

# PREGNANT WOMEN'S BELIEFS ABOUT THIRD-HAND SMOKE AND EXPOSURE TO TOBACCO SMOKE

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## SUMMARY

**Objective:** The aim of this study was to reveal pregnant women's beliefs about third-hand smoke and their exposure to tobacco smoke.

**Methods:** The population of this cross-sectional study consisted of patients attending the obstetrics and gynaecology outpatient clinic of the hospital in Samsun, a province of Turkey on the Black Sea coast (annual average 4,000 pregnant women). The minimum sample size of the study was determined as 350 at a confidence interval of 95%, prevalence of 50% and margin of error 0.05. The study data were collected with the personal information form used to determine the personal characteristics of the participants, and the Beliefs about Third-Hand Smoke (BATHS-T) scale. The data were analysed in the SPSS 25.0 program using the descriptive statistics and multiple regression analysis.

**Results:** The mean age of the participating pregnant women was  $26.84 \pm 4.372$  years. Of them, 48.4% were high school graduates and 86% did not work. Their mean gestational age was  $29.85 \pm 9.238$  weeks, and 69.8% of them were in the third trimester. Of them, 9.8% were smokers, and the average number of cigarettes they smoked per day was  $6.97 \pm 4.931$ . The mean score they obtained from the BATHS-T scale was  $3.79 \pm 0.859$ . There was a significant relationship between the mean score obtained from the BATHS-T scale and the variables such as education and smoking status. As the level of education increased, exposure to third-hand smoke decreased ( $p < 0.05$ ). The mean score the smoking pregnant women obtained from the BATHS-T scale was lower than that of the non-smoking pregnant women.

**Conclusion:** High level of education decreases exposure to third-hand smoke. Belief in third-hand smoke is an important factor affecting pregnant women's smoking habit.

**Key words:** pregnant women, third-hand smoke, exposure to tobacco smoke

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## INTRODUCTION

Tobacco use, one of the most serious public health problems in the world, kills on average more than 8 million people a year. Of these deaths, approximately 7 million are the results of direct tobacco use and 1.2 million are the results of non-smokers being exposed to second-hand smoke. Therefore, although all states try to develop policies to reduce smoking, smoking remains the most important public health problem (1–3).

The health risks of tobacco smoking are well known and include a 2-fold increase in the risks of heart disease and cancers of the bladder, stomach and pancreas; a 10- to 20-fold increase in the risks of lung cancer; and a 10-fold increase in the risk of chronic obstructive pulmonary disease (COPD). Smoking also significantly increases the risks of stroke and pneumonia as well as of many problems not commonly linked to smoking, such as facial wrinkling (4). Smoking has been associated with greater risk of injury from fires, and motor vehicle and workplace accidents.

In epidemiological studies, it has been demonstrated that exposure to second-hand smoke is not free of risk. While smoking has been shown to be the cause of many diseases in an unprecedented

way, the effects of exposure to third-hand smoke on health, which E. Wynder pointed out in 1953, have only recently become the subject of new studies (1, 5). Third-hand tobacco smoke was first introduced during studies conducted on the adverse effects of second-hand smoke in Boston Massachusetts General Hospital. Studies on the health effects of third-hand tobacco smoke exposure were carried out in 2011 when the Tobacco-Related Disease Research Program (TRDRP) was conducted in California. Scientists from all over the world contributed to these studies, and studies on third-hand smoke exposure have gained momentum (5–7).

Third-hand smoke is mostly the result of tobacco smoked. The term third-hand smoke (THS) is a relatively new concept. Exposure to second-hand cigarette smoke is a result of involuntary inhalation of the smoke combination released from the cigarette and released into the environment. Third-hand smoke exposure is caused by dust and surfaces, inhalation, ingestion (digestion), and dermal intake of cigarette residues in addition to air. Dermal absorption is another important way of exposure to pollutants bound to settled dust (5).

