



Tobacco consumption from the 1st trimester of pregnancy to 7 months postpartum: Effects of previous tobacco consumption, and depression and anxiety symptoms

Beatriz Pereira^a, Bárbara Figueiredo^b, Tiago Miguel Pinto^b, M. Carmen Míguez^{a,*}

^a University of Santiago de Compostela, Faculty of Psychology, Department of Clinical Psychology and Psychobiology, Santiago de Compostela, Spain

^b University of Minho, School of Psychology, Campus de Gualtar, Braga, Portugal

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ABSTRACT

Objective: Previous tobacco consumption, and depression and anxiety symptoms are major predictors of women's tobacco consumption during pregnancy and the postpartum period. However, the joint effect of these predictors is still unexplored. This study aimed to analyse the effects of previous tobacco consumption, and depression and anxiety symptoms on women's tobacco consumption status and quantity from the 1st trimester of pregnancy to 7 months postpartum.

Method: A sample of 803 Spanish women was assessed at the 1st and the 3rd trimester of pregnancy, and at 2 and 7 months postpartum. Previous tobacco consumption, and depression and anxiety symptoms were self-reported. Pregnancy and postpartum tobacco consumption were confirmed with biochemical tests.

Results: Women with more previous tobacco consumption or more anxiety symptoms presented a steeper decrease in the number of cigarettes smoked per week from the 1st trimester of pregnancy to the childbirth, although smoking more cigarettes than women with less previous tobacco consumption or less anxiety symptoms. Women with more depression symptoms showed a higher tendency to relapse smoking during the first 2 months postpartum.

Conclusions: Previous tobacco consumption and anxiety symptoms were associated with higher smoking quantity during pregnancy, while depression symptoms were associated with consumption relapse during postpartum period.

1. Introduction

Smoking is one of the main causes of premature morbidity and mortality, and therefore an important public health problem (World Health Organization, 2015). Smoking during pregnancy increases the risk of complications during pregnancy (Gould, Havard, Lim, & Kumar, 2020; Homer, Bernard & Collet, 2014; Shobeiri & Jenabi, 2017; U.S. Department of Health and Human Services, 2001). Besides, active and passive smoking shows negative effects on maternal and infant health in the postpartum period (Adibelli & Kirca, 2020; Míguez & Pereira, 2020).

Although the harmful effects of tobacco are widely known, the percentage of smoking women during pregnancy remains high (Lange, Probst, Rehm, & Popova, 2018). Nevertheless, women tend to reduce their tobacco consumption or try to quit smoking during pregnancy

(Erlingsdottir, Sigurdsson, Jonsson, Kristjansdottir, & Sigurdsson, 2014; Lauria, Lamberti & Grandolfo, 2012; Míguez, Pereira & Figueiredo, 2017; Míguez, Pereira, & Figueiredo, 2019), and tend to relapse during the postpartum period (Correa-Fernández et al., 2012; Lauria et al., 2012; Míguez & Pereira, 2021; Park et al., 2009). To understand the factors associated with smoking during pregnancy and with postpartum relapse is an important issue, namely to design preventive interventions since it is necessary to know what to intervene on and which are the appropriate times.

The number of cigarettes smoked before pregnancy is a relevant predictor to continuing or relapsing smoking. A greater previous tobacco consumption is associated with continuing smoking (Erlingsdottir et al., 2014; Jiménez-Muro, Samper, Marqueta, Rodríguez, & Nerín, 2012; Mateos-Vílchez et al., 2014) and difficulties to spontaneously quitting

* Corresponding author at: Department of Clinical Psychology and Psychobiology, Faculty of Psychology, University of Santiago de Compostela, Campus Vida, Santiago de Compostela 15782, Spain.

E-mail address: mcarmen.miguez@usc.es (M.C. Míguez).

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smoking during pregnancy (Anderka et al., 2010; Rozas et al., 2008; Vaz et al., 2014), and higher tobacco relapse during the postpartum period (Lauria et al., 2012; Míguez & Pereira, 2021; Solomon et al., 2007).

