

# Attitude and Practice Toward Use of Cigarettes and Electronic Cigarettes Among Pregnant Women: A Questionnaire-Based Survey

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## Abstract

**OBJECTIVE:** This study aimed to evaluate attitude and practice toward use of regular tobacco cigarettes and electronic cigarettes among pregnant women.

**MATERIAL AND METHODS:** A total of 1123 pregnant women participated on a voluntary basis in this questionnaire survey. Maternal characteristics, cigarette consumption parameters, and personal opinions regarding the adverse effects of smoking during pregnancy were evaluated.

**RESULTS:** Active smokers composed 12.4% (9.4%: regular tobacco cigarettes, 3.0%: electronic cigarettes) of the study population. Smoking during the current pregnancy, particularly via regular tobacco cigarettes, was more likely for women with smoking during previous pregnancies (56.0% vs. 7.8%,  $P < .001$ ), previous history of low birth weight infant delivery (16.1% vs. 8.6%,  $P = .013$ ), premature delivery (16.7% vs. 7.0%,  $P < .001$ ), and stillbirth (22.8% vs. 11.7%,  $P = .002$ ). The presence versus absence of smoking during pregnancy was associated with a lower likelihood of being a housewife (70.5% vs. 80.5%,  $P = .010$ ) and a higher likelihood of having an actively smoking mother (25.9% vs. 11.2%,  $P < .001$ ) or partner (65.7% vs. 46.9%,  $P < .001$ ). Regular tobacco cigarette users considered electronic cigarettes to have a higher risk of adverse impacts (11.1% vs. 2.9%,  $P = .012$ ), while electronic cigarette users considered regular cigarettes to have a higher risk of nicotine exposure (55.9% vs. 13.0%,  $P < .001$ ).

**CONCLUSION:** Our findings indicate being employed, having an actively smoking mother or partner, as well as smoking in previous pregnancies, to be the risk factors for increased likelihood of smoking during pregnancy.

**KEYWORDS:** Smoking, pregnancy, regular tobacco cigarette, electronic cigarette, risk factors

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## INTRODUCTION

Smoking in pregnancy is both a significant public health concern and a significant risk factor for adverse neonatal and maternal outcome.<sup>1,2</sup> Low birth weight infant (LBWI) delivery, miscarriage, preterm birth, and increased neonatal and maternal morbidity and mortality, as well as long-term consequences in the offspring (i.e., neurological development, childhood asthma, endocrine dysfunction, and oncogenesis) are among the health risks associated with smoking in pregnancy.<sup>1,3,4</sup>

However, despite the consistently reported harmful effects of smoking during pregnancy,<sup>5-7</sup> only 40% of women consider quitting smoking during pregnancy, with more than half relapsing within 6 months, and up to 90% relapsing within 1 year.<sup>2</sup> Moreover, electronic nicotine delivery systems (ENDSs) such as electronic cigarettes are also considered an

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emerging risk factor given their increasing popularity during recent years, as they are commonly marketed as safer alternatives to regular cigarettes without considering the risk of the intrinsic adverse effects of nicotine.<sup>7-9</sup>

Accordingly, pregnant women are considered likely to be susceptible to the increased advertising of electronic cigarettes as safer alternatives to tobacco smoking.<sup>7</sup> Whereas there are extensive studies on the effects of tobacco smoking, the effects of ENDSs during pregnancy on maternal or fetal or newborn health have been investigated only by a few studies.<sup>7,10,11</sup>

Moreover, relatively little is known about the effect of public health-directed tobacco control policies and programs among pregnant women<sup>12,13</sup> and there is a scarcity of available literature on the prevalence of smoking in pregnancy in relation to potential maternal sociodemographic and smoking-related risk factors for continued smoking among pregnant women.<sup>2,13</sup>

Likewise, no study to date has investigated the attitudes and practices regarding tobacco smoking as well as the use of electronic cigarettes among pregnant women in Turkey. This cross-sectional, questionnaire-based survey was therefore designed to determine the prevalence of smoking among Turkish pregnant women and to evaluate the attitude and practices of pregnant women regarding the use of regular tobacco cigarettes and electronic cigarettes during pregnancy in relation to maternal sociodemographic and obstetric characteristics and smoking-related parameters.

## MATERIAL AND METHODS

### Study Population

A total of 1123 adult pregnant women who were routinely followed up at obstetrics outpatient clinics participated on

a voluntary basis in this multicenter, cross-sectional questionnaire survey conducted between September 2017 and December 2017 at 15 tertiary care hospitals in 11 provinces across Turkey.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study which was conducted in accordance with ethical principles stated in the "Declaration of Helsinki" and approved by the ethics committee of Health Sciences University Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital (date of approval: 04/09/17, protocol no: KAEK-116/ 2017/5/019).

