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Does environmental cigarette smoke affect breastfeeding behavior?

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Abstract

BACKGROUND: Exposure of lactating women to environmental cigarette smoke may increase cotinine in breast milk, which in turn may reduce the volume of milk and the duration of breastfeeding.

OBJECTIVES: To assess the relationship between exposure to environmental cigarette smoke and breastfeeding behavior.

MATERIALS AND METHODS: This prospective cohort study was conducted on 290 mothers in Babol - Iran, who had been breastfeeding for 3–5 days after delivery. The lactating mothers were divided into two groups: those exposed to environmental cigarette smoke, and those free from smoke exposure. The study questionnaire included demographic data, information on environmental cigarette smoke, and breastfeeding behavior. Data was collected through telephone interviews at 2, 4, and 6 months of follow-up. Statistical analysis included descriptive statistics, and test of significance using Chi-square test, *t*-test, log-rank test, and Cox proportional hazards model.

RESULTS: The continuation of breastfeeding for the group of exposed mothers and the unexposed group was (mean \pm standard deviation) 5.57 ± 0.098 and 5.58 ± 0.109 , respectively in 6 months of follow-up. There was no significant difference between the two groups ($P = 0.93$). The percentage of exclusive breastfeeding at 6 months in the group exposed to cigarette smoke was 65% compared to 76% of the nonexposed group. However, the difference was not statistically significant ($P = 0.149$).

CONCLUSIONS: In this study, no significant association was observed between the group exposed to environmental cigarette smoke and the nonexposed group in breastfeeding behavior, although the percentage of exclusive breastfeeding at 6 months was less in the group exposed to environmental cigarette smoke. Further exploratory studies are needed.

Key words:

Breastfeeding behavior, environmental cigarette smoke, exclusive breastfeeding, lactating mothers

Introduction

Exposure to environmental smoke at home, the workplace, or in public is a major public health concern.^[1] According to the World Health Organization, 41.7% of people at home and 50.6% outdoors are exposed to cigarette smoke in Iran.^[2,3] In addition, more than half of pregnant women are exposed to environmental cigarette smoke.^[4] Smoking poses a serious risk to the health of mothers and future generations. It also affects all stages of women's lives with regard to birth, fertility, middle-age and menopause,^[5] and endangers their quality of life.^[6] Toxic compounds in cigarette smoke such as nicotine and cotinine (a metabolite of nicotine)^[7,8] cause vasoconstriction and hypoxia^[9] generate neurotoxins^[10] that cause symptoms such as intrauterine growth retardation,^[11] low birth

weight, spontaneous abortion,^[12] infant mortality, perinatal mortality, and preterm delivery.^[13] Increased cotinine in the blood of women exposed to cigarette smoke during lactation is followed by vasoconstriction and decreased blood flow in the breasts and the reduction of the levels of oxytocin, which in turn diminishes the production of milk.^[14] Because of the low volume of milk,^[15] the process of lactation changes^[16] and the duration of breastfeeding is shortened.^[17]

Breast milk is known as the best food source for infants, especially in the 1st year of life. The World Health Organization considers exclusive breastfeeding until 6 months as the most desirable and important food for the child.^[18] Breastfeeding provides substantial protection from diseases such as bacterial meningitis, otitis media, urinary tract infection, diabetes, and obesity,^[19] cancers, and gastrointestinal problems in infants.^[20]

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Cotinine, the most important metabolite of nicotine in cigarettes, can be used as a biomarker for the diagnosis of exposure of infants with mothers who smoke or those exposed to cigarette smoke and is 10 times higher than that of formula-fed infants.^[21] The results of some studies showed that women who had been exposed to environmental cigarette smoke had higher nicotine level in their breast milk and that the cessation of breastfeeding by these mothers in the first 6 months after delivery was higher than mothers who were not exposed to cigarette smoke.^[22] However, other researchers have reported no such relationship between any kind of cigarette smoke and exposure to cigarette smoke and the duration of breastfeeding.^[23]

No studies have been conducted on the relationship between exposure to cigarette smoke during pregnancy and lactation with breastfeeding behavior in Iran. Because of the importance of exclusive breastfeeding in the first 6 months of infants' life, increased exposure to cigarette smoke during pregnancy and lactation, and the priority given to the prevention of adverse effects of smoking by the Ministry of Health and Medical Education; this study was designed to assess the relationship between exposure to environmental cigarette and breastfeeding behavior.

