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ORIGINAL RESEARCH – QUANTITATIVE

Tobacco use in the third trimester of pregnancy and its relationship to birth weight. A prospective study in Spain

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ABSTRACT

Background: Few studies have been carried out in Spain examining the use of tobacco amongst expectant mothers and its effect on birth weight.
Aims: To observe the proportion of expectant mothers who smoke during their pregnancy, and the impact of tobacco consumption on maternal and birth weight. We also aimed to identify the trimester of pregnancy in which tobacco use produced the greatest reduction in birth weight.
Methods: Prospective observational study in Spain. A random sampling strategy was used to select health centres and participant women. A total of 137 individuals were enrolled in the study. Exposure to tobacco was measured through a self-reported questionnaire. Regressions were performed to obtain a predictive model for birth weight related to smoking.
Findings: Overall, 35% of study participants were smokers during the pre-gestational period (27% in the first trimester, 21.9% in the second and 21.2% in the third). 38.7% of smoking cessation attempts took place in the third-trimester. Pregnant women who smoked up to the third trimester had a higher risk of giving birth to a baby under 3000 g, compared to non-smokers (OR = 5.94, CI 95%: 1.94–18.16). Each additional unit of tobacco consumed daily in the 3rd trimester led to a 32 g reduction in birth weight.
Conclusion: An important proportion of pregnant women in Spain smoke during pregnancy. Pregnant women exposed to tobacco have newborns with lower birth weight. Smoking during the 3rd trimester of pregnancy is associated with the greatest risk of lower birth weight.

1. Introduction

Optimal foetal growth is dependant on a variety of physiological and pathological determinants.[1] Amongst the physiological factors, pre-gestational body mass index (BMI) is directly related to birth weight, with higher BMI associated with higher birth weight.[2] On the contrary, the misuse of toxic substances during pregnancy, including tobacco, can lead to foetal growth retardation and low birth weight.[3,4] Nicotine reduces the blood flow to the placenta, whilst carbon monoxide present in smoke reduces oxygenation of the fetus.[5]

Different authors have analysed tobacco use during pregnancy using different methods including self-reported questionnaires, measurements of nicotine concentration in urine or expired carbon monoxide.[6–8] In Europe, the prevalence of tobacco use during pregnancy is approximately 20%.[9] In Spain, figures are higher and

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around 30–43% of expectant mothers are smokers at the start of their pregnancy.[6] Although about 40% of them quit in the first trimester,[10] about 13–25% continue smoking up to delivery.[11] Spanish studies, however, are affected by methodological weaknesses. For example, the majority of studies assessed tobacco use through self-reported instruments, which may facilitate socially desirable responses and thus underestimate smoking status by 11–26%.[6,10]

However, the combined effect of BMI and tobacco on birth weight remains unclear[12] and few studies on tobacco prevalence have examined the effect of quitting smoking in the third-trimester of pregnancy and birth weight. Some authors have suggested that early cessation of smoking in pregnancy has a greater impact on birth weight improvement[13,14] with a relatively small impact if quitting takes place during the third-trimester of pregnancy.[15] However, other researchers have claimed that third-trimester maternal cigarette consumption had the strongest association with birth weight, regardless of pre-pregnancy consumption levels.[16] Our study evaluated the association of prenatal exposure to maternal smoking with birth weight in different stages of pregnancy. Additionally, we aimed to identify the trimester of pregnancy in which tobacco use produced the greatest reduction in neonatal birth weight.

2. Subjects and methods

2.1. Design

Prospective observational study. Participating expectant mothers were classified into two groups according to their use of tobacco during gestation. A sample of 159 women was obtained from April 2011 to March 2012.

A two-stage sampling approach was used. In the first stage, we selected health centres in Carlet and Benimodo (Spain) from all primary care centres of La Ribera health district using simple random probability sampling (probability = 2/13). In the second stage, we selected pregnant women using a similar probability sampling with systematic monitoring of the number of pregnancies per year on each health centre (N'). The ratio's value (k) for the calculated sample size (n) was 2 ($k = N'/n$). We estimated that for 180 pregnant women per year attending the health centres, a minimum sample of 123 women was required (95% confidence interval (95% CI), 5% precision error). The attending midwives recruited the women at clinic and obtained their informed consent to participate. Overall, one of every two pregnant women was selected until the required sample size was obtained.