### The Questionnaire

The questionnaire form was applied via a face-to-face interview method and elicited items on maternal sociodemographic (age, marital status, number of children, occupation, educational level, monthly income) and obstetric (gestational week, gestational diseases, comorbid diseases) characteristics, and smoking-related parameters including current smoking status, type of cigarettes (regular tobacco, electronic), age at smoking onset, partner's and mother's smoking status, smoking and related complications during previous pregnancies, personal opinions regarding the adverse effects of smoking during pregnancy, and a comparison of regular versus electronic cigarettes in terms of adverse impacts, degree of dependency, and nicotine exposure. The number of cigarettes smoked per day was also calculated, along with scores for the Fagerström test for nicotine dependence (FTND).<sup>14</sup>

Income categories were based on Turkey's minimum wage level set by the government, while monetary results were converted by using an average of 3.44 USD/TL (U.S. dollar/Turkish lira) exchange rates within the study period. Accordingly, income class, based on monthly income, was categorized as lowest (<1000 TL [USD 290.6]), middle (1000–5000 TL [USD 290.6–1453]), high (5000–10 000 TL [USD 1453–2907]), and very high (>10 000 TL [>USD 2907]).

### Study Parameters

Maternal sociodemographic and obstetric characteristics, smoking-related parameters, and personal opinions regarding the adverse effects of smoking during pregnancy were evaluated with respect to presence and type of cigarette smoking during pregnancy.

### Statistical Analysis

Analyses were performed using MedCalc Statistical Software version 12.7.7 (MedCalc Software Ltd, Ostend, Belgium; <http://www.medcalc.org>; 2013). The chi-square ( $\chi^2$ ) test was used for the comparison of categorical data, while numerical data were analyzed using the Student's t-test. Data were expressed as mean  $\pm$  standard deviation (SD) and percentage (%) where appropriate. A *P* value <.05 was considered statistically significant.

## RESULTS

### Maternal Sociodemographic and Obstetric Characteristics

A total of 1123 pregnant women (mean [SD] age: 27.9 years, range 16-50 years) participated in the study. Most of women

### MAIN POINTS

- Our findings revealed 12.4% of pregnant women to smoke either regular tobacco cigarettes or electronic cigarettes during their pregnancy, along with low smoking intensity in the majority of participants, and continued third trimester smoking in at least half of interviewees.
- Being employed, smoking in previous pregnancies and having an actively smoking partner were the risk factors for increased likelihood of smoking during pregnancy
- The increasing popularity of electronic cigarettes and their consideration as a safer alternative to regular tobacco cigarettes further increase the risk of prenatal smoking exposure, particularly among young pregnant women.
- Improved awareness among women on the seriousness of smoking-related adverse neonatal outcomes and health risks, for both regular tobacco and electronic cigarettes, is needed along with the promoting increased awareness among the public and healthcare providers about the risks of electronic cigarette use in pregnancy.
- The implementation of smoking cessation interventions, ideally before conception, or at least in early pregnancy, is crucial to maintain cessation and prevent relapse.

**Table 1.** Baseline Characteristics (n = 1123)

Maternal characteristics		
Age (in years)	Mean ± SD	27.9 ± 5.7
	Median (min.-max.)	27 (16-50)
Marital status, n (%)	Single	13 (1.2)
	Married	1105 (98.8)
Occupation, n (%)	Employed	890 (79.3)
	Housewife	233 (20.7)
Educational status, n (%)	Illiterate	77 (6.9)
	Primary education	542 (48.3)
	Secondary education	250 (22.3)
	University	227 (20.2)
Monthly income, n (%)	Lowest	142 (13.7)
	Middle	724 (69.9)
	High	132 (12.7)
	Very high	38 (3.7)
Number of children, n (%)	None	385 (34.4)
	1	383 (34.3)
	2	221 (19.8)
	≥3	129 (11.6)
Obstetric characteristics, n (%)		
Gestational week	0–12	203 (18.1)
	13–24	292 (26.0)
	25–36	370 (32.9)
	≥36	258 (23.0)
Gestational disease	No	1029 (91.6)
	Yes	94 (8.4)
Comorbid disease	No	960 (85.6)
	Yes	162 (14.4)
Current smoking status		
Overall, n (%)		
Nonsmoker		671 (60.3)
Former smoker		329 (29.2)
	Long-term quitter	249 (22.1)
	Recent quitter	80 (7.1)
Active smoker		139 (12.4)
Age at smoking onset (in years), mean ± SD		18.2 ± 3.1
Smoking intensity (no. of cigarettes per day), mean ± SD	Current	8.5 ± 5.9
	Prior to pregnancy	7.7 ± 4.3
FTND score, mean ± SD		2.44 ± 2.4
Smoking during current pregnancy, n (%)		
No		984 (87.6)
Yes	Total	139 (12.4)
	Regular tobacco cigarettes	105 (9.4)
	Electronic cigarettes	34 (3.0)