Materials and Methods

This was a prospective cohort study of 290 pregnant women during 3–5 days postnatal counseling on under-breastfeeding in urban and rural health centers of Babol, South of the Caspian Sea, Iran, in 2014. The participants were divided into two groups according to whether they were exposed ($n = 141$) or not exposed to cigarette smoke ($n = 149$). This sample size was able to detect the effect size of 0.35 in proportion to the continuation of breastfeeding of the two groups with 95% confidence level and 80% power. Their responses showed that the exposed group included nonsmokers, who lived with smokers or were exposed to cigarette smoke at work (as defined by the World Health Organization, a smoker is a person who smokes at least one cigarette a day.^[24] In addition, according to their own statements, the nonexposed group included nonsmoker subjects who were not exposed to passive smoking at home or at work.

Inclusion criteria included singleton pregnancy, the birth of a healthy baby without any problems, and an Apgar score of more than 7, 5 min after birth. Exclusion criteria include mothers with chronic or mental diseases, smokers and those who took prescribed drugs that interfered with breastfeeding or had a child who had to be formula fed on the account of a doctor's diagnosis (or health problem of the mother or baby).

After explaining the purpose of the study to the mothers and obtaining their consent, the questionnaire on demographics and exposure to smoke was completed by the researcher for each participant by an interview. The breastfeeding behavior questionnaire which included initiation of breastfeeding, breastfeeding at night, education about breastfeeding in hospital, rooming-in after delivery, duration of lactation, and the type of milk (breast, formula, and cow's milk) was then completed by the researcher by telephone interviews at 2, 4, and 6 months for each participant. The information obtained was analyzed using SPSS software version 19 (Chicago,

Illinois: SPSS Inc.) and statistical analysis, such as Chi-square, survival analysis, Cox regression model, and log-rank test on the significance level of 0.05.

Results

The results showed that the average age of mothers was 25.5 years. No significant relationship was found with respect to mothers' and husbands' age, the number of pregnancies, parity, and live children between the two groups. There was, however, a significant difference between the two groups with respect to mothers' education ($P = 0.001$), husbands' education ($P = 0.001$), mothers' occupation ($P = 0.002$), and husbands' occupation ($P = 0.001$) [Table 1].

The results showed that 100% of participants maintained breastfeeding. Most (88%) pregnancies (87.1% in the exposed group and 89.1% in nonexposed group) were wanted. The reason for the mother's exposure to cigarette smoke in 95.7% of cases was a husband who smoked. In 32.1% of these cases, the husband smoked in the presence of his wife. None of the subjects were exposed to cigarette smoke in the workplace. In addition, the results showed that the mean period of maternal exposure to cigarette smoke was 3 min, and the number of cigarettes smoked was approximately two cigarettes per day.

Between the two groups, there was no statistical difference in terms of initiation of breastfeeding in the 1st h after birth, breastfeeding at night, being taught breastfeeding at the hospital, breastfeeding on the mother's prompting [Table 2].

The continued trend of breastfeeding based on the survival analysis using Kaplan–Meier method showed the duration of breastfeeding in the nonexposed group as (mean \pm standard deviation) 5.57 ± 0.098 months, and 5.58 ± 0.109 months in the exposed group, with no significant difference between the two groups ($P = 0.93$) [Figure 1]. After adjusting the effects of occupation and education using the Cox regression model, no significant difference was found in the risk to breastfeeding in the two groups ($P = 0.98$).

The trend of exclusive breastfeeding based on survival analysis using the Kaplan–Meier method in the two groups showed that the possibility of survival in the exposed group to cigarette smoke was less than the nonexposed group. Breastfeeding rate at 6 months was 65% in the exposed group and 76% in the nonexposed group. Although the difference between the groups was not significant using the above-mentioned tests ($P = 0.149$) [Figure 2], again, after adjusting for occupation and education using the Cox regression model, there was no statistically significant difference ($P = 0.48$).