Third-hand smoke is the residual nicotine and other chemicals lingering on surfaces and dust for a long time after smoking and

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spreading into the air by reacting with oxidants and other compounds inhaled into the body (7, 8). Although third-hand smoke has a lower concentration than second-hand smoke, it remains on surfaces longer (8, 9). In this way, the person is also exposed to third-hand tobacco smoke through the skin (2).

Thus, as does active smoking, exposure to tobacco smoke causes many diseases. In addition, metabolites of harmful substances in tobacco smoke are higher in individuals who are passively exposed to tobacco smoke than in those who have never been exposed to tobacco smoke. In this way, pregnant women and children are the ones who are passively exposed to tobacco smoke more (10, 11). Pregnant women's smoking is a more serious health problem because of the harm it causes to the foetus. Smoking or exposure to tobacco smoke during pregnancy adversely affects foetal development, every period of pregnancy and delivery, and produces negative consequences such as low birth weight, premature birth, stillbirth and risky birth. It is also known that smoking during pregnancy is associated with mood disorders, psychiatric problems, mental retardation, substance abuse, tendency to commit criminal crimes during adolescence, type 2 diabetes, obesity, childhood cancers, and chest diseases in children (12–16). Exposure to tobacco smoke passively in the prenatal period threatens the health of the baby and mother as negatively as does active smoking. Nowadays, problems such as low birth weight, preterm birth weight and respiratory distress observed in active smoker pregnant women are now on the increase in pregnant women who are passively exposed to tobacco smoke (17–21).

Identifying the biomarkers of third-hand smoke is important because they indicate the severity and presence of the disease. In a recent study conducted on mice, biomarkers of third-hand smoke were detected four weeks after initial exposure at levels equivalent to those determined in smokers' homes. Mice were exposed to third-hand smoke in different months, and they began to show the signs of increases in inflammatory cytokines in the circulation, tumor necrosis factor, granulocyte macrophage colony stimulating factor, and the stress hormone epinephrine as early as one month (22).

Damage caused by THS exposure remained after two, four, and six months. Some of the mice also became hyperglycaemic and hyperinsulinaemic, which suggests that insulin resistance may be a result of prolonged exposure (3). The results of this study imply that increased exposure to THS can have dramatic effects. If the effects of THS are to be completely understood, more studies should be conducted with human subjects. In the literature, there are several studies indicating that third-hand smoke has harmful effects at the gene level, can be quite risky for babies, and causes negative changes in lung physiology in rats (23, 24).

Pregnant women are also in the at-risk group in terms of third-hand tobacco smoke. In their study Drehmer et al. detected markers of third-hand tobacco smoke in children's bodies and reported that these markers were in higher concentrations in children than they were in adults. They also stated that the chemicals in third-hand tobacco smoke damage DNA and that the smoke contains carcinogenic substances. They also stated that there were studies in which these markers were detected in sick children in medical settings, and that in animal studies, a relationship was determined between environmental tobacco smoke exposure and conditions such as prediabetes, asthma, attention deficit hyperactivity disorder, asthma, metabolic syndrome, and low birth weight (5).

Smokers continue to be a serious health threat for not only themselves but also non-smokers. Smoking is still an important public health problem in Turkey and all over the world. The ban on smoking was first implemented in San Luis Obispo, California, in 1990, including bars and restaurants in all public indoor spaces. In the following years, this practice has spread into many countries. One of the most important reasons is that the harmful effects of smoking are not limited to smokers, and smoke is shared with non-smokers who are in the same indoor areas (2, 3, 5).