**Table 1.** Baseline Characteristics (n = 1123) (Continued)

Environmental factors, n (%)		
Active smoking by own mother		145 (13.0)
Active smoking by partner		536 (49.3)
Electronic cigarette usage by partner		61 (6.1)
Obstetrician recommended on cessation of smoking		248 (60.0)
Opinions on smoking during pregnancy, n (%)		
Regular tobacco cigarette smoking		
Has adverse impact on baby	Absolutely no	34 (3.1)
	No	19 (1.8)
	Possible	87 (8)
	No idea	80 (7.4)
Has adverse impact on pregnancy	Absolutely yes	864 (79.7)
	Absolutely no	38 (3.5)
	No	14 (1.3)
	Possible	149 (13.7)
Electronic cigarette smoking	No idea	89 (8.2)
	Absolutely yes	798 (73.3)
	Absolutely no	245 (22)
	No	52 (4.7)
Has adverse impact on pregnancy	Possible	144 (12.9)
	No idea	283 (25.4)
	Absolutely yes	392 (35.1)
	Absolutely no	87 (9.6)
Partner and smoking	No	8 (0.9)
	Possible	157 (17.3)
	No idea	287 (31.7)
	Absolutely yes	367 (40.5)
Partner should quit smoking during pregnancy	Absolutely	427 (73.1)
	Maybe	71 (12.2)
	No idea	59 (10.1)
	No	27 (4.6)
Regular tobacco versus electronic cigarettes		
Adverse impact	Similar	364 (37.1)
	More for regular tobacco cigarettes	238 (24.3)
	More for electronic cigarettes	49 (5.0)
	No idea	329 (33.6)
Degree of dependency	Similar	272 (30.7)
	More for regular tobacco cigarettes	43 (4.9)
	More for electronic cigarettes	201 (22.7)
Nicotine exposure	No idea	370 (41.8)
	Similar	439 (52.8)
	More for regular tobacco cigarettes	123 (14.8)
	More for electronic cigarettes	19 (2.3)
	No idea	251 (30.2)

FTND, Fagerström test for nicotine dependence; LBWI, low birth weight infant.

were employed (79.3%) and had primary education (48.3%) without gestational disease (91.6%) or comorbidity (85.6%), and the pregnancy beyond the 25th gestational week (55.9%) (Table 1).

Overall, the presence versus absence of smoking during pregnancy was associated with lower likelihood of being a housewife (70.5% vs. 80.5%,  $P = .010$ ) but a higher likelihood of having gestational (13.7% vs. 7.6%,  $P = .021$ ) or comorbid (20.9% vs. 13.5%,  $P = .028$ ) diseases (Table 2).

Use of electronic versus regular tobacco cigarettes during pregnancy was associated with younger age ( $26 \pm 5$  vs.  $29 \pm 6$  years,  $P = .028$ ), and a lower likelihood of married status (94.1% vs. 99.0%,  $P = .033$ ), housewifery (52.9% vs. 76.2%,  $P = .001$ ), and gestational disease (8.8% vs. 15.2%,  $P = .028$ ), but with a higher likelihood of high-income class (47.1% vs. 7.2%,  $P < .001$ ) (Table 3).

Smoking during current pregnancy, particularly via the regular tobacco cigarettes, was more likely for women with smoking during previous pregnancies (56.0% vs. 7.8%,  $P < .001$ ), previous history of LBWI delivery (16.1% vs. 8.6%,  $P = .013$ ) and smoking in that pregnancy (22.5% vs. 3.5%,  $P < .001$ ), premature delivery (16.7% vs. 7.0%,  $P < .001$ ) and smoking in that pregnancy (23.5% vs. 1.8%,  $P < .001$ ), and stillbirth (22.8% vs. 11.7%,  $P = .002$ ) and smoking in that pregnancy (31.4% vs. 3.0%,  $P < .001$ ) (Supplementary Table 1).

### Smoking-Related Parameters

Overall, nonsmokers, former smokers, and active smokers comprised 60.3%, 29.2% (7.1% were recent quitters), and 12.4% of the study population, respectively. Among the women who were smoking during their current pregnancy ( $n = 139$ ), 105 (9.4%) were using regular tobacco cigarettes and 34 (3.0%) were using electronic cigarettes (Table 1). Data on smoking intensity of women, smoking status of their mothers and partners, and previous history of adverse pregnancy outcomes are provided in Table 1.

Overall, the presence versus absence of smoking during pregnancy was associated with a higher likelihood of having an actively smoking mother (25.9% vs. 11.2%,  $P < .001$ ) or partner (65.7% vs. 46.9%,  $P < .001$ ) and was evident despite the obstetrician's recommendations on cessation of smoking (68.0% vs. 56.6%,  $P = .038$ ) (Table 2).

Use of electronic versus regular tobacco cigarettes during pregnancy was associated with higher smoking intensity prior to current pregnancy ( $9 \pm 2$  vs.  $3 \pm 6$  cigarettes/day,  $P < .001$ ), obstetrician's recommendations on cessation of smoking (96.9% vs. 58.1%,  $P < .001$ ), and having an actively smoking mother (28.6% vs. 17.6%,  $P < .001$ ) or partner (75.7% vs. 35.3%,  $P < .001$ ) (Table 3).