Discussion

The results of this study indicate that about 71% of children (65% of children in the exposed and 76% in the nonexposed group) were exclusively breastfed up to 6 months, but there was no statistically significant difference between the two groups. The results of this study in relation to exclusive breastfeeding were higher than the results of Ssenyonga *et al.*^[25] of 35.1%, and 61.6% for Naserpoor *et al.*,^[26] and 47% for Noughabi *et al.*^[27] Initiation of breastfeeding in the first 2 h after birth,^[26,28,29] wanted

Table 1: Demographic and reproductive characteristics of study participants by exposure to environmental cigarette smoke

Variable	Exposed group (n=141)	Non-exposed group (n=149)	Statistical test	p-value
Age (year), mean±SD*	25.5±4.9	25.5±4.5	t-test	0.653
Husband's age, mean±SD	29.5±5.3	30.5±5.1	t-test	0.155
Number of pregnancy, mean±SD	1.74±0.87	1.64±0.75	t-test	0.416
Number of live children, mean±SD	1.46±0.56	1.4±0.58	t-test	0.983
Number of childbirth, mean±SD	1.72±0.86	0.75±1.88	t-test	0.691
Mother's education, n (%)				
Primary school	76 (53.9)	36 (24)	Chi-square	0.001**
High school	65 (46.1)	107 (70.7)		
College	-	8 (5.3)		
Husband's education, n (%)				
Primary school	17 (12.1)	5 (3.3)	Chi-square	0.001**
High school	115 (81.6)	87 (58)		
College	9 (6.4)	58 (38.7)		
Mother's occupation, n (%)				
Housewife	137 (97.2)	131 (87.3)	Chi-square	0.002**
Employed	4 (2.8)	19 (12.7)		
Husband's occupation, n (%)				
Employed	7 (5)	34 (22.7)	Chi-square	0.001**
Worker	14 (9.9)	19 (12.70)		
Self-employed	120 (85.1)	97 (64.7)		

*SD: Standard deviation, **Statistically significant

Table 2: Frequency distribution of breastfeeding related variables by exposure to environmental cigarette smoke

Variables	Exposed group N (%)	Non-xposed group N (%)	p-value
Initiation of breastfeeding			
<1 h after birth	130 (93.5)	139 (90.5)	0.352
>1 h after birth	9 (6.5)	14 (9.5)	
Breastfeeding at night			
Yes	140 (99.3)	148 (99.3)	0.969
No	1 (0.7)	1 (0.7)	
Breastfeeding education			
Yes	102 (72.3)	102 (68.5)	0.507
No	39 (27.7)	46 (30.9)	
Rooming in			
Yes	132 (95)	140 (94.6)	0.88
No	7 (5)	8 (5.4)	
Breastfeeding planning			
On baby's demand	88 (62.4)	100 (67.1)	0.2
Planned	5 (3.5)	10 (6.7)	
My prompting	48 (34)	39 (26.2)	

pregnancies,^[30] no medical conditions during pregnancy, pregnancy complications,^[31] and receipt of proper training and advice from health personnel during pregnancy were the most effective factors for exclusive breastfeeding.^[27] In this study, more than 90% of lactating mothers initiated breastfeeding in the 1st h; for most, the pregnancy was wanted, and they received breastfeeding education at health centers or hospitals. While the exclusion criteria included mother's medical condition and complications during pregnancy, the sum of these factors had increased exclusive breastfeeding for mothers in this study compared to other studies. In addition, Jedrychowski *et al.*'s study showed that women who were exposed to environmental cigarette smoke had higher nicotine levels in their breast milk,

and the cessation of breastfeeding in the first 6 months after delivery was higher for these mothers than those who were not exposed to cigarette smoke.^[22] The results of these studies were not consistent with the present study. Consistent with our results, however, are the results of the Leung *et al.* study, in which no relationship was found between all kinds of smoking and exposure to cigarette smoke and the duration of breastfeeding.^[23]