On the other hand, psychological factors play a fundamental role in smoking, highlighting the role of depression and/or anxiety during pregnancy (Irfan et al., 2016; Míguez, Pereira, Pinto, & Figueiredo, 2019; Tong et al., 2016). An association between depression (De Wilde et al., 2013; Gyllstrom, Hellerstedt, & Henrikus, 2012; Lauria et al., 2012; Maxson, Edwards, Ingram, & Miranda, 2012; Orr, Blazer & Orr, 2012; Smedberg, Lupattelli, Mårdby, Øverland, & Nordeng, 2015) and/or anxiety (Correa-Fernández et al., 2012; Goedhart, van der Wal, Cuijpers, & Bonsel, 2009; Míguez & Pereira, 2021; Orton et al., 2018; Park et al., 2009; Tong et al., 2016) and continuing smoking during pregnancy or postpartum relapse was largely observed. Nevertheless, this association was not found in all studies about the subject (e.g., Beijers et al., 2014; Bull, Burke, Walsh, & Whitehead, 2003; Meghea et al., 2012).

Most of the studies have focused on analysing separately these factors, without considering that the effects appearing concurrently (e.g., Beijers et al., 2014; Correa-Fernández et al., 2012; Orton et al., 2018), and have adopted a cross-sectional perspective and usually during pregnancy (Beijers et al., 2014; De Wilde et al., 2013; Gyllstrom et al., 2012). So, while evaluating the effect of depression or anxiety symptoms at one moment (Goedhart et al., 2009; Maxson et al., 2012; Meghea et al., 2012; Orr et al., 2012; Tong et al., 2016), the possible effects of other individual variables contributing to tobacco consumption may not have been controlled. Tobacco consumption, depression and anxiety symptoms present large changes during pregnancy and the postpartum period (Dietz et al., 2007; Figueiredo & Conde, 2011; Lee et al., 2007). Therefore, take into account these changes at the possible impact of these factors to continuing and/or to relapse smoking is necessary.

Moreover, previous literature (e.g., Beijers et al., 2014; Tong et al., 2016) focused on investigating the risk factors regarding smoking status exclusively. However, special characteristics of consumption during the perinatal period make the evaluation of smoking quantity a very relevant issue. First, because dose-effects of tobacco consumption on negative pregnancy outcomes occur (Murphy, Dunney, Mullally, Adnan, & Deane, 2013; Salihi & Wilson, 2007). Second, because, despite social pressure suffered by women not to smoke, most of the women continue smoking during pregnancy, reducing significantly the number of cigarettes smoked (Taghavi, Arger, Heil, Higgins, & Tyndale, 2018).

The present study aimed to analyse the effect of previous tobacco consumption, and depression and anxiety symptoms on women's tobacco consumption status and quantity, from the 1st trimester of pregnancy to 7 months postpartum. The novelties of this study are: (1) to analyse the jointly effect of previous tobacco consumption, and depression and anxiety symptoms on women's tobacco consumption; (2) to analyse the effect of these factors on the women's smoking quantity and not only on the smoking status; and (3) to analyse the effect of women's depression and anxiety symptoms, considering them as time-varying factors over pregnancy and the postpartum period and not only as fixed factors.

2. Materials and methods

2.1. Participants

The sample of this study comprises 803 pregnant women assessed from the 1st trimester of pregnancy to 7 months postpartum. Participants' age ranged between 18 and 46 years old ($M = 32.70$ years; $SD = 4.35$). The majority were married or cohabiting (83.9%). More than half were primiparous (66.0%), had university studies (53.4%), were employed (71.1%), had a medium-low economic level (57.4%) and (87.7%) had planned their pregnancy (see Table 1). Of the total sample, 28.3% smoked before seeking or confirming their pregnancy, while 71.7% were non-smokers. Among women who were smokers before

Table 1

Women's socio-demographic characteristics at the baseline (1st trimester of pregnancy).

	<i>n</i>	%
Age		
>30	576	71.7
≤ 30	227	28.3
Marital status		
Single	129	16.1
Married/living with partner	674	83.9
Parity		
Primiparous	530	66.0
Multiparous	273	34.0
Educational level		
Non-university	374	46.6
University	529	53.4
Occupational status		
Unemployed	232	28.9
Employed	571	71.1
Socioeconomic level		
Medium- low	461	57.4
Medium- high	266	33.1
Planned Pregnancy		
Yes	704	87.7
No	99	12.3
Smoking before pregnancy		
Non-smoker	581	71.7
Smoker	222	28.3

pregnancy (occasional and daily smokers), the average of previous tobacco consumption was 10.89 daily cigarettes ($SD = 6.75$), and 75.42 weekly cigarettes ($SD = 47.26$).

