Original Article

Factors Affecting the Behavior of Pregnant Women toward Avoiding Polluted Air

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Abstract

Introduction: Pregnant women are highly vulnerable to air pollution, which has a significant impact on the health of the pregnant women and their fetus.

Objective: The present study aimed at determining the factors affecting the behavior of pregnant women in Arak, Iran toward avoiding exposure to polluted air.

Materials and Methods: In this analytic cross-sectional study, 208 pregnant women who were referred to health centers in Arak city were selected using multistage random sampling method. The data was collected by a researcher-made questionnaire, completed after determining its validity and reliability. This questionnaire included demographic characteristics of the mother, knowledge and the behavior of some of the mothers toward avoiding exposure to polluted air, and was scored on 100 points. Data were analyzed using Pearson and Spearman correlation coefficients, one-way analysis of variance (ANOVA) and T-test.

Results: The mean age of mothers was 26.48 ± 4.77 years, mean gestational age was 14.88 ± 5.9 weeks, and mean knowledge score was 40.56 ± 16.91. There was a positive and significant correlation between knowledge and mother's age (r = 0.279), husband's age (r = 0.222), and number of smokers in the family (r = 0.178) and a negative and significant correlation with gestational age (r = -0.168) (p = 0.05). Also, there was a significant association between educational level of mother and husband, husband's job and income with knowledge and behavior (p = 0.05).

Conclusion: According to the results of this study, mothers' knowledge was less than average. It is thus suggested to develop and implement educational programs for pregnant women advanced in age and during the end of pregnancy to improve their behavior toward avoiding polluted air.

***Keywords*: Pregnant Women, Air Pollution, prevention & control**

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Introduction

Human life depends on breathing air and oxygen. Now, if this vital material is polluted with foreign materials, humans will have to transfer about 20-30 times of each of these external materials into their lungs every minute [1]. According to World Health Organization (WHO) and the United Nations Environment Program, majority of world population today live in cities, where air pollutants are much higher than those defined by WHO [2]. The potential hazards of air pollution are high-risk individuals including elderly, children, cardiovascular patients, pregnant mothers and their fetus [1]. Mothers and children are not only a high-population group, but also a vulnerable and at-risk group [3-5].

Pregnancy is one of the most important and most risky periods of maternal and fetal life, which is very important for the individual, family and society from health and social perspectives [5]. Pregnant women are highly vulnerable to air pollution, which affects their health, as well as the health of their fetus [6]. Many studies addressed the effects of air pollutants on human health. These worldwide studies have shown the association of air pollution with cardiovascular problems, respiratory diseases, and adverse pregnancy outcomes, such as low birth weight, early delivery, pre-eclampsia, and intrauterine growth retardation [7, 8].

Promoting maternal and neonatal health is considered one of the global public health goals that can affect the mortality rate of children under the age of 5 and maternal mortality ratio[9]. In Iran, air pollution has reached a dangerous level in many cities, including Tehran, Mashhad, Isfahan, Tabriz, Shiraz, Karaj, Arak and Ahwaz [10].

Arak is today one of the most polluted cities in Iran. Urban industrialization began largely from the 40's and industrial development since mid40's. Air pollution is one of the most important effects of the presence of industries in Arak. Contaminating factors, in addition to industrial pollution, originate from other factors such as pollution from vehicle transportation, various fuels and non-standard household and service centers that have a significant impact on urban air pollution [11].

Considering the undeniable impact and adverse effects of environmental pollutants on pregnancy, this study aimed to determine factors on avoiding exposure to air pollution in pregnant women in Arak.

Materials and Methods

In this analytic cross-sectional study, 208 pregnant women referred to Arak health centers in 2014 were evaluated. Multi-stage sampling was carried out thereafter; firstly, Arak city was divided into four geographical sections and two health centers were randomly selected from each section, based on the size of the target population (total of 8 centers). Then, study samples were selected from eligible individuals in each center randomly and in proportion to the number of clients in the center.

The minimum sample size was calculated at 192 people according to previous studies in Tehran [12] with a maximum standard deviation of knowledge at 5.3, considering 95% confidence interval and accuracy of 0.75%, using sample size calculation formula to estimate mean. Considering 10% drop-out, 208 people were included in the study.

The inclusion criteria consisted of pregnant women, literate , with single pregnancy, a gestational age of 6 weeks to 6 months, aged 18 to 35 years, without a history of chronic disease (known cases of

cardiac, pulmonary, or kidney diseases, diabetes, and thyroid disease) and the exclusion criteria consisted of complicated pregnancy (pre-eclampsia, pregnancy-induced hypertension, diabetes and hemorrhage).