Cotinine is the main and first nicotine metabolite and is measured in breast milk.^[32] It is also known as pollutant and a harmful factor in breast milk, and some studies show that cigarette smoke is the main cause of an increase in the amount of this substance in mother's milk.^[33] Cotinine

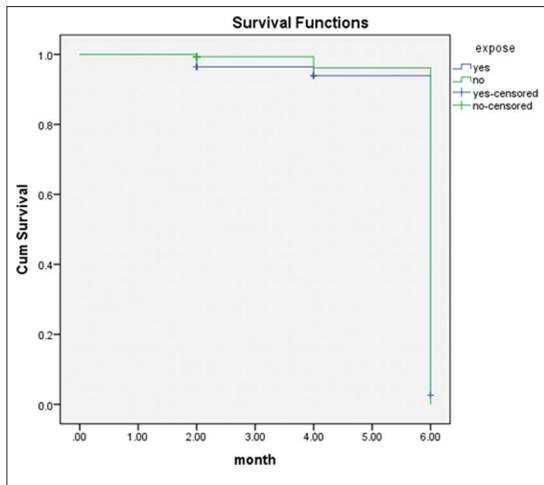


Figure 1: Continued trend of breastfeeding in mother in two groups of exposed and nonexposed to cigarette smoke

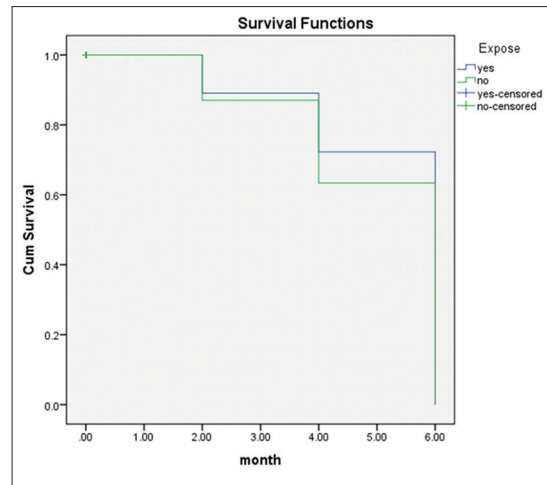


Figure 2: The exclusive breastfeeding in both groups exposed and nonexposed to cigarette smoke

effects vasoconstriction and decreased blood flow in the breast, lowering the level of oxytocin and thus reducing milk production.^[16] Cotinine levels in mother's milk are associated with the level of exposure to cigarette smoke (that is, the number of cigarettes per day). In this study, the exposure to cigarette smoke was 3 min, and the number of cigarettes smoked was almost two cigarettes per day, which was lower^[22] than the previous studies with an average of 10 cigarettes a day, which may explain the absence of a difference between the two groups in the duration of breastfeeding.

In this study, 96% of exposure of lactating women to environmental cigarette smoke was because of husbands who smoked. Unfortunately, 32% of husbands smoked in the presence of their lactating wives. This is consistent with the results of the previous studies on the smoking status in the country.^[34] According to this study, the smoking ban is not respected in the homes of many families. Health interventions in this area are essential because these factors call for a ban on smoking in the family.

The limitations of our study were the inability to lack of determine serum cotinine and evaluate its relationship with the duration of breastfeeding. However, the number of cigarettes smoked per day and duration of exposure were examined, which was helpful. Exposure was defined by the minimal dose of one cigarette per day. In addition, we had little information about husband's smoking behavior in the exposed group and the number of cigarettes smoked per day. The small sample size in this study could have affected the significant difference between the two groups.

Conclusions

The findings showed that exclusive breastfeeding in the exposed group was shorter than the nonexposed group, but this difference was not statistically significant. The results of this study indicate that there should be more prospective studies with larger samples, to compare lactating women exposed to varying quantities of cigarette smoke, the percentage of exclusive breastfeeding, and to continued breastfeeding.

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Conflicts of interest

There are no conflicts of interest.

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