The inclusion criteria were: a maternal age of 18–36 years, first prenatal visit between 5 and 12 weeks of gestation, and single foetus with no malformations. Exclusion criteria included: patient declined to participate in the study, language barrier, and expectant mothers with pathologies that significantly modified foetal growth, such as pre-gestational diabetes, essential hypertension prior to pregnancy, maternal infection or other chronic maternal pathologies.

2.2. Ethics

The Committee of Ethics and Research of the University Hospital of La Ribera (UHLR) approved the study proposal in January 2011 (#11-415). Written informed consent was obtained from all women. The participants were free to decline their participation and withdraw from the research at any time.

2.3. Study variables

The questionnaire was purposely designed with agreement from the research team. Birth weight was considered the dependent variable, and was recorded in the delivery room following the clamping and separation of the umbilical cord, using a digital scale (SECA®, Vogel & Halke GmbH & Co, Hamburg, Germany), to an accuracy of 10 g.

The independent variables included socio-demographic characteristics (maternal age, country of origin, marital status, educational level, occupational state), anthropometric measurements (pre-gestational BMI, as calculated from self-reported body weight at 2–3 months prior to pregnancy and recorded at the first prenatal visit; absolute gestational weight gain; and difference between final weight on the day of delivery and pre-gestational weight), and obstetric-neonatal features (newborn gender and gestational age at birth expressed in days of gestation from the end of the mother's last menstrual cycle). Women selected for inclusion in our study provided an estimate of their pre-pregnancy day cigarette consumption. Self-reported average tobacco consumption was used to estimate pre-gestational tobacco misuse. Equally, women were asked to report the mean number of cigarettes consumed per day in the 7 days prior to the enrolment in the study, and again for each trimester on appointment with the midwife.

Data collection also included the frequency of smoking cessation attempts and relapses during pregnancy and for a period of 30 days postpartum.

2.4. Statistical analysis

An analysis of the dependent variables was carried out for each of the categories of pre-gestational BMI, using descriptive methods. Afterwards, the normality of the distribution of continuous variables was examined using the Kolmogorov–Smirnov test. Statistical significance was set at the 0.05 level. Bivariate correlation analyses using Pearson correlation coefficient were initially used to explore factors associated with neonatal birth. The comparison of multiple averages was carried out using analysis of variance tests (ANOVA), after assessment of the homogeneity and normality of the data with the Levene test. The magnitude of the effect of first-hand exposure to tobacco on categorised birth weight was estimated using multiple logistic regression, with birth weight (<3000 g or >3000 g) as the outcome measure and adjusted for pre-gestational maternal BMI (WHO categories: underweight (UW) <18.5 kg/m^2, normal weight (NW) 18.5–24.9 kg/m^2, overweight (OW) 25.0–29.9 kg/m^2, obese (OB) >30 kg/m^2)[17] as explanatory variable. Additional explanatory variables included gestational age at birth (days).

To analyse the relationship between birth weight (dependent variable) and tobacco use by the expectant mother (independent variable), an adjusted multiple linear regression model was applied using a stepwise method for variables shown to have an effect on birth weight. Smoking indicators examined included the number of cigarettes consumed per day before pregnancy, at the time of registration into the study (first trimester), and in the second and third trimester. Partial correlation coefficients represent the strength of the linear relationship between each independent variable and birth weight, after controlling for other predictors in the regression model. The data was analysed using SPSS Statistics version 22.

3. Results

Out of a total of 159 expectant mothers initially included in the study, we excluded 22 cases (10 cases of spontaneous miscarriage in the first trimester, 1 case of foetal malformation in the second trimester, 2 cases of loss to follow-up during the pregnancy, and 9 cases of gestational diabetes). Therefore, the final sample included 137 expectant mothers.