

# Dual use of alternative forms of cigarettes and traditional smoked tobacco in Pregnant Smokers

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## Research article

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# Abstract

Background to assess the prevalence of concomitant use of alternative forms of tobacco and analyze tobacco smoking characteristics in pregnant women. Methods: 127 pregnant women who smoked conventional cigarettes were evaluated during prenatal care. Those signing the informed consent form responded to a specific questionnaire containing questions related to general characteristics, comorbidities, gestational history, smoking history, secondhand smoke, degree of nicotine dependence, motivation stage and the prevalence of concomitant use of alternative forms of tobacco. They were separated into those who smoked conventional cigarettes only and those who smoked conventional cigarettes associated with straw cigarettes, waterpipe and/or e-cigarettes. Results: Mean age was  $26.9 \pm 6.6$  years, most had only elementary education and belonged to economic classes C and D. Diagnosis of pulmonary disease was reported by 23.6% and cardiovascular diseases by 53.5%. Twenty-five (19.6%) smoked conventional cigarettes only and 102 also smoked alternative forms of tobacco. Those who smoked only conventional cigarettes had significantly lower smoke-load than those using alternative forms of tobacco. Those who smoked conventional cigarettes and waterpipe had higher nicotine dependence than other groups. Secondhand smoking was common (82.6%) and 59.1% were contemplative in relation to cessation. Conclusions: The prevalence of alternative tobacco forms is high and factors such as smoking during previous pregnancy, alcohol consumption during current pregnancy and high smoke-load may have contributed to the maintenance of smoking in the gestational period.

## Introduction

The negative consequences of smoking for the general population are well known; however, some disorders are particularly important for women. Smoking is associated with premature aging of the female reproductive system leading to infertility and early menopause.(1, 2) Complications during pregnancy associated with both the pregnant woman and the fetus, makes the harm even more significant.(3) Some negative consequences of tobacco exposure during and after the gestational period include increased occurrence of placenta previa, ectopic pregnancy, miscarriage, and sudden infant death syndrome.(3)

Studies have shown prevalences ranging from 1.8% to 27.1% in the USA(4) and 25% in Canada.(5) In Brazil, the prevalence of active smoking varies between 11.0% and 35.7%; passive smoking is also high (28.2% to 33.0%).(6, 7)

The tobacco industry recognizes women as a promising population group for expanding their business and uses preparations to alter the taste, smell and pharmacological properties of their products in order to increase smoking prevalence in this population group.(8) The most common alternative tobacco products are waterpipe and e-cigarettes.(6, 7) However, the prevalence of using alternative forms of tobacco is still unknown and, in the case of waterpipe, limited to Middle Eastern countries. Some studies in countries such as Lebanon, Saudi Arabia, and Iran have shown prevalence rates of waterpipe use

ranging from 8.2% to 39.6% in pregnant women.(9–12) In Brazil, we did not identify any surveys evaluating the prevalence of alternative forms of tobacco in pregnant women.

Few studies have evaluated the characteristics of smoking in pregnant women and the prevalence of using alternative forms of tobacco needs to be understood to facilitate smoking cessation. Therefore, the objective of this study was to evaluate the characteristics related to smoking in pregnant smokers and identify dual use of tobacco products.

## Methods

A cross-sectional study was performed with a convenience sample of pregnant smokers followed at prenatal care units in Botucatu, Sao Paulo, Brazil between September 2013 and September 2016. The study was approved by the Research Ethics Committee of Botucatu Medical School (Reference number: 430.718).

For inclusion in the study the pregnant women should be active smokers at the time of the approach. Non-smokers and former smokers were not included. One hundred and forty-three pregnant women were invited to participate of which 127 signed the Informed Consent Form and were included in the study (Figure 1). A specific questionnaire with questions including general characteristics, comorbidities, gestational and smoking history, passive smoking, degree of nicotine dependence, stage of motivation and concomitant use of alternative forms of tobacco was developed taking in consideration references (13, 14). Patients were interviewed and data recorded about comorbidities known to be associated with smoking after evaluation of medical records.