### Opinions on Smoking during Pregnancy

Overall, 79.7% and 73.3% of participants considered regular tobacco cigarettes to be associated with adverse impacts on baby and pregnancy, respectively, while for electronic cigarettes, these percentages were 35.1% and 40.5%, respectively. In general, regular tobacco and electronic cigarettes were considered to be similar in terms of adverse impacts (37.1%), degree of dependency (30.7%), and nicotine

exposure (52.8%), while adverse impacts were considered to be more for regular tobacco cigarettes by 24.3% of all participants and degree of dependency was considered to be more for electronic cigarettes by 22.7% of participants (Table 1).

The presence versus absence of smoking during pregnancy was associated with consideration of the potential adverse impacts of regular tobacco and electronic cigarette smoking on baby ( $P < .001$  and  $P = .003$ , respectively) and on pregnancy ( $P < .001$  for each) by a lower percentage of women, while consideration of a higher risk of regular tobacco versus electronic cigarettes in terms of adverse impacts ( $P = .007$ ) and nicotine exposure ( $P = .001$ ) by a higher percentage of women (Table 2).

Higher percentage of regular tobacco versus electronic cigarette users during pregnancy considered regular tobacco cigarettes to have a lower risk of adverse impacts ( $P < .001$ ) and electronic cigarettes to have a higher risk of adverse impacts ( $P = .012$ ). Higher percentage of electronic versus regular tobacco cigarette users during pregnancy considered a higher risk of electronic cigarettes in terms of dependency (61.8 vs. 11.5%,  $P < .001$ ) but a higher risk of regular tobacco cigarettes in terms of nicotine exposure (55.9 vs. 13.0%,  $P < .001$ ) (Table 3).

## DISCUSSION

Our findings revealed the rate of smoking during pregnancy to be 12.4% including use of regular tobacco cigarettes (9.4%) and electronic cigarettes (3.0%), along with a low intensity of smoking (1-10 cigarettes/day) in the majority of pregnant smokers. Smoking during current pregnancy was more likely in those smoking in previous pregnancies, in employed women and in those with actively smoking mother or partner, while the use of electronic cigarettes rather than regular cigarettes was more likely for younger age, and single and employed women with high-income class.

Our findings on the prevalence of using regular tobacco cigarettes and electronic cigarettes in pregnancy seem consistent with previous studies of obstetric populations that revealed the self-reported rate of tobacco smokers to range from 7.2% to 30.0%<sup>7,13,15-18</sup> and that of electronic cigarette smokers to range from 0.6% to 15.0%<sup>7,19,20</sup> among pregnant women.

Although younger age, lower educational level, and housewifery have been reported to be associated with an increased likelihood of continuing smoking during pregnancy,<sup>15,21</sup> our findings revealed a correlation between housewifery and a lower likelihood of smoking and a higher likelihood of regular tobacco versus electronic cigarette usage, and no significant impact of age or educational level on the likelihood of smoking during pregnancy.

At least half of pregnant smokers were at >25 gestational weeks of pregnancy in the current study, while the first trimester was the time of smoking cessation among the majority of quitters. Notably, in a past study among pregnant women, the authors indicated the overall rate of smoking during pregnancy to be 7.1% and higher in the first trimester, particularly for younger and less-educated women, than in