2.2. Procedure

This study was conducted in according with the Helsinki Declaration and received previous approval from the Ethical Commission of all the institutions involved (Ethical Board consent number 2010/299). Pregnant women attending primary public health care services in the Northwest of Spain were recruited during the 1st trimester of pregnancy ($N = 901$). The aims and procedures were explained and pregnant women who were willing to participate provided a written informed consent form. Two trained psychologists conducted the interviews individually. This longitudinal study had four assessment waves: 1st ($M = 9.86$ weeks of gestation, $SD = 4.17$) and 3rd trimester of pregnancy ($M = 33.29$ weeks of gestations, $SD = 1.99$), and 2 ($M = 7.40$ postpartum weeks, $SD = 0.86$) and 7 months postpartum ($M = 28.42$ postpartum weeks, $SD = 3.04$). Women were assessed with a questionnaire on socio-demographic and tobacco consumption information, and self-measures of depression and anxiety symptoms in the four assessment waves. The average time for individual assessment of each participant was 20 min.

From the 901 pregnant women recruited at the 1st trimester of pregnancy, 98 women were lost at 7 months postpartum (10.9%): 28 had suffered a miscarriage, 29 could not be contacted, 4 refused to continue participating in the study, and 37 were excluded. Women who consumed other substances ($n = 10$) were excluded from the analyses because could become confounding variables. Likewise, those women who hid their consumption ($n = 27$) were excluded because there was a lack of information regarding the consumption quantity. The final sample comprise 803 pregnant women (89.12%).

2.3. Measures

2.3.1. Socio-demographic and tobacco consumption information

Information regarding socio-demographic characteristics (e.g., age, marital and professional status, educational and socioeconomic level, parity and planned pregnancy) and consumption information (e.g., consumption status and number of cigarettes smoked before and during pregnancy and postpartum) were obtained for this study.

2.3.2. Depression symptoms

The Edinburg Postnatal Depression Scale (EPDS) is a 10-item self-reported questionnaire designed to assess the intensity of depression symptoms within the previous 7 days (Cox, Holden & Sagovsky, 1987). Higher scores indicate more intensity of depression symptoms. In Spain, validation of the EPDS showed good psychometric properties (García-Esteve, Ascaso, Ojuel, & Navarro, 2003; Vázquez & Míguez, 2019). In the present study, the EPDS showed good internal consistency (Cronbach's α range = 0.77–0.85).

2.3.3. Anxiety symptoms

The State Anxiety Scale (STAI-S) of State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) consists of a 20-item scale designed to assess the current state of anxiety. Higher scores indicate higher anxiety symptoms. In the present study, the STAI-S showed good internal consistency (Cronbach's α range = 0.84–0.93).

2.3.4. Smoking status and consumption quantity (number of cigarettes)

The number of cigarettes smoked per week during each assessment wave was self-reported by women. Smoking status was defined for each assessment wave, considering both self-report and the result of a biochemical test. Pregnant women were classified into three groups: women who reported never smoking or who reported quit before trying to get pregnancy were classified as non-smoker; women who reported quit and whose biochemical test confirmed abstinence were classified as quitters; those women who claimed to smoke were classified as smokers. Women whose self-report did not match the biochemical test were excluded. Self-reports of smoking abstinence were biochemically verified at the 1st trimester through urinary cotinine by Cotinine Test Medi-marketing (cut-off 200 ng/mL) and at 3rd trimester and at 2 and 7 months postpartum through the expired air carbon monoxide (CO) (cut-off of 5 ppm), using a Carbon Monoxide Monitor (Model Smokerlyzer Pico Simple; Bedfont Technical Instruments Ltd., Sittingbourne, Kent, UK). Biochemical measurement and self-report were combined to establish smoking status.

