancy was 251.26 gr. lower than non- exposure to SHS.

There is a hypothesis that maternal exposure to SHS purposely to nicotine, may cause to low birth weight during a pathway of fetal hypoxia [48].

Elevated nucleated red blood cell counts is a marker of fetal hypoxia, and some studies have reported that this marker occurs among infants of maternal who actively smoked during pregnancy [49] and maternal exposure to SHS during pregnancy [50].

Some studies show that exposure to cigarette smoke in pregnancy, increases the risk of fetal restriction [51,52]. Also, exposure to second-hand smokes increases the risk of having a low birth weight baby and premature delivery and this weight loss, occurs due to a decrease in oxygen supply to the fetus [23,26]. it is estimated that, mean weight reduction is about 30 to 60 grams [28].

However, some finding confirmed that, maternal exposure to SHS was not associated with low birth weight [26,30,53,54].

Birth length –Baby's head circumference

Our results showed, infant's length of maternal exposure to SHS during pregnancy was 1.73 cm and head circumference 0.46 cm lesser than infants of non- exposure to SHS.

Salmasi Giselle, et al. in a systematic and analysis study, investigated 76 papers and reported that infant's length of maternal exposure to SHS during pregnancy was 1.75 cm higher, and head circumference 0.11 cm lesser than infants of non-exposure to SHS [55].

In a study conducted in California, decrease in mean height, 0.84 Cm, and in another study in US, it was 1.7 cm [56]. Also, in a study was conducted in the Netherlands, on 114 pregnant women, has been shown that exposure to SHS, during pregnancy leads to decrease in diameter between parietal bone of baby [57].

In another study, wahabi, et al. said, the mean birth length of maternal exposure to SHS, was 0.261 cm lesser than control group [40].

Numerous study confirmed that infant's birth length and head circumference of maternal exposure to Secondhand smoke during pregnancy were lesser than infants of non- exposure to SHS, but this difference was not significant statistically [58].

Preterm delivery – gestational age

Several studies demonstrated that, exposure to SHS, leads to increased risks in preterm delivery [20,59,60]. Although numerous studies revealed that there is not statistically

significant relationship between maternal exposure to SHS, and preterm delivery [61-63].

Salmasi Giselle, et al. reported that, odds of preterm delivery and gestational age was identical in two groups [55].

Jie Qiu, et al. Conducted a birth cohort study included 10,095 nonsmoking women and reported that there is a positive association between passive smoking and the risk of very preterm birth [64].

Main articles differ in their conclusions about the relationship between second hand smoke and preterm delivery. According to the US Environmental Protection Agency, exposure to passive smoking is a cause of preterm delivery [65]. The results of a study conducted in the US in 2010, showed that the risk of preterm delivery in women who expose to cigarette smoke, is 2.3 times more than others [56]. Fantuzzi G, et al. expressed that, Smoking throughout pregnancy, was powerfully relation to preterm delivery with a dose-response effect and pregnant women exposure to Second hand smoke was connected only with early preterm delivery [66].

Our results showed, odds of preterm delivery in the exposed to SHS group was 7.95, more than control group, also exposed to SHS, has adverse effect on gestational age. These results are consistent with several studies [23,56].

PROM

PROM is Spontaneous rupture of membranes before the beginning of labor [67,68].

Our results showed, premature rupture of membranes, in maternal exposure SHS, was 6.67 times more than maternal non-exposure. These results consistent with several studies [69-71].

In a study Amasha H, et al. indicated that maternal smoking and exposure to cigarette smoke during pregnancy significantly increases the risk of premature rupture of the membranes (PROM: rupture of membranes before the onset of labor, or up to 37 weeks of gestation) [71].

Also, a number of studies confirmed that exposure of pregnancy women to SHS, cause to reducing the birth length and decrease of head circumference [34,72].

Stillbirth

Generally, fetal death after twenty weeks of pregnancy is called stillbirth [73]. Results of increased risk of stillbirth in maternal exposure to SHS, is complex and further studies are needed [23]. Search in literature review suggest that, maternal exposure to environmental tobacco smoke, increases the risk of stillbirth [28]. But, present study indicated that, maternal exposure to SHS, has not effect on stillbirth.

Finding about the relationship between pregnant women expose to tobacco smoke and increase of stillbirth (fetal death after twenty weeks of pregnancy) is complex and needs to further studies [23,28,31]. Leonardi-Bee Jo, et al. in a meta-analysis reported that, expose to SHS, is along with the increase of stillbirth [41].

Fetal breathing activities are necessary for ordinary growth and structural maturation of the embryo lungs and animal studies demonstrate that exposure to cigarette smoke during pregnancy cause to a reduce in fetal breathing activities [74]. Several studies expressed that, impairment of breathing activities is probable to result in hypoplasia of the fetal lungs [75].

There is no doubt, compare the results of different studies is difficult and complex. Because, in each of studies, there are differences in methods, sample size and sampling method, control group and methods of data analysis. One of the problems in these studies is methods of this issue. According to a study, reported by mothers, which it is used in this study, may report, the underestimated the true level of maternal exposure to SHS. In addition, determination of exposure to tobacco smoke, can be based on diversity and number of smoking, the space in which, a pregnant woman is exposed to tobacco smoke, the distance between the consumer of cigarette and pregnant women, how smoking, the inherent characteristics of each individual and etc, is difficult, for example, in some studies, even maternal exposure to one cigarette per day are considered as passive smoking.

Aveyard Paul, et al. in a study showed that, smoking cessation programs for husbands of pregnant women exposed to smoke is not very successful [76]. But, Yao Tingting, et al. in a study expressed that, education of pregnant women, is effective in the improvement of knowledge and behavior, in order to avoid exposure to environmental tobacco smoke [31].

Therefore, increasing the knowledge and skills necessary to reduce the exposure of pregnant women exposed to environmental smoke, is a practical approach, which, certainly would be, more effective implementation of programs for prenatal care.

Conclusion

Our studies showed that, PROM in maternal exposure to SHS during pregnancy, by using, odds Ratio was, 6.67 times more than maternal non exposure maternal gestational age, infant's weight, length and head circumference in maternal exposure to SHS, were lesser than control group. Our findings demonstrate that 251g reduction in birth weight from passive smoking exposure is highly significant. Also, there was no relationship between maternal exposure to SHS during pregnancy and rates of abortion, type of delivery and stillbirth.

Conflict of interest

The authors have no financial or nonfinancial conflicts of interest.

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