**Table 2.** Study Variables with respect to Presence of Smoking during Pregnancy

		Smoking during pregnancy (regular tobacco or electronic cigarettes)		
		No (n = 984)	Yes (n = 139)	P <sup>a</sup>
Maternal characteristics				
Age (in years), mean ± SD		28.0 ± 6.0	29.0 ± 6.0	.097 <sup>2</sup>
Marital status, n (%)	Single	10 (1)	3 (2.2)	.213
	Married	969 (99)	136 (97.8)	
Occupation, n (%)	Employed	192 (19.5)	41 (29.5)	<b>.010</b>
	Housewife	792 (80.5)	98 (70.5)	
Educational status, n (%)	Illiterate	66 (6.7)	11 (7.9)	.181
	Primary education	478 (48.6)	64 (46)	
	Secondary education	212 (21.5)	38 (27.3)	
	University	201 (20.4)	26 (18.7)	
	Master's degree	27 (2.7)	0 (0)	
Monthly income, n (%)	Lowest	127 (14)	15 (11.5)	.274
	Middle	637 (70.4)	87 (66.4)	
	High	109 (12)	23 (17.6)	
	Very high	32 (3.5)	6 (4.6)	
Obstetric characteristics, n (%)				
Gestational disease	No	909 (92.4)	120 (86.3)	<b>.021</b>
	Yes	75 (7.6)	19 (13.7)	
Comorbid disease	No	850 (86.5)	110 (79.1)	<b>.028</b>
	Yes	133 (13.5)	29 (20.9)	
Environmental factors, n (%)				
Active smoking by own mother		109 (11.2)	36 (25.9)	<b>&lt;.001</b>
Active smoking by partner		446 (46.9)	90 (65.7)	<b>&lt;.001</b>
Electronic cigarette usage by partner		49 (5.5)	12 (10.2)	.062
Obstetrician recommended on cessation of smoking		163 (56.6)	85 (68.0)	<b>.038</b>
Opinions on smoking during pregnancy, n (%)				
Regular tobacco cigarette smoking				
Has adverse impact on baby	Absolutely no	26 (2.8)	8 (5.8)	<b>&lt;.001</b>
	No	15 (1.6)	4 (2.9)	
	Possible	61 (6.5)	26 (18.7)	
	No idea	67 (7.1)	13 (9.4)	
	Absolutely yes	776 (82.1)	88 (63.3)	
Has adverse impact on pregnancy	Absolutely no	26 (2.7)	12 (8.7)	<b>&lt;.001</b>
	No	10 (1.1)	4 (2.9)	
	Possible	117 (12.3)	32 (23.2)	
	No idea	74 (7.8)	15 (10.9)	
	Absolutely yes	723 (76.1)	75 (54.3)	
Electronic cigarette smoking				
Has adverse impact on baby	Absolutely no	204 (20.9)	41 (29.5)	<b>.003</b>
	No	39 (4)	13 (9.4)	
	Possible	127 (13)	17 (12.2)	
	No idea	250 (25.6)	33 (23.7)	
	Absolutely yes	357 (36.5)	35 (25.2)	

(Continued)

**Table 2.** Study Variables with respect to Presence of Smoking during Pregnancy (*Continued*)

		Smoking during pregnancy (regular tobacco or electronic cigarettes)		
		No (n = 984)	Yes (n = 139)	P <sup>1</sup>
Has adverse impact on pregnancy	Absolutely no	63 (7.9)	24 (22.2)	<b>&lt;.001</b>
	No	5 (0.6)	3 (2.8)	
	Possible	137 (17.2)	20 (18.5)	
	No idea	261 (32.7)	26 (24.1)	
	Absolutely yes	332 (41.6)	35 (32.4)	
Partner and smoking				
Partner should quit smoking during pregnancy	Absolutely	382 (78)	45 (47.9)	<b>&lt;.001</b>
	Maybe	48 (9.8)	23 (24.5)	
	No idea	39 (8)	20 (21.3)	
	No	21 (4.3)	6 (6.4)	
Regular tobacco versus electronic cigarettes				
Adverse impact	Similar	326 (38.1)	38 (30.6)	<b>.007</b>
	More for regular tobacco cigarettes	197 (23)	41 (33.1)	
	More for electronic cigarettes	38 (4.4)	11 (8.9)	
	No idea	295 (34.5)	34 (27.4)	
Degree of dependency	Similar	239 (30.9)	33 (29.5)	.186
	More for regular tobacco cigarettes	34 (4.4)	9 (8)	
	More for electronic cigarettes	171 (22.1)	30 (26.8)	
	No idea	330 (42.6)	40 (35.7)	
Nicotine exposure	Similar	386 (52.9)	53 (51.5)	<b>.001</b>
	More for regular tobacco cigarettes	95 (13)	28 (27.2)	
	More for electronic cigarettes	18 (2.5)	1 (1)	
	No idea	230 (31.6)	21 (20.4)	

LBWI, Low birth weight infant. Values in bold indicate statistical significance ( $P < .05$ ).  
<sup>1</sup> $\chi^2$  test, <sup>2</sup>Student's t-test.

the second or the third trimester and found that high rates of smoking during the first trimester to be associated with quitting of smoking in the third trimester among 20% of women.<sup>13</sup> Hence, high rates of third trimester smoking in our study population seems notable given the association between higher intensity of smoking later in pregnancy with the increasing stress of advancing pregnancy and guilt about not being able to quit smoking, particularly for heavy smokers who find it more difficult to quit smoking upon entering pregnancy.<sup>13,22,23</sup>

In the current study, smoking versus nonsmoking during pregnancy and the use of regular tobacco versus electronic cigarettes by smokers were both more common in pregnant women with actively smoking mothers or partners. Likewise in a past study on characteristics associated with quitting smoking during pregnancy and relapse postpartum, authors reported that compared to pregnant smokers, pregnant quitters had more favorable relationship characteristics, including being more likely to be married and less likely to have a significant other who smokes.<sup>2</sup> In addition, the authors indicated

that having a significant other who smokes was also among the predictors of postpartum relapse.<sup>2</sup> Indeed, the familial transmission of nicotine dependence has also been suggested to be an important factor, given the fact that the majority of women who smoke during pregnancy developed their addiction to tobacco in early life.<sup>24</sup>