2.4. Data analysis

Descriptive statistics were performed for all the studied variables. Likewise, bivariate correlations between the different variables were also calculated.

Piecewise growth curve models were estimated using multilevel modelling (Heck, Thomas, & Tabata, 2010) to analyse the effect of previous tobacco consumption, and depression and anxiety symptoms on tobacco consumption (status and quantity) from the 1st trimester of pregnancy to 7 months postpartum. This analysis allows evaluating the effect of each variable of interest bearing in mind the effect of the others, likewise, analyses the changes in the variables over time. Two models were estimated, one for the smoking status (non-smoker or smoker at each time), and another for the smoking quantity – number of cigarettes smoked per week (outcome variables). Data of women who did not smoke were excluded from both models.

The time variable was scored in weeks and three different times were calculated: time 1 was defined from the 1st trimester of pregnancy to childbirth, time 2 was defined from childbirth to 2 months postpartum, and time 3 was defined from 2 to 7 months postpartum. Fixed effects for previous tobacco consumption (number of cigarettes smoked before

pregnancy) and depression and anxiety symptoms (time-varying moderators) were included in the models. Standard deviation of each independent variable (previous tobacco consumption, depression and anxiety) was used to establish what were high and low values for those variables. High depression or anxiety symptoms or high previous tobacco consumption were present when the women's score in that variable was a standard deviation above the mean at the time of the assessment. Low symptoms were noted in those women whose scores on depression, anxiety or previous smoked cigarettes were at least one standard deviation below the mean.

Statistical analyses were performed using the IBM SPSS 23.0 Windows version (PASW Statistics for Windows, SPSS Inc, Chicago). Statistical significance level was considered at $p < 0.05$.

3. Results

3.1. Preliminary analysis

Descriptive statistics for the study variables were performed at all assessments (see Table 2). Statistically significant positive correlations were found between the independent (number of cigarettes smoked per week before pregnancy, depression and anxiety symptoms) and dependent (smoking status and number of cigarettes smoked per week) variables of the study at all assessment waves (r 's range = 0.092–0.962).

3.2. Smoking status from the 1st trimester of pregnancy to 7 months postpartum: Effects of previous tobacco consumption, and depression and anxiety symptoms

Main effects of time from childbirth to 2 months postpartum ($b = 0.002, p = 0.018$) and of time from 2 to 7 months postpartum ($b = 0.001, p = 0.016$) were found on smoking status. The number of women who smoke increased from childbirth to 2 months postpartum and from 2 to 7 months postpartum.

Main effects of previous tobacco consumption and depression symptoms were found on smoking status (quitters vs. smokers). Smoking more cigarettes per week before pregnancy was associated with being a smoker at the 1st trimester of pregnancy ($b = 0.005, p < 0.001$). Likewise, at the 1st trimester, more depression symptoms ($b = 0.011, p = 0.028$) were associated with being a smoker (see Table 3).

Interaction effects between depression symptoms and time from childbirth to 2 months postpartum and between depression symptoms and time from 2 to 7 months postpartum were found on smoking status, as shown by Table 3 and by Fig. 1. Women with more depression symptoms revealed higher tendency to relapse during the first 2 months postpartum ($b = 0.001, p = 0.011$), than women with less depression symptoms. Fig. 1 shows, through a higher and slightly steeper line, how women with more depression symptoms tend to smoke status, especially, at 2 months postpartum. After 2 months postpartum, those women with less depression symptoms tend to relapse ($b = 0.001, p = 0.022$).

3.3. Smoking quantity (number of cigarettes smoked per week) from the 1st trimester of pregnancy to 7 months postpartum: Effects of previous tobacco consumption, and depression and anxiety symptoms

Main effects of time from the 1st trimester of pregnancy to childbirth ($b = -0.307, p = 0.001$) and of time from childbirth to 2 months postpartum ($b = 0.216, p < 0.001$) were found on the number of cigarettes smoked per week. The number of cigarettes smoked per week decreased from the 1st trimester to childbirth and increased from the childbirth to 2 months postpartum. Main effects of previous tobacco consumption and anxiety symptoms were found on the number of cigarettes smoked per week. Women who smoked more cigarettes per week before pregnancy smoked more cigarettes at the 1st trimester of pregnancy ($b = 0.228, p < 0.001$). At the 1st trimester, women with more anxiety symptoms ($b =$