Eight economic classes were identified: A1, A2, B1, B2, C1, C2, D and E according to possessions, contracting services and education level of the head of the family.(15)

Nicotine dependence was evaluated by the Fagerström test (16) and motivation stage was identified according to Prochaska and DiClemente.(17)

Pregnant women were previously identified in relation to current smoking and no previous information of use of alternative forms of tobacco was captured. In addition, there were no participants lost due to the study design.

### Statistical analysis

Descriptive analysis was performed on qualitative variables of characterization, schooling, marital status, economic class, motivation stage, degree of dependence and prevalence of alternative forms of tobacco using the Chi-Squared and Fisher's exact test and presented as frequency and percentage. Analysis of the quantitative variables of age, age of smoking initiation and smoke-load was by Kruskal-Wallis One Way Analysis of Variance on Ranks and Dunn's method and presented as medians and quartiles. Statistical analysis software SigmaPlot 12.0. was used and statistical significance was considered when  $p < 0.05$ .

## Results

Twenty-five women (19.6%) smoked only conventional cigarettes. The others smoked conventional cigarettes associated with one or two alternative forms of tobacco. Demographic characteristics of participants, according to tobacco use, are presented in Table 1. The proportion of single women smoking conventional cigarettes only (16%) was lower than the other groups. Those in economic class D presented higher proportions of alternative form use [straw cigarettes (53.6%), waterpipe (52.1%) and e-cigarettes (93.3%)] than use of conventional cigarettes only (12%). (Table 1)

Table 2 shows that those who smoked e-cigarettes began smoking at a younger age than those who smoked only conventional cigarettes or in combination with straw cigarettes. Those who smoked only conventional cigarettes presented significantly lower smoke-load (5.4 pack-years) and a higher proportion previous cessation attempts (68%) than the other groups. (Table 2)

A higher proportion (60%) of those who smoked e-cigarettes presented a mild degree of nicotine dependence. A high degree of nicotine dependence was found mainly in those who smoked conventional cigarettes only (68%), conventional cigarettes associated with waterpipe (73.9) and straw cigarettes (60.8%) (Table 2)

The alternative forms of smoking were associated with significantly higher occurrences of cancer (straw cigarettes: 27.5%, waterpipes: 52.1% and e-cigarettes: 53.3%) than with conventional cigarettes only (0%) (Table 3). Alcohol intake during current pregnancy was significantly higher in those who smoked straw cigarettes (59.4%), waterpipes (69.5%) and e-cigarettes (83.3%) than in those smoking conventional cigarettes only (8%). Smoking in previous pregnancies was higher in those who smoked straw cigarettes (91.3%) (Table 3).

## Discussion

The main findings of this study were the high prevalence of dual use combining alternative forms of smoking with traditional cigarettes and its association with a higher level of cancer diagnosis in pregnant women. They also presented a high rate secondhand smoke conditions, an important history of smoking in previous pregnancies and alcohol consumption during the current gestation. The majority started smoking before the age of 18, were contemplative in relation to cessation and presented a high degree of nicotine dependence.

The prevalence of pregnant smokers who used waterpipes, e-cigarettes and straw cigarettes was high. According to our findings, in Lebanon, 14.6% of adults, 25% of pregnant women and 32% of university students used waterpipes regularly.(9) In Jeddah, Saudi Arabia, a study conducted to identify the prevalence and factors associated with waterpipe use showed that 39.6% of the women interviewed reported using waterpipes.(10) A study evaluating 285 mothers and anthropometric measurements of live births showed that 26% of these women used waterpipes, 29% used conventional cigarettes only, and 9% used both forms of tobacco during pregnancy.(11) Between 2016 and 2018, 714 women were assessed

in southeastern Iran; 8.2% of them smoked waterpipes during gestation.(12) In the state of Sao Paulo, Brazil, an observational study that evaluated the knowledge pregnant women had about tobacco use and alternative forms of smoking showed that 41% had some experience with flavored cigarettes and 19.7% with waterpipes.(13)

In addition to waterpipes, a high proportion of pregnant women in our study concomitantly used straw cigarettes. In agreement with our data, a study conducted in Brazil found that 56.7% of the women interviewed concomitantly used conventional and straw cigarettes (18). Also in Brazil, a cohort study evaluating the epidemiological profile of patients with oral and pharyngeal cancer showed that 52.2% smoked conventional cigarettes, 31.9% smoked only straw cigarettes and 15.9% combined the two forms of tobacco, conventional and straw.(19) No international or national studies on the prevalence of alternative forms of tobacco use in pregnant women were found.