Overall, our participants considered regular tobacco cigarette smoking and electronic cigarette smoking to be similar in terms of nicotine exposure, while the adverse impact of smoking on baby and pregnancy was reported to be higher for regular tobacco cigarettes, and dependency potential was reported to be higher for electronic cigarettes. Specifically, the adverse impact of smoking on baby and pregnancy was confirmed by >70% of participants for regular tobacco cigarettes, but only by 40% of participants for electronic cigarettes. Likewise, in a past study on knowledge, attitudes, and practice of pregnant women regarding electronic cigarette use, the authors reported that most pregnant women understood the risk of smoking during pregnancy, whereas 45% of respondents considered electronic cigarettes to be less

**Table 3.** Study Variables with Respect to Type of Smoking During Pregnancy

		Smoking during Pregnancy		P <sup>1</sup>
		Regular Tobacco Cigarettes (n = 105)	Electronic Cigarettes (n = 34)	
Maternal characteristics		<b>n (%)</b>	<b>n (%)</b>	
Age (in years), mean ± SD		29 ± 6	26 ± 5	<b>.028<sup>2</sup></b>
Marital status	Single	1 (1)	2 (5.9)	<b>.033</b>
	Married	104 (99.0)	32 (94.1)	
Occupation	Employed	25 (23.8)	16 (47.1)	<b>.001</b>
	Housewife	80 (76.2)	18 (52.9)	
Educational status	Illiterate	11 (10.5)	0 (0)	.199
	Primary education	47 (44.8)	17 (50)	
	Secondary education	29 (27.6)	9 (26.5)	
	University	18 (17.1)	8 (23.5)	
	Master's degree	0 (0)	0 (0)	
Monthly income	Lowest	15 (15.5)	0 (0)	<b>&lt;.001</b>
	Middle	70 (72.2)	17 (50)	
	High	7 (7.2)	16 (47.1)	
	Very high	5 (5.2)	1 (2.9)	
Obstetric characteristics		<b>n (%)</b>	<b>n (%)</b>	
Gestational disease	No	89 (84.8)	31 (91.2)	<b>.028</b>
	Yes	16 (15.2)	3 (8.8)	
Comorbid disease	No	83 (79)	27 (79.4)	.071
	Yes	22 (21)	7 (20.6)	
Current smoking status, mean ± SD		<b>n (%)</b>	<b>n (%)</b>	
Age at smoking onset (year)		18.0 ± 3.0	18.0 ± 2.0	.099 <sup>2</sup>
Smoking intensity (cigarettes/day)	Current	9.0 ± 6.0	12.0 ± 3.0	.271 <sup>2</sup>
	Prior to pregnancy	3.0±6.0	9.0 ± 2.0	<b>&lt;.001<sup>2</sup></b>
FTND score		3.0±2.0	4.0 ± 2.0	.491 <sup>2</sup>
Environmental factors				
Active smoking by own mother		30 (28.6)	6 (17.6)	<b>&lt;.001</b>
Active smoking by partner		78 (75.7)	12 (35.3)	<b>&lt;.001</b>
Electronic cigarette usage by partner		3 (3.6)	9 (26.5)	<b>&lt;.001</b>
Obstetrician recommended on cessation of smoking		54 (58.1)	31 (96.9)	<b>&lt;.001</b>
Opinions on smoking during pregnancy		<b>n (%)</b>	<b>n (%)</b>	
Regular tobacco cigarette smoking				
Has adverse impact on baby	Absolutely no	8 (7.6)	0 (0)	<b>&lt;.001</b>
	No	4 (3.8)	0 (0)	
	Possible	21 (20)	5 (14.7)	
	No idea	11 (10.5)	2 (5.9)	
	Absolutely yes	61 (58.1)	27 (79.4)	
Has adverse impact on pregnancy	Absolutely no	12 (11.5)	0 (0)	<b>&lt;.001</b>
	No	4 (3.8)	0 (0)	
	Possible	23 (22.1)	9 (26.5)	
	No idea	15 (14.4)	0 (0)	
	Absolutely yes	50 (48.1)	25 (73.5)	

(Continued)