Table 2

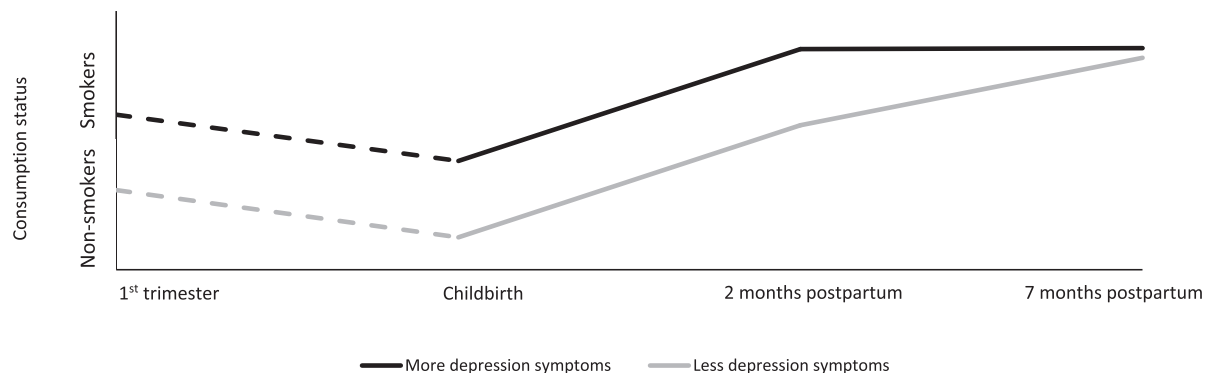
Descriptive statistics of study variables at each assessment wave.

		1st trimester of pregnancy		3rd trimester of pregnancy		2 months postpartum		7 months postpartum	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Depression symptoms		5.03	4.34	4.49	3.59	5.47	4.15	5.03	3.92
Anxiety symptoms		14.79	10.25	13.25	8.96	16.93	8.12	16.96	8.15
Number of cigarettes smoked by week		4.73	14.44	2.92	9.37	5.02	15.90	4.95	15.88
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Smoking status	Non Smokers	581	72.4	581	72.4	581	72.4	581	72.4
	Quitters	103	12.8	116	14.4	98	12.2	82	10.2
	Smokers	119	14.8	106	13.2	124	15.4	140	17.4

Notes. *M* = Mean; *SD* = Standard deviation.**Table 3**

Effects of previous tobacco consumption, and depression and anxiety symptoms on smoking status and on smoking quantity (number of cigarettes smoked by week) from the 1st trimester of pregnancy to 7 months postpartum.