Many theories of behaviour change rely on a person's risk awareness and access to information (12–14). Knowledge of the health effects of smoking is one of the possible prerequisites for quitting and is targeted by prevention programmes (25). Determining the beliefs and determinants of the harmful effects of third-hand smoke is important because it provides guidance for those who establish health policies that can be developed in the fight against the issue. Therefore, in the present study, aimed at determining the beliefs of pregnant women about third-hand tobacco smoke and their exposure to tobacco smoke, responses to the following questions were sought:

- What is the level of smoking exposure in pregnant women?
- What is the third-hand smoke belief level of pregnant women?
- Do pregnant women's beliefs about third-hand smoke affect their exposure to tobacco smoke?
- What are the factors affecting pregnant women's beliefs about third-hand smoke?

## **MATERIALS AND METHODS**

### **Population and Sample**

The population of the study consists of pregnant women attending the Samsun Training and Research Hospital Gynaecology and Obstetrics Polyclinics of Health Sciences University (annual average 4,000 pregnant women). The sample size of the study was determined as 350 at a confidence interval of 95%, prevalence of 50% and margin of error 0.05.

### **Data Collection Tools**

The study data were collected with the personal information form used to determine the personal characteristics of the participants, and the Beliefs about Third-Hand Smoke (BATHS-T) Scale.

#### **Personal Information Form**

The form includes items questioning the participants' socio-demographic characteristics and exposure to tobacco smoke.

#### **Beliefs about Third-Hand Smoke (BATHS-T) Scale**

The scale was developed by Wen Kuo and Rees in 2019. The content validity and reliability of the Turkish version of the scale was performed by Çadırcı et al. (3). The scale consists of 9 items and 2 sub-dimensions. The health sub-dimension includes items 1 through 5, and the persistence sub-dimension includes items 6 through 9. Responses given to the items are rated on a 5-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree). There is no reverse scored item in the scale (3). In the present study, the Cronbach's alpha value of the scale was

0.963. The highest and lowest possible scores that can be obtained from the scale are 5 and 1, respectively. The higher the score the more the individual believes in the effects of third-hand smoke on the environment and health and the lower the score the less the individual believes in the effects of third-hand smoke on the environment and health.

### Data Collection

The data of this cross-sectional study were collected between 1 June 2021 and 31 July 2021 using the drop and collect method. The survey forms administered by the midwives working in the blood pressure monitoring unit were filled in by the pregnant women before they were examined. Of the 500 survey forms administered, 364 completely filled in were analysed.

### Analysis

The data were analysed in the SPSS 25.0 program using the descriptive statistics and multiple regression analysis.

### Ethical Issues

Ethics committee approval to conduct the study was obtained from the University Health Field Scientific Ethics Committee and permission from the institution where the study was to be conducted. Informed consent was obtained from the participants.

## RESULTS

The mean age of the pregnant women was  $26.84 \pm 4.372$  years. Of them, 48.4% were high school graduates, 86% were not employed, 89.6% were in a low-income group, 47.5% lived in a district centre until the age of twelve; 86.3% had a nuclear family, and 87.9% had social security. The mean duration of their marriage was  $4.13 \pm 4.015$  years. As for their husbands, 40.9% were college/university graduates and 50.3% worked in low-income jobs (Table 1).

The mean number of pregnancies was  $1.85 \pm 1.189$ , the mean number of live births  $1.46 \pm 0.668$ , the mean number of living children  $1.45 \pm 0.634$ , the mean number of spontaneous abortions  $1.42 \pm 1.016$ , and the mean gestational age was  $29.85 \pm 9.238$  weeks. Of the participants, 69.8% were in the 3rd trimester of pregnancy, 84.3% had planned pregnancies, 89.5% had no pregnancy-related problems, 96.4% had spontaneous pregnancies, and 89.6% together with their husbands wanted the pregnancy. The mean score they obtained from the overall BATHS-T was  $3.79 \pm 0.859$  (Table 2).