Before entering the study, the objectives and methods of the research were explained to the participants and if they desired to participate in the study, they entered the study after they signed the written consent. In this research, necessary permissions were obtained from relevant authorities and research ethics code (17-167-93) was received from Arak University of Medical Sciences.
In this study, data was collected by self-report, using a researcher-made questionnaire based on various sources [2, 6-10].

Validity of the questionnaire was assessed by content validity method. Content validity index (CVI) for knowledge and behavior variables was 0.83 and 0.81, respectively. The content validity ratio (CVR) was 0.81 for knowledge and behavior. The reliability of the questionnaire was calculated by computing Cronbach's alpha of the questionnaire, completed by 30 pregnant women with demographic characteristics similar to the study population. The alpha value was 0.86 for knowledge variable and 0.82 for behavior. The first part of the questionnaire included demographic characteristics, the second part included 12 questions related to knowledge, the third part included 26 questions about attitude, and the fourth part included 11 questions about the function of pregnant women in behaviors of avoiding exposure to air pollution during pregnancy. The maximum score for the knowledge variable was 48 and the behavior variable was 55.
In order to score the questionnaire in the knowledge section, correct answer was scored 1 and wrong answer was scored 0 points. In the behavior section of the questionnaire, each question on the mother's behavior regarding avoiding exposure to polluted air was scored from 0 to 4: never 0, rarely 1, sometimes 2, often 3, and always 4. At the end, the score earned by each person was divided by the number of questions, multiplied by 100 and the score was calculated from 100.

In this research, reduced exposure to air pollution outside the home signified attitude toward reduced contact with polluted air, such as not leaving the house at peak hours of air pollution (7-9 am and 6-9 pm), not leaving the house on days with emergency and warning state of air pollution, not entering high-traffic and highly-polluted areas of the city [13], and that in the home meant reducing contact with smoke and other smoking products such as hookah, etc. (Leaving the house when exposed to tobacco smoke), using air conditioner while cooking and avoiding contact with smoke of burnt foods and reduced use of air-fresheners.

Information collected from the questionnaire was imputed into SPSS software version 20 and analyzed by Pearson and Spearman correlation, drawing tables and charts, as well as one-way ANOVA and independent t-test, considering significance level of less than 0.05.

Results

In this study, mean age of pregnant women referring to prenatal care clinics with inclusion criteria was 26.48 ± 4.77 years, mean gestational age was 14.88 ± 5.9 weeks, and mean number of pregnancies was 1.70 ± 0.82. Most participants had a high school diploma (47.1%). Other demographic characteristics of the samples are presented in Table 1 (Table 1).

Table 1. Demographic characteristics of studied pregnant mothers

Variable		N (%)
Mother's educational level	Elementary	24 (11.5)
	Secondary school	35 (16.8)
	High school	98 (47.1)
	Academic education	51 (24.5)
Family income	Low	41 (19.7)
	Moderate	93 (44.7)
	High	74 (35.6)
Smoking of the pregnant mother	Yes	3 (1.4)
	No	205 (98.6)
Number of smokers in the family	None	147 (70.7)
	More than one person	61 (29.3)

Table 2. Number and percentage of responses of pregnant mothers to avoiding exposure to air pollutants

Over the past three months	Always N (%)	Often N (%)	Sometimes N (%)	Rarely N (%)	Never N (%)
1. I don't go out in unhealthy conditions and during peak hours of air pollution	20 (9.6)	76 (36.5)	68 (32.7)	26 (12.5)	18 (8.7)
2. I don't enter heavily-polluted and crowded city areas in unhealthy conditions of air pollution	34 (16.3)	75 (36.1)	48 (23.1)	27 (13)	24 (11.5)
3. If there is one, I use air-conditioner during cooking.	68 (32.7)	46 (22.1)	35 (16.8)	26 (12.5)	33 (15.9)
4. If family members smoke cigarette or hookah, I ask them not to smoke inside home.	121 (58.2)	32 (15.4)	27 (13)	12 (5.8)	16 (7.7)
5. I avoid being in closed environments contaminated with cigarette smoke.	102 (49)	50(24)	32 (15.4)	15 (7.2)	9 (4.3)
6. I do not use insecticides inside home.	71 (34.1)	51 (24.5)	31 (14.9)	29 (13.9)	26 (12.5)
7. I do not use air-freshening sprays inside home.	53 (25.5)	55 (26.9)	44 (21.3)	38 (13.5)	27 (13)
8. I wash the house with hot water, sodium bicarbonate, textile, and less toxic detergents.	29 (13.9)	68 (32.7)	52 (25)	32 (15.4)	27 (13)
9. I reduce my physical activity (walking or other sports) during peak hours of air pollution outdoors.	52 (25)	73 (35.1)	29 (13.9)	25 (12)	29 (13.9)
10. I heat oil slowly with low flame.	94 (45.2)	66 (31.7)	34 (16.3)	12 (5.8)	2 (1)
11. Even if the detergents are scented, I avoid inhaling them.	59 (28.4)	78 (37.5)	38 (17.3)	31 (14.9)	4 (1.9)