	Smoking status				Number of cigarettes		
	<i>b</i>	<i>SE</i>	95% <i>CI</i>		<i>b</i>	<i>SE</i>	95% <i>CI</i>
Intercept	0.536	0.023	[0.492, 0.580]***	Intercept	17.058	1.154	[14.792, 19.325]***
Time from 1st trimester to childbirth	−0.003	0.002	[−0.007, 0.001]	Time from 1st trimester to childbirth	−0.307	0.096	[−0.495, −0.119]*
Time from childbirth to 2 months postpartum	0.002	0.001	[0.001, 0.004]*	Time from childbirth to 2 months postpartum	0.216	0.048	[0.122, 0.311]***
Time from 2 to 7 months postpartum	0.001	0.001	[0.001, 0.003]*	Time from 2 to 7 months postpartum	−0.015	0.031	[−0.077, 0.046]
Previous tobacco consumption	0.005	0.001	[0.004, 0.006]***	Previous tobacco consumption	0.228	0.022	[0.184, 0.272]***
Depression symptoms	0.011	0.006	[0.001–0.022]*	Depression symptoms	0.035	0.232	[−0.421, 0.491]
Anxiety symptoms	0.002	0.002	[−0.002, 0.005]	Anxiety symptoms	0.300	0.115	[0.074, 0.526]*
Previous tobacco consumption × Time from 1st trimester to childbirth	−0.001	0.001	[−0.001, 0.001]	Previous tobacco consumption × Time from 1st trimester to childbirth	−0.005	0.002	[−0.008, −0.001]***
Depression symptoms × Time from 1st trimester to childbirth	−0.001	0.001	[−0.001, 0.001]	Anxiety symptoms × Time from 1st trimester to childbirth	−0.015	0.007	[−0.029, −0.001]*
Previous tobacco consumption × Time from childbirth to 2 months postpartum	0.001	0.001	[−0.001, 0.001]	Previous tobacco consumption × Time from childbirth to 2 months postpartum	0.001	0.001	[−0.001, 0.003]
Depression symptoms × Time from childbirth to 2 months postpartum	0.001	0.001	[0.001, 0.002]*	Anxiety symptoms × Time from childbirth to 2 months postpartum	0.010	0.006	[−0.0002, 0.021]
Previous tobacco consumption × Time from 2 to 7 months postpartum	−0.001	0.001	[−0.001, 0.001]	Previous tobacco consumption × Time from 2 to 7 months postpartum	−0.001	0.001	[−0.001, 0.001]
Depression symptoms × Time from 2 to 7 months postpartum	0.001	0.001	[0.001, 0.002]*	Anxiety symptoms × Time from 2 to 7 months postpartum	0.001	0.004	[−0.006, 0.007]
Random effects							
Intercept + Time	0.001	0.001	[0.001, 0.002]***	Intercept + Time	0.593	0.076	[0.462, 0.761]***
Residuals	0.094	0.005	[0.084–0.104]***	Residuals	252.291	13.909	[226.450, 281.079]***

SE = Standard error; *CI* = Confidence interval.* $p < 0.05$.*** $p < 0.001$.**Fig. 1.** Estimated smoking status in women with more and less depression symptoms.

0.300, $p = 0.009$) smoked more cigarettes per week.

Interaction effects of previous tobacco consumption, anxiety symptoms and time from the 1st trimester of pregnancy to childbirth were found on the number of cigarettes smoked per week, as shown by Table 3 and by Fig. 2. Women with more previous tobacco consumption presented a steeper decrease in the number of cigarettes smoked per week from the 1st trimester to childbirth ($b = -0.005$, $p = 0.008$), than women with less previous tobacco consumption. Likewise, women with more anxiety symptoms showed a steeper decrease in the number of cigarettes smoked per week from the 1st trimester to childbirth, than women with less anxiety symptoms ($b = -0.015$, $p = 0.047$). Fig. 2 shows, through a slightly steeper continuous line, how women with more previous tobacco consumption (Fig. 2A) or with more anxiety symptoms (Fig. 2B) tend to reduce the number of cigarettes smoked per week during pregnancy the most.

4. Discussion

The present study aimed to analyse the effect of previous tobacco consumption, and depression and anxiety symptoms on women's tobacco consumption status and quantity, from the 1st trimester of pregnancy to 7 months postpartum.

4.1. Smoking status from the 1st trimester of pregnancy to 7 months postpartum

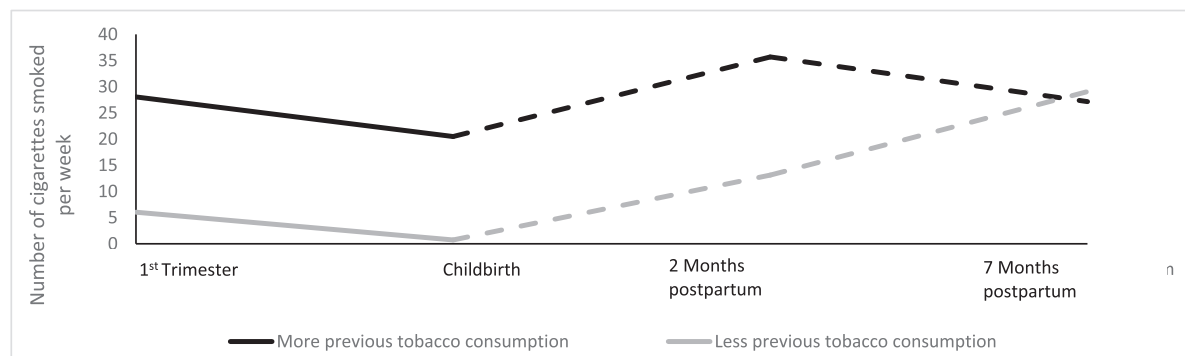
Although no changes were observed in women's smoking status from the 1st trimester of pregnancy to childbirth, since most of the women quit tobacco consumption before being evaluated, the number of smoking women increases during the postpartum period. Results