**Table 3.** Study Variables with Respect to Type of Smoking During Pregnancy (*Continued*)

		Smoking during Pregnancy		P <sup>1</sup>
		Regular Tobacco Cigarettes (n = 105)	Electronic Cigarettes (n = 34)	
Electronic cigarette smoking				
Has adverse impact on baby	Absolutely no	26 (24.8)	15 (44.1)	<b>&lt;.001</b>
	No	3 (2.9)	10 (29.4)	
	Possible	14 (13.3)	3 (8.8)	
	No idea	33 (31.4)	0 (0)	
	Absolutely yes	29 (27.6)	6 (17.6)	
Has adverse impact on pregnancy	Absolutely no	4 (5.4)	20 (58.8)	<b>&lt;.001</b>
	No	3 (4.1)	0 (0)	
	Possible	11 (14.9)	9 (26.5)	
	No idea	26 (35.1)	0 (0)	
	Absolutely yes	30 (40.5)	5 (14.7)	
Partner and smoking				
Partner should quit smoking during pregnancy	Absolutely	36 (43.9)	9 (75)	<b>&lt;.001</b>
	Maybe	21 (25.6)	2 (16.7)	
	No idea	20 (24.4)	0 (0)	
	No	5 (6.1)	1 (8.3)	
Regular tobacco vs. electronic cigarettes				
Adverse impact	Similar	25 (27.8)	13 (38.2)	<b>.012</b>
	More for regular tobacco cigarettes	29 (32.2)	12 (35.3)	
	More for electronic cigarettes	10 (11.1)	1 (2.9)	
	No idea	26 (28.9)	8 (23.5)	
Degree of dependency	Similar	30 (38.5)	3 (8.8)	<b>&lt;.001</b>
	More for regular tobacco cigarettes	7 (9)	2 (5.9)	
	More for electronic cigarettes	9 (11.5)	21 (61.8)	
	No idea	32 (41)	8 (23.5)	
Nicotine exposure	Similar	39 (56.5)	14 (41.2)	<b>&lt;.001</b>
	More for regular tobacco cigarettes	9 (13)	19 (55.9)	
	More for electronic cigarettes	1 (1.4)	0 (0)	
	No idea	20 (29)	1 (2.9)	

FTND, Fagerström test for nicotine dependence; LBWI, low birth weight infant. Values in bold indicate statistical significance ( $P < .05$ ).  
<sup>1</sup> $\chi^2$  test, <sup>2</sup>Student's t-test.

harmful than tobacco cigarettes.<sup>19</sup> Accordingly, our findings support the likelihood of the marketing of electronic cigarette use as a supposedly safer alternative to cigarette smoking to result in increasing use, even in pregnancy, with the use of electronic cigarettes during pregnancy by otherwise tobacco-smoking women considered to be safer than tobacco cigarettes.<sup>7,19,20,25,26</sup>

However, in a systematic review of 41 articles on the use of electronic cigarettes in pregnancy, the authors reported that the amount of nicotine consumed by electronic cigarette users

was comparable to that consumed by cigarette smokers.<sup>19</sup> Given that younger age and single women with high-income class in our study population were more likely to use electronic cigarettes than regular tobacco cigarettes, our findings seem to support the increasing popularity of electronic cigarettes among young women to add to the increased risk of prenatal smoking exposure.<sup>13,27</sup>

Notably, the risk of prenatal exposure and adverse pregnancy outcomes in smoking pregnant women has been associated not only with prevalence but also with smoking



intensity status during pregnancy.<sup>13</sup> While higher versus lower smoking intensity, as measured by the number of cigarettes smoked per day, has been reported to be more harmful on the fetus, no level of smoking during pregnancy is actually considered safe.<sup>13,28,29</sup> In this regard, it should be noted that electronic versus regular tobacco cigarette users in the current study were found to have a nonsignificant tendency for higher smoking intensity (average 9 vs. 12 cigarettes per day, respectively), and significantly higher FTND scores during the current pregnancy, along with a significantly higher smoking intensity prior to pregnancy (average 3 vs. 9 cigarettes per day).

Risk perception, that is, the perceived susceptibility to a threat, is considered an important determinant of health behavior,<sup>30</sup> while smoking pregnant women are considered less likely to acknowledge and understand the health risks of both tobacco smoking and electronic cigarette usage during pregnancy.<sup>7</sup> Similarly, in the current study, the potential adverse impacts of smoking on baby and pregnancy were reported by only a lower percentage of women who smoked during current pregnancy, particularly by regular tobacco cigarette users. Regular tobacco cigarette smokers also considered electronic cigarettes to be associated with a higher risk of adverse impact on pregnancy/baby, while electronic cigarette smokers considered regular tobacco cigarette smoking to be associated with higher nicotine exposure.

Moreover, our findings indicated that the likelihood of smoking during current pregnancy, as well as the use of regular tobacco versus electronic cigarettes, was more common in women smokers who had continued smoking in their previous pregnancies, along with those who had a history of LBWI delivery, premature delivery, and stillbirth in those pregnancies. Our findings are consistent with the association of prenatal maternal smoking with adverse neonatal outcomes such as an estimated 13%-19% LBWI deliveries, 5%-8% preterm deliveries, and 5%-7% preterm-related infant deaths found by Frank Wolf et al.<sup>31</sup> Hence, our findings emphasize the need for improved harm awareness strategies on nicotine exposure and associated complications among pregnant smokers, particularly given the increased likelihood of continued smoking in future pregnancies despite experience of significant maternal-fetal complications.<sup>7</sup>

Our findings also revealed higher rates of receiving smoking-related consultation by obstetricians among pregnant smokers, particularly those using electronic cigarettes during their pregnancy. Several authors have emphasized that while the assessment of tobacco use has been recommended as a routine part of pregnancy care, many healthcare providers may still not address the use of electronic cigarettes, however.<sup>7,32</sup> Another study reported that 13.5% of participants in a survey of practicing obstetricians-gynecologists did not perceive any health risks associated with the use of electronic cigarettes in pregnancy.<sup>32</sup> Our findings seem to indicate the likelihood of continued smoking during pregnancy, not only despite the previous experience of maternal-fetal adverse outcomes, but also against physicians' recommendations, as well as the

likelihood of previous tobacco smokers to prefer electronic cigarette usage in accordance with the recommendations specific to tobacco smoking.