The average age of women in our study was under 30 years. Most of them lived in a stable union, had only elementary education, belonged to economic classes D and C2 and had smoked during previous pregnancies. In agreement with our data, a study conducted in six Brazilian capitals showed that the majority of pregnant smokers had a mean age of less than 30 years, 87.8% lived in secondhand smoke conditions, 57.5% had primary education and 82.3% smoked in previous pregnancies.(20) Research evaluating factors related to smoking during gestation showed that smokers were on average 26.5 years old and presented higher proportion with elementary education than pregnant nonsmokers. In addition, the authors identified that 51.4% had smoked during previous pregnancies.(21). Another study reinforces the association between smoking during pregnancy with smoking during previous pregnancy, elementary education and lower income.(22) Although well-known in literature, the above information is still relevant in guiding smoking cessation strategies in women who smoke during pregnancy.

Those in the study who started smoking under 18 years old were contemplative in relation to smoking cessation and had a high degree of nicotine dependence. In addition, almost half used alcohol during the gestation period. Initiation age was similar to a previous study (21) as was the concomitant use of alcohol during the current gestation (31.3% vs 43.3%).(23) Previous findings show that the motivation stage for smoking cessation at the beginning of prenatal care was contemplative in 39.9%.(24) Low and very low degrees of nicotine dependence were found at the beginning of gestation (66.7%) in women who smoked 1 to 5 cigarettes a day. However, in women who smoked more than 11 cigarettes a day, nicotine dependence was high.(25) Our study found secondhand smoking in 82.6%. Previous studies have shown that 82.2% lived in a secondhand smoking environment at home (husband: 36.7% - 33.3% or another relative: 48.9%).(22)

Studies in literature with pregnant smokers have evaluated tobacco-related diseases, demographic data, and factors associated with smoking and smoking cessation during gestation and after delivery. However, no studies were found that evaluated comorbidities of pregnant smokers. In our study, we easily obtained comorbidity data because part of the sample was collected from high-risk pregnant women attending an outpatient clinic mainly due to the presence of a pregnancy associated comorbidity.

Regarding generalization, the study presents results comparable to the literature regarding a poorly studied population group.

One of the potential limitations of this study is that the sample was taken from an outpatient clinic that treats high-risk pregnant women. Therefore, our results cannot be extrapolated to female smokers during gestation from other regions of Brazil. However, because the participants were invited and agreed to participate in the study, there was no selection error.

## **Conclusions**

The prevalence of pregnant women who smoke conventional cigarettes and other forms of tobacco is important. Smoking in previous pregnancies, alcohol consumption during current pregnancy, smoke-load, cessation attempts and degree of nicotine dependence may be linked to smoking and the use of alternative forms of tobacco during pregnancy. Alternative forms of tobacco may have contributed to the maintenance of smoking during the gestational period. These data reinforce the importance of a family approach towards smoking in pregnant women and education about the risks of alternative forms of smoking.

## **Declarations**

## **Ethics approval and consent to participate**

The study was approved by the Research Ethic Committee of Botucatu Medical School, Botucatu, Sao Paulo, Brazil (reference number: 430.718).

## **Consent for publication**

Not applicable.

## **Availability of data and materials**

Most of the data supporting the results are available in the article. Additional data have been kept confidential to ensure the safety and privacy of research participants.

## **Competing interests**

The authors declare that they have no competing interests.

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## Author contributions

ALB and IG participated in the study design. The data was collected by ALB and RF. Analysis and interpretation was performed by ALB, LMOC, RF, SET and IG. The manuscript was authored by ALB, as well as IG and SET, with support from LMOC and RF. All authors have read, revised, and approved the final manuscript prior to submission.