showed no significant effects of time from the 1st trimester to childbirth, while significant effects of time were found from childbirth to 2 months postpartum and from 2 to 7 months postpartum. These results are in line with previous studies (Correa-Fernández et al., 2012; Gilbert, Nelson, & Greaves, 2015; Lauria et al., 2012). Therefore, postpartum is highly vulnerable period for smoking relapse.

Smoking more cigarettes before pregnancy was associated with more likely to be a smoker at the 1st trimester of pregnancy. A higher consumption of cigarettes could be related to a higher level of nicotine dependence (Dierker et al., 2007), which can difficult women to quit smoking. Additionally, depression symptoms were associated with smoking status at the 1st trimester of pregnancy. Specifically, women with more depression symptoms were associated with more likely to be smokers at 1st trimester of pregnancy. High depression symptoms could make difficult to quit smoking, as they could be related to addicted to nicotine (Orr et al., 2012). Nicotine may have an antidepressant action, and smoking could be a coping strategy used to reduce the discomfort associated with depression symptoms (De Wilde et al., 2013; Flemming, Graham, Heirs, Fox, & Sowden, 2013; Goedhart et al., 2009; Smedberg et al., 2015). Furthermore, depressed women could have less confidence in their ability to quit smoking (Zhu & Valbø, 2002).

Although no significant effects of depression symptoms were found on smoking status from the 1st trimester of pregnancy to childbirth, effects of depression symptoms were found during the postpartum period. Women with more depression symptoms revealed higher tendency to relapse, specifically during the first 2 months postpartum. This result suggested that depression symptoms are associated with a higher likelihood of smoking relapse during the early postpartum period (De Wilde et al., 2013; Gyllstrom et al., 2012; Lauria et al., 2012).

(A)



(B)

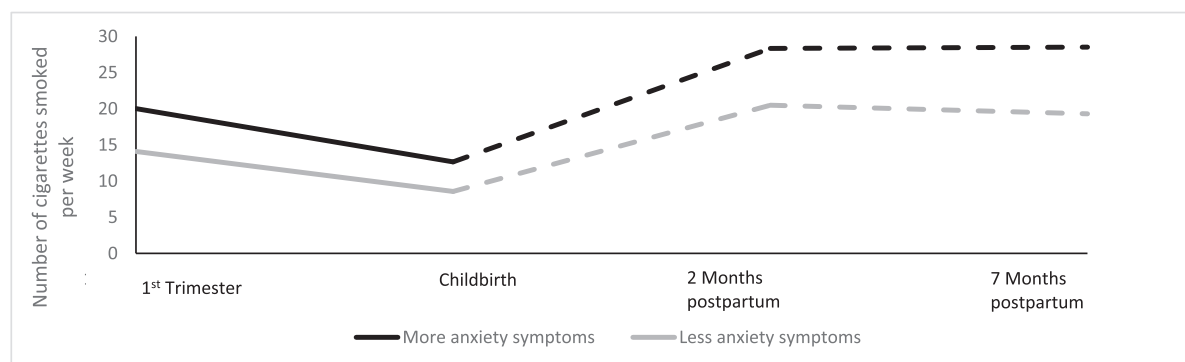


Fig. 2. Estimated smoking quantity (number of cigarettes smoked per week) from the 1st trimester of pregnancy to 7 months postpartum in women with more and less previous tobacco consumption (Fig. 2A) and women with more and less anxiety symptoms (Fig. 2B).

4.2. Smoking quantity from the 1st trimester of pregnancy to 7 months postpartum

Regarding smoking quantity, the number of cigarettes smoked was found to decrease during pregnancy and to increase during the early postpartum period, while no significant changes were observed from 2 to 7 months postpartum. Pregnancy is a period in which those women, who have not achieved abstinence, tend to reduce their tobacco consumption maybe trying to protect themselves and their future infant from the adverse effects of tobacco. Meanwhile, the postpartum period is associated with an increase in tobacco consumption, being a period of great vulnerability to smoking relapse (Gilbert et al., 2015; Lauria et al., 2012; Taghavi et al., 2018).