In this regard, our findings emphasize the potential role of improved awareness among women on the significant health risks of smoking, including electronic cigarettes, in pregnancy, as well as implementation of smoking cessation interventions as early as possible to maintain cessation and prevent postpartum relapse.<sup>13,33</sup> However, cessation of smoking during pregnancy is an ongoing challenge given that none of the methods under investigation, such as psychological interventions, nicotine replacement therapy, group therapy, motivational interviewing and exercise, have been considered an effective antenatal model of care for smokers.<sup>1,13,34,35</sup>

Certain limitations to this study should be considered. First, the self-reported survey design involves the potential for recall bias. Second, although data were gathered using a multicenter design at 15 centers across Turkey, a potential lack of generalizability seems another important limitation due to the relatively small sample size, particularly for smoking subgroups. Third, the exclusion of women aged <18 years is another limitation with potential impact on the estimated prevalence rates found in this study. Despite these limitations, our findings nevertheless seem to represent a valuable contribution to the literature given the restricted amount of data available on this subject area.

## CONCLUSION

In conclusion, our findings revealed 12.4% of pregnant women to smoke either regular tobacco cigarettes (9.4%) or electronic cigarettes (3.0%) during their pregnancy, along with low smoking intensity in the majority of participants, and continued third trimester smoking in at least half of interviewees. Being employed, smoking in previous pregnancies, and having an actively smoking mother or partner were the risk factors for increased likelihood of smoking during pregnancy. Our findings emphasize that the increasing popularity of electronic cigarettes and their consideration as a safer alternative to regular tobacco cigarettes further increase the risk of prenatal smoking exposure, particularly among young pregnant women. In this regard, our findings underscore the potential role of improved awareness among women on the seriousness of smoking-related adverse neonatal outcomes and health risks, for both regular tobacco and electronic cigarettes, the need for promoting increased awareness among the public and healthcare providers about the risks of electronic cigarette use in pregnancy, as well as the implementation of smoking cessation interventions, ideally before conception, or at least in early pregnancy, to maintain cessation and prevent relapse. Further large-scale studies are needed to evaluate smoking prevalence among pregnant women in relation to sociodemographic characteristics, smoking intensity, and type of smoking product to better understand the risk factors for continued smoking and to develop effective interventions for smoking cessation in pregnancy.

**Data Availability** The data underlying this article will be shared on reasonable request to the corresponding author.

**Ethics Committee Approval:** This study was approved by Ethics Committee of Health Sciences University Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital, (Approval No: KAEK-116/ 2017/5/019, Date: 04/09/17).

**Informed Consent:** Written informed consent was obtained from the patients who agreed to take part in the study.

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**Supplementary Table 1.** Adverse Pregnancy Outcomes and Smoking during Previous Pregnancies

		Total (n = 1123)	Smoking during Current Pregnancy			Type of Smoking during Current Pregnancy		
			No (n = 984)	Yes (n = 139)	<i>P</i>	Regular Tobacco Cigarettes (n = 105)	Electronic cigarettes (n = 34)	<i>P</i>
Smoking during previous pregnancy, n (%)		132 (14.4)	62 (7.8)	70 (56.0)	<b>&lt;.001</b>	58 (62.4)	12 (37.5)	<b>&lt;.001</b>
Previous LBWI delivery, n (%)	Yes	88 (9.6)	68 (8.6)	20 (16.1)	<b>.013</b>	17 (18.5)	3 (9.4)	<b>.010</b>
	Smoking during pregnancy	40 (6.1)	20 (3.5)	20 (22.5)	<b>&lt;.001</b>	16 (27.6)	4 (12.9)	<b>&lt;.001</b>
Previous premature delivery, n (%)	Yes	91 (8.2)	68 (7)	23 (16.7)	<b>&lt;.001</b>	21 (20.2)	2 (5.9)	<b>&lt;.001</b>
	Smoking during pregnancy	30 (4.7)	10 (1.8)	20 (23.5)	<b>&lt;.001</b>	17 (31.5)	3 (9.7)	<b>&lt;.001</b>
Previous stillbirth, n (%)	Yes	120 (13.2)	92 (11.7)	28 (22.8)	<b>.002</b>	20 (22)	8 (25)	<b>.003</b>
	Smoking during pregnancy	44 (6.8)	17 (3)	27 (31.4)	<b>&lt;0.001</b>	21 (38.2)	6 (19.4)	<b>&lt;.001</b>

LBWI, low birth weight infant. Values in bold indicate statistical significance ( $P < .05$ ).  $\chi^2$  test.