Mean of knowledge score was 40.56 ± 16.91, while 87.4% of participants did not know which of the year's seasons was more polluted and 76% did not know the peak hours of air pollution. Mean of the behavior score was 72.99 ± 13.77 of 100 points. The number and percentage of respondents to the behavior section of the questionnaire regarding avoiding exposure to polluted air in pregnant women is shown in Table 2. A total of 76% of pregnant women did not leave their homes often in unhealthy conditions and at peak hours of air pollution. Pearson and Spearman correlation coefficients between some demographic characteristics and maternal knowledge and behavior are presented in Table 3.

Table 3. Correlation of demographic characteristics of mothers with knowledge and behavior regarding avoiding exposure to polluted air.

Variable	Knowledge	Sig.	Behavior	Sig.
Mother's age	0.279	0.001*	0.066	0.343*
Gestational age	-0.168	0.015*	-0.077	0.269*
Spouse's age	0.222	0.001*	0.107	0.122*
Number of pregnancies	0.083	0.236**	-0.014	0.839**
Number of children	0.079	0.259**	-0.063	0.362**
Number of family members	0.017	0.813**	-0.076	0.273**
Number of smokers in the family	0.178	0.010**	-1.7	0.123**

*Pearson Correlation
**Spearman Correlation

Table 4. Comparison of the effect of demographic factors on knowledge and behavior of avoiding exposure to polluted air in pregnant mothers

Variable		Knowledge	Sig.	Behavior	Sig.
Mother's education	Elementary	30.76±15.78	0.0001*	65.68±18.41	0.002*
	Secondary school	31.64±15.80		68.36±14.37	
	High school	41.13±15.62		72.31±12.72	
	Academic education	50.22±15.10		77.25±10.85	
Spouse's job	Employee	45.97±16.86	0.029*	78.09±11.51	0.005*
	Worker	36.49±18.17		69.67±16.30	
	Businessman	40.27±16.04		70.93±12.90	
Spouse's education	Elementary	27.88±12.38	0.0001*	65.90±13.12	0.001*
	Secondary school	38.62±17.94		68.97±16.68	
	High school	40.76±15.70		72.38±13.5	
	Academic education	48.39±16.17		77.68±13.77	
Income	Low	38.27±17.58	0.022*	71.52±13.89	0.002*
	Moderate	38.13±16.47		68.93±13.71	
	High	44.56±16.45		76.38±12.78	
Smoking of the pregnant mother	Yes	35.89±16.01	0 .631**	61.21±15.46	1.168*
	No	40.63±16.95		72.25±13.72	

*** ANOVA**
**** Independent T-test**

According to the results, maternal age (p=0.001), husband's age (p=0.001), and the number of smokers in the family (p=0.10) had a positive and significant correlation and gestational age (p=0.015) had a reverse correlation with knowledge.
To examine the association between qualitative variables and knowledge and behavior of mothers, independent t-test and one way ANOVA were used (Table 4). According to the results, there was a significant association between mother's and husband's educational level, husband's job, and income with knowledge and behavior, so that mean score of knowledge and behavior were significantly higher in mothers with higher education, with higher education of husbands, with employed husbands, and mothers with higher family income. However, as indicated by the results of T-test, significant association between smoking of the pregnant mother and knowledge and behavior was not discovered.

Discussion

In this study, the knowledge score of mothers avoiding exposure to polluted air was less than average. A number of mothers had no knowledge of the peak pollution seasons as well as peak pollution hours, which indicates insufficient awareness of the individuals and emphasizes the need for providing information on air pollution. This finding was in line with the study of Shamsi and colleagues on the effect of education based on health belief model on increasing the awareness of the subjects [14].

In the present study, mean score of function was higher than average, and some pregnant women did not leave their homes in unhealthy conditions and at peak hours of air pollution, and nearly half of the pregnant women avoided exposure to cigarette smoke, while only about a quarter of them did not use air-freshening sprays inside the house.