While 9.8% of the pregnant women were smokers, 63.1% of the spouses were smokers. The mean number of cigarettes smoked per day by the smoker pregnant women and the smoker husbands was  $6.97 \pm 4.93$  and  $12.64 \pm 7.43$ , respectively. The smoker pregnant women's mean age of starting smoking was  $18.22 \pm 4.211$  years. The rate of the husbands and guests not smoking in the room where the pregnant women stayed were 86.9% and 95.1%, respectively. Of the pregnant women, 100% were knowledgeable about the harms of smoking, and 57.7% obtained this information from the mass media. While 51.6% of the pregnant women

**Table 1.** Socio-demographic characteristics of participating pregnant women (N=364)

	n	%
Age		
18–29	279	76.6
30–39	81	22.3
40+	4	1.1
Education status		
Primary education	97	26.6
High school	176	48.4
College/university	91	25.0
Having a job worked regularly		
Yes	51	14
No	313	86
Social class		
Upper social class	38	10.4
Lower social class	326	89.6
Place of residence stayed longest until the age of 12		
City center	95	26.1
District center	173	47.5
Small town or village	95	26.1
Abroad	1	0.3
Economic status of the family		
Income less than or equal to expenses	343	94.2
Income more than expenses	21	5.8
Mean number of people in family	$3.02 \pm 1.379$ (1–11) <sup>#</sup>	
Mean number of rooms at home	$3.47 \pm 0.736$ (2–7) <sup>#</sup>	
Family members lived together		
Participant, husband and children	314	86.3
Participant, husband, children, mother/ father in law	50	13.7
Social security		
Yes	320	87.9
No	44	12.1
Mean duration of marriage	$4.13 \pm 4.015$ (1–18) <sup>#</sup>	
Spouse's education status		
Primary education	127	34.9
High school	88	24.2
College/university	149	40.9
Income level of the spouse's job		
Upper	181	49.7
Lower	183	50.3
Total	364	100.0

<sup>#</sup>Mean  $\pm$  SD (min – max)

perceived their general health status as good, 97.3% of them did not have a chronic disease (Table 3).

As is seen in Table 4, the mean scores the participating pregnant women obtained from the BATHS-T scale, and its health and persistence subscales were  $3.79 \pm 0.859$ ,  $3.83 \pm 0.893$  and  $3.75 \pm 0.895$ , respectively (Table 4).

**Table 2. Obstetric characteristics of participating pregnant women (N=364)**

	n	%
Mean number of pregnancies	364	1.85 ± 1.189 (1-7) <sup>#</sup>
Mean number of live births	164	1.46 ± 0.668 (1-5) <sup>#</sup>
Mean number of living children	158	1.45 ± 0.634 (1-4) <sup>#</sup>
Mean number of spontaneous abortions	52	1.42 ± 1.016 (1-4) <sup>#</sup>
Gestational age		
1st trimester	36	9.9
2nd trimester	74	20.3
3rd trimester	254	69.8
Is the current pregnancy a planned pregnancy?		
Yes	307	84.3
No	57	15.7
Have you had any problems during your pregnancy?		
Yes	40	10.5
No	324	89.5
What problems have you had?		
Threatened abortion	19	47.3
Threat of premature birth	9	21
Preeclampsia/eclampsia	3	7.3
Diabetes	7	17.1
Cardiac disease	3	7.3
Is the current pregnancy an intended pregnancy?		
Both my husband and I wanted	326	89.6
I wanted but my husband did not	7	1.9
My husband wanted but I did not	31	8.5
Way of getting pregnant		
Natural	351	96.4
After treatment	13	3.6
Total	364	100.0

<sup>#</sup>Mean ± SD (min – max)

In Table 5 the results of analysis of beliefs about third-hand smoke and influencing factors, performed using the multiple regression model, are given. The results of the analysis indicated that the regression model was statistically significant [F (4.360) = 7.045, p < 0.001]. The independent variables accounted for 7% of the changes in the scores obtained from the BATHS-T scale. The results of this analysis demonstrated that while the relationship between the BATHS-T scale, educational status and smoking status of pregnant women was significant, the relationship between the BATHS-T scale and other variables was insignificant. As is seen in Table 5, after other variables were controlled, a 1-point increase in smoking status led to a 0.265-point decrease in the BATHS-T scale score. In other words, smoking decreased as the BATHS-T scale score increased (Table 5).