Results also showed that women who smoked more cigarettes before pregnancy had a higher likelihood of smoked more cigarettes at the 1st trimester of pregnancy. More previous tobacco consumption is related to greater dependence of nicotine and greater difficulty to reduce and to quit smoking (Anderka et al., 2010; Rozas et al., 2008; Vaz et al., 2014).

Likewise, women with more anxiety symptoms had a higher likelihood of smoked more cigarettes at the 1st trimester of pregnancy. A possible hypothesis for this relationship is that women with high anxiety could use smoking as a coping strategy against the anxiety symptoms, due to the popular belief that tobacco helps to relax (Irwin, Johnson & Bottorff, 2005; Parrot, 1999).

Results also showed significant association between anxiety symptoms and women's smoking quantity from the 1st trimester of pregnancy to childbirth. Although women with more anxiety symptoms had a higher likelihood of smoked more cigarettes during pregnancy, they presented a steeper decrease in the number of cigarettes smoked from the 1st trimester to childbirth than women with less anxiety symptoms. This steeper decrease could be related to the popular belief that quitting smoking can increase anxiety symptoms, and it may be more convenient to reduce tobacco consumption than to quit. Therefore, women with more anxiety symptoms may not try to quit smoking but rather try to control and reduce their quantity of tobacco consumption during pregnancy (Taghavi et al., 2018). Women with more anxiety symptoms try to reduce the consumption to reach a "suitable consumption" for pregnancy compared to women with low anxiety, whose consumption reduction is not so abrupt. Likewise, during the postpartum period, women tend to return to their previous tobacco consumption (Solomon et al., 2007), regardless of their anxiety symptoms. This may be because the awareness of postpartum smoke damage is diluted, and smoking is no longer a social taboo (Rattan, Mamun, Najman, Williams, & Doi, 2013).

This study has certain limitations. Previous tobacco consumption, and depression and anxiety symptoms were self-reported, which could affect the results due to biases such as social desirability. Although, should be noted that the self-reported instruments used to assess depression and anxiety symptoms are those of international reference. This same limitation makes difficult the establishment of cause-effect relationships. Likewise, some strengths should also be pointed out. This is a longitudinal study that was conducted with a large sample of women assessed in 4 assessment waves, from early pregnancy to 7 months postpartum, with low dropout rate. In addition, to our knowledge, this was the first longitudinal study that jointly analysed the effects of previous tobacco consumption, and depression and anxiety symptoms on tobacco consumption during pregnancy and the postpartum period, considering the changes that can occur in these variables over these periods. Also, another strength refers to the fact that this study tried to identify which of these relevant variables have more effects on women's smoking status, but also quantity, a variable that had been forgotten within this population.

This study's results have important implications for clinical practice. First, the screening of the different risk factors that can affect smoking status and quantity can help to design more effective interventions to increase women's tobacco consumption cessation during pregnancy and

decrease women's relapse during the postpartum period. Secondly, knowing the associations between the risk factors and the different times over the perinatal period will facilitate the implementation of the intervention in the most vulnerable times, thus hoping to increase its effectiveness.

These results also have implications for research. Previous tobacco consumption, and depression and anxiety symptoms changes were associated with women's tobacco consumption during pregnancy and the postpartum period. Future studies could explore the underlying mechanisms (e.g., biological, psychological, and social) of these relationship. Exploring the causal and/or bidirectional effects between depression and anxiety and tobacco consumption during pregnancy and the postpartum period could also be a major advance to the literature in this field.

4.3. Conclusions

Women's tobacco consumption during pregnancy and the postpartum period is affected by both previous tobacco consumption, and depression and anxiety symptoms. The influence of these factors varies depending on time (pregnancy or postpartum) and on tobacco consumption dimension (status or quantity). Overall, these findings suggested that depression symptoms play a fundamental role on smoking status during the postpartum period, while anxiety symptoms explain better the consumption quantity during pregnancy.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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