Araban et al. [6] examined the preventive behaviors of pregnant mothers in polluted air and showed that half of the subjects were in the pre-functional stage (pre-thinking, thinking, and preparedness).
This study results indicate that despite public media advertisements on air pollution, many people still possess inappropriate behaviors regarding the unfavorable effects of air pollution, which may be ascribed to inaccurate knowledge of the harmful effects of air pollution or the benefits of reducing exposure to air pollution. Awareness of pregnant women about the complications of exposure to polluted air can lead to avoiding exposure; with this in mind, there is a need to inform them about avoiding exposure to polluted air.

The results showed no significant correlation between mother's and Spouse's age, number of children, number of family members and smokers in the family with maternal knowledge and behavior, but there was significant and inverse association between gestational age and knowledge and none between gestational age and mother's behavior. This can be ascribed to the unwillingness of mothers to leave home, because of weight gain and the change in their physiological conditions during pregnancy, so they learn more. The Araban's study [6] also states that pregnant women tend to leave their homes less with increasing gestational age. However, in the study of Baqiyani-Moghadam et al. [15], there was no significant association between gestational age and knowledge or function.

The findings of this study indicated no significant association between the number of pregnancy and the mother's knowledge and behavior. However, the results of

some studies indicate that number of pregnancy can be related to maternal behaviors regarding fetal health [6, 16]. In the present study, mothers with higher educational level had higher knowledge and better function in avoiding exposure to polluted air. The analysis showed increased knowledge by higher level of education, which is consistent with the results of Sajjadi-Hazavehi et al. [17] and Khojawi-Shojaei et al. [18]. In the study of Baqiyani-Moghadam et al [15] and Askari-Nejad et al [19], knowledge increased with increasing educational level, but educational level did not have a significant association with function.

Another finding of this study was significant association between the educational level of the pregnant mothers and knowledge or function. In the study of Baqiyani-Moghadam et al, there was a significant association between husband's educational level and knowledge, but this association was not significant in terms of function. While Araban et al [6] showed a significant association between the stages of changes in pregnant women and husband's educational level (rather than mother's educational level), as with increasing husband's educational level, individuals were at higher stages of behavioral change. Husband's educational level effect on the knowledge and behavior of mothers' is due to information transmission and the influence of the husband as an intellectual source for the mother.

According to the findings of this study, the mean scores of knowledge and behavior were significantly higher in the mothers whose husband's job was as an employee. This can be ascribed to higher educational level of husbands. In the study of Balali Meybodi et al. [20], there was a significant association between knowledge and function with the mother's job, so that employees' knowledge was higher than other occupational groups, while Baqiyani-Moghadam et al. reported no association between mother's job and knowledge, which improved by higher income [15]. Notable dissimilarities may be as a result of the fact that most pregnant women were housewives in our study, so we measured the association between their husband's job, rather than mother's job.

The findings of this study indicated significant association between knowledge and behavior of mothers with income, so that the mean score of knowledge and behavior was significantly higher in families with higher income, so the higher the level of income was, the more likely they cultivate health-related behaviors. In the study of Balali Meybodi et al. [20], the knowledge and function score of individuals with fixed income was higher than others. However, the results of the research by Baqiyani-Moghaddam et al [15] showed a significant association between income and knowledge, but there was no significant association between income and function.
Goldberg et al. conducted a study on the association between long-term exposure to air pollution and chronic diseases, which illustrates the adverse effects of air pollution on increasing mortality rate in vulnerable groups of societies [21].

Giles et al. published the results of a Canadian meeting on strategies to reduce the adverse effects of air pollution on health, entitled "From Decision to Effective Intervention". In this workshop, the unfavorable and proven adverse effects of air pollution on human health and the exposure of a wide range of people as well as the strategies for reducing the harmful effects of air pollution in the individual and the environment were determined and it was found that modifying the personal behaviors and reducing exposure to

contaminants are powerful approaches to reduce the adverse effects of air pollution [22].

A significant limitation of the present research was data collection by self-report. As deduced from the results of this study, mothers' knowledge was lower than average, so it is suggested to design and implement training programs for pregnant women with higher age and during the end of pregnancy to improve the behavior of avoiding air pollution.

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No conflict of interest has been declared by the authors.

Author contributions
All authors have agreed on the final version and meet at least one of the following criteria [recommended by the ICMJE (http://www.icmje.org/recommendations/):
-Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;

-Drafting the article or revising it critically for important intellectual content

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