## DISCUSSION

In the present study, 9.8% of the 364 pregnant women were smokers, and the number of cigarettes they smoked per day varied

**Table 3. Smoking status of participants and their husbands (N=364)**

	n	%
Are you a smoker?		
No	328	90.2
Yes	36	9.8
Mean number cigarettes smoked per day		
	6.97 ± 4.931 (1-20) <sup>#</sup>	
Mean age of starting smoking		
	18.22 ± 4.21 (12-34) <sup>#</sup>	
Have you tried to quit smoking?		
I have and I will try again	16	39.4
I have, I don't think I will try again	8	24.2
I haven't, I'm thinking of quitting	10	30.3
I haven't, I don't intend to quit	2	6.1
Do you smoke cigar, pipe or hookah?		
No	363	99.7
Yes	1	0.3
Is your husband a smoker?		
No	229	63.1
Yes	112	30.9
Mean number of cigarettes the husbands smoke per day		
	12.64 ± 7.43 (1-40) <sup>#</sup>	
Does your husband smoke in the room you stay?		
Yes	19	13.1
No	126	86.9
Do your guests smoke in the room you stay?		
Yes	18	4.9
No	346	95.1
Are you knowledgeable about the harms of smoking?		
Yes	364	100.0
No		
Source of the knowledge about the harms of smoking		
Health workers	126	34.6
TV/newspaper/close relative/friend	238	65.4
How do you perceive your health in general?		
Excellent/good	205	56.3
So-so/bad/very bad	159	43.7
Do you have any chronic disease?		
Yes	10	2.7
No	354	97.3

<sup>#</sup>Mean ± SD (min – max)

**Table 4. Mean scores participants obtained from BATHS-T and its sub-dimensions**

	Mean ± SD
Health sub-dimension	3.83 ± 0.893
Persistence sub-dimension	3.75 ± 0.895
Overall BATHS-T	3.79 ± 0.859

**Table 5.** Results of multiple regression analysis for educational status, smoking status and BATHS-T scale

Variable	B	Standard error	$\beta$	t	p-value
Constant	2.986	0.595		5.015	<0.001*
Educational status	0.282	0.053	0.238	4.267	<0.001*
Smoking status	-0.265	0.085	-0.164	-3.054	0.002*
Husband's smoking status	0.018	0.073	0.013	0.242	0.809
Planned pregnancy	-0.131	0.121	-0.055	-1.085	0.278
Husband smoking in the room where the pregnant woman stays	0.050	0.189	0.016	0.265	0.791
Guests smoking in the room where the pregnant woman stays	0.248	0.239	0.062	1.037	0.300
Pregnant woman's income group	0.010	0.152	0.003	0.063	0.950
Husband's income group	0.166	0.095	0.098	1.687	0.092
Gestational age (weeks)	0.012	0.044	0.017	0.279	0.780
Age	-0.114	0.097	-0.065	-1.173	0.241
Adjusted R <sup>2</sup> = 0.073	F = 7.045; p < 0.001				