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## Abbreviations

Not applicable

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## Tables

**Table 1.** Demographic characteristics of pregnant women.

Variables	Conventional Cigarettes N=25	Straw Cigarettes N=69	Water Pipes N=23	E Cigarettes N= 30	p
<b>Age (years)</b>	28 (21 - 33)	26 (18 - 32)	29 (23 - 30)	24.5 (18 - 30)	0.169
<b>Marital Status n(%)</b>					
Married	21(84.0) <sup>a</sup>	36(52.1) <sup>ac</sup>	11(47.8) <sup>b</sup>	7(23.3) <sup>b</sup>	<b>0.001</b>
Single	4(16.0) <sup>a</sup>	33(47.8) <sup>b</sup>	12(52.1) <sup>b</sup>	23(76.7) <sup>b</sup>	
<b>Schooling n(%)</b>					
Illiterate	0(0.0)	7(10.1)	6(26.1)	6(20.0)	
Elementary School	16(64.0)	37(53.6)	13(56.5)	15(50.0)	0.214
High School	7(28.0)	20(28.9)	2(8.7)	6(20.0)	
Higher Education	2(8.0)	5(7.2)	2(8.7)	3(10.0)	
<b>Economic Class n(%)<sup>*</sup></b>					
D	3(12.0) <sup>a</sup>	37(53.6) <sup>b</sup>	12(52.1) <sup>b</sup>	28(93.3) <sup>b</sup>	
C2	6(24.0) <sup>a</sup>	19(27.5) <sup>b</sup>	4(17.4) <sup>ab</sup>	1(3.3) <sup>ab</sup>	
C1	10(40.0) <sup>a</sup>	6(8.7) <sup>ac</sup>	3(13.0) <sup>bc</sup>	0(0.0) <sup>abc</sup>	<b>0.001</b>
B2	6(24.0) <sup>a</sup>	6(8.7) <sup>a</sup>	3(13.0) <sup>a</sup>	1(3.3) <sup>a</sup>	
B1	0(0.0) <sup>a</sup>	1(1.4) <sup>a</sup>	1(4.3) <sup>a</sup>	0(0.0) <sup>a</sup>	

\* No-one in A and E economic classes. Values expressed as median (quartile 1 to 3) and proportions. a, b, c: different letters indicate a statistically significant difference between groups in each category (lines).  $p < 0.05$  evaluated by Kruskal-Wallis One Way Analysis of Variance on Ranks, Dunn's method, Chi-Square and Fisher's exact test.

**Table 2.** Smoking history, level of dependence and motivation to change.

Variables	Conventional Cigarettes n=25	Straw Cigarettes n=69	Water Pipes n=23	E Cigarettes n=30	p
<b>Initiation Age (years)</b>	14 (13 - 15.5) <sup>a</sup>	13 (11 - 14) <sup>b</sup>	13 (12 - 14) <sup>abc</sup>	12 (11.7 - 13) <sup>c</sup>	<b>0.001</b>
<b>Smoke-load (pack-years)</b>	5.4 (3.2 - 14.5) <sup>a</sup>	23 (13.4 - 44) <sup>b</sup>	22 (9 - 45) <sup>b</sup>	23 (18.5 - 44.2) <sup>b</sup>	<b>0.001</b>
<b>Cessation Attempts n(%)</b>	17(68.0) <sup>a</sup>	31(44.9) <sup>b</sup>	8(34.7) <sup>c</sup>	4(13.3) <sup>c</sup>	<b>0.001</b>
<b>Secondhand Smoke n(%)**</b>	20(80.0)	54(78.2)	17(73.9)	29(96.6)	0.111
<b>Motivational Stage n(%) ***</b>					
Pre-contemplative	9(36.0)	22(31.8)	9(39.1)	4(13.3)	0.143
Contemplative	16(64.0)	47(68.1)	14(60.8)	26(86.6)	
<b>Nicotine Dependence n(%)</b>					
Mild	3(12.0) <sup>a</sup>	22(31.8) <sup>a</sup>	6(26.1) <sup>a</sup>	18(60.0) <sup>b</sup>	
Moderate	5(20.0) <sup>a</sup>	5(7.2) <sup>a</sup>	0(0.0) <sup>ab</sup>	1(3.3) <sup>b</sup>	<b>0.001</b>
High	17(68.0) <sup>a</sup>	42(60.8) <sup>b</sup>	17(73.9) <sup>a</sup>	11(36.6) <sup>c</sup>	