Dependent variable: BATHS-T Scale; \*significant at 0.05

from 2 to 12. In the studies conducted on the rate of smoking in pregnant women in Turkey, the rate varies between 6.8% and 28% (12, 21, 31, 32). According to our review of the foreign literature, in Lange et al. (18) meta-analysis and systematic study the rate of smoking in pregnant women was 1.7%. In the study by Kataoka et al. (26) conducted with 189 pregnant women, 11.3% of the pregnant women smoked during pregnancy. In their study conducted in Finland between 1989 and 2006, Harju et al. investigated the asthmatic children of women who gave live births and determined that 9.6% of these women smoked during pregnancy (27). Riaz et al. in their study reported that the rate of smoking among pregnant women was between 10% and 26% in high-income countries, and between 15% and 37% in low-income countries (28). The rate of smoking among pregnant women in our study is in the range of the global average. The high rate of smoking in pregnant women threatens the health of future generations and suggests that more meticulous studies should be conducted on the harms of smoking. In Rissanen et al. cohort study, the children of mothers who smoked during pregnancy also smoked in later ages (29). In a study conducted by Ayano et al., the academic achievement levels of children whose mothers smoked during pregnancy were low (30). In several studies, pregnant women's quitting smoking in the first two trimesters of pregnancy significantly reduced the negative results of smoking (21–23, 31).

In the present study, 13.1% of the husbands of the pregnant women and 4.9% of the guests smoked in the environments where the pregnant women were present. Our review of studies conducted with pregnant women demonstrated that in Tarhan and Yılmaz's study (12), the rate of those who smoked cigarettes near the smoker and non-smoker pregnant women was 84.5% and 61.1%, respectively. According to the study by Çadırcı et al. 45.8% of the individuals smoked in environments where pregnant women were present (3). Erbaş et al. in their study determined that 59.1% of people smoked in the house (32). Dilcen et al found that 25.4% of the pregnant women were exposed to tobacco smoke at home (33). Danagöz et al. in the study conducted with non-smoker pregnant women found that 83.0% of them were exposed to tobacco smoke (2). Our review of foreign literature demonstrated that 45.3% of the pregnant

women were exposed to tobacco smoke at home. Rang et al. in the study conducted in Vietnam found that 28% of the pregnant women were exposed to tobacco smoke (34). In the study by Mahmoodabad et al. conducted with 255 pregnant women in Iran (35), and 24% to 92% of the pregnant women were exposed to tobacco smoke in Sharma and Khapre's review of studies conducted on exposure to tobacco smoke during pregnancy in 2004 and subsequent years (36). The analysis of these results revealed that pregnant women are exposed to tobacco smoke at high rates, higher than the rates in the present study. Pregnant women's exposure to such high levels of tobacco smoke may cause their children to be born with some health problems. This may also cause these children to smoke and use drugs in their future lives. In order to reduce these rates, awareness trainings should be given by family physicians or pregnant schools in hospitals. These rates should be also reduced by conducting regional studies with pregnant women.

In the present study, a significant relationship was determined between education level and awareness of third-hand tobacco smoke exposure. According to the results of the present study, the awareness of third-hand tobacco smoke exposure increased as the education level increased. This finding is consistent with those of the studies conducted by Tarhan and Yılmaz (12) and Smedberg et al. (37). Unlike the current study, in the Tarhan and Yılmaz's study variables such as the spouse's smoking status, the spouse's or guests' smoking in the room where the pregnant women were present, planned pregnancy, and gestational age affected the pregnant women's beliefs related to third-hand tobacco smoke exposure (12). On the other hand, in our study, a negative relationship was determined between the pregnant women's smoking status and their awareness of third-hand tobacco smoke exposure. Smoking was less common in the pregnant women with high awareness of third-hand tobacco smoke exposure than it was in other pregnant women.

### Limitation of the Study

The main limitation of the study is that it was conducted in one place, Samsun, and in a short period.

## CONCLUSIONS

In the present study, it was determined that education and awareness play a significant role in reducing exposure to tobacco smoke. Pregnant women's awareness of third-hand tobacco smoke exposure should be raised through training provided in primary healthcare services, pregnant schools, etc.

## Conflicts of Interests

None declared

## Authors' Contribution

S.Ö – design of the work, drafting the work, statistical analysis, writing the manuscript; Y.D – data collection, interpretation of data for the work, statistical analysis, writing the manuscript; B.Y. – design of the work, data collection, writing the manuscript; S.B. – data collection, design of the work, drafting the work. All authors have approved the final version to be published.

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