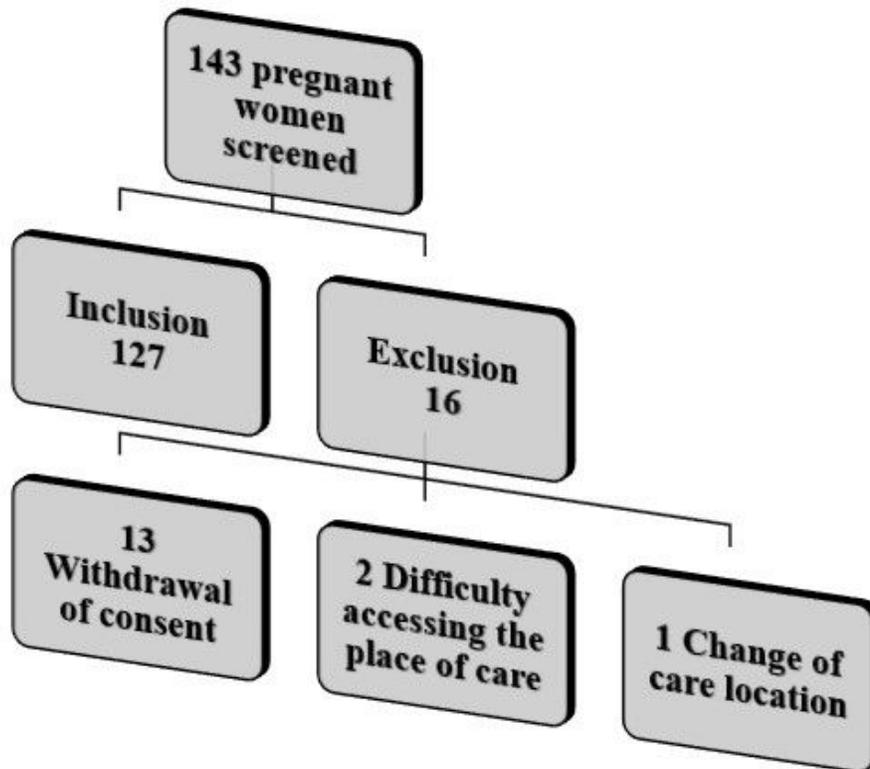
er smoking. \*\*\* No-one in cessation, Preparation or Maintenance stages. Values expressed in median (quartile 1 and 3) and proportions. a, b, c: different letters indicate a statistically significant difference between groups in each variable (lines). p < 0.05 evaluated by Kruskal-Wallis One Way Analysis of Variance on Ranks, Dunn's method, Chi-square and Fisher's exact test.

**Table 3.** Diseases, alcohol consumption, past smoking and miscarriages associated with current pregnancy.

Variables	Conventional Cigarettes n=25	Straw Cigarettes n=69	Water Pipes n=23	E Cigarettes n=30	p
<b>Comorbidities n(%)</b>					
Pulmonary Disease	3(12)	19(27.5)	4(17.3)	11(36.6)	0.148
Cardiovascular Disease	12(48)	43(62.3)	13(56.5)	24(80.0)	0.089
Cancer	0(0.0) <sup>a</sup>	19(27.5) <sup>b</sup>	12(52.1) <sup>b</sup>	16(53.3) <sup>c</sup>	<b>0.001</b>
Other *	11(44)	30(43.4)	14(60.8)	14(46.6)	0.530
<b>Consuming Alcohol n(%)</b>	2(8.0) <sup>a</sup>	41(59.4) <sup>b</sup>	16(69.5) <sup>c</sup>	25(83.3) <sup>c</sup>	<b>0.001</b>
<b>Smoked during Previous Pregnancies n(%)</b>	17(68.0) <sup>a</sup>	63(91.3) <sup>b</sup>	18(78.2) <sup>ac</sup>	12(40.0) <sup>a</sup>	<b>0.001</b>
<b>Miscarriage History n(%)</b>	8(32.0)	41(59.4)	14(60.8)	20(66.6)	0.051

Diseases: diabetes mellitus, hypothyroidism and drug addiction. Values expressed as proportions. a, b, c: letters indicate a statistically significant difference between groups in each category (lines).  $p < 0.05$  evaluated square and Fisher's exact test.

## Figures



**Figure 1**

Organization chart of pregnant women included and reasons for exclusion.

## Supplementary Files

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