

Primary care

Smokeless tobacco use, birth weight, and gestational age: population based, prospective cohort study of 1217 women in Mumbai, India

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Abstract

Objective To study the effect of using smokeless tobacco during pregnancy on babies' birth weight and gestational age at birth.

Design Population based, prospective cohort study using a house to house approach.

Setting Eight primary health post areas in the city of Mumbai (Bombay), India.

Participants 1217 women who were three to seven months pregnant and planning to deliver in the study area. 1167 women (96%) were followed up.

Main outcome measures Birth weight and gestational age in singleton births.

Results Smokeless tobacco use was associated with an average reduction of 105 g in birth weight (95% confidence interval 30 g to 181 g) and a reduction in gestational age of 6.2 (3.0 to 9.4) days. The odds ratio for low birth weight was 1.6 (1.1 to 2.4), adjusted by logistic regression for maternal age, education, socioeconomic status, weight, anaemia, antenatal care, and gestational age. The adjusted odds ratio for preterm delivery (<37 weeks) was 1.4 (1.0 to 2.1); for delivery before 32 weeks it was 4.9 (2.1 to 11.8) and before 28 weeks was 8.0 (2.6 to 27.2).

Conclusions Consumption of smokeless tobacco during pregnancy decreases gestational age at birth and birth weight independent of gestational age. It should receive specific attention as a part of routine prenatal care.

Introduction

In South East Asia smoking among women may be rare, but use of smokeless tobacco is common.¹⁻² There are indications that using smokeless tobacco could be as detrimental to fetal health as cigarette smoking; previous studies have shown that the proportion of low birthweight babies born to users was higher than non-users.³⁻⁴ The effect of using smokeless tobacco on gestational age at birth has not been reported. We studied a cohort of pregnant women in the city of Mumbai (Bombay), India, for the effect of using smokeless tobacco during pregnancy on babies' birth weight and gestational age at birth.

Methods

We conducted this study in collaboration with eight government health posts in Mumbai with their community

health volunteers (n=177), who routinely monitor all women in their respective areas for pregnancy.

Recruitment

We screened the women listed by the community health volunteers during house to house visits for eligibility. Two social workers interviewed 1217 eligible women between June 2002 and November 2002. Women in the third to seventh month of their pregnancy were eligible if they were planning to remain in Mumbai for the birth. We used reinterview by a different social worker as a quality control check in 10% of participants (n=123).

Measurements at recruitment

We gathered information on demographics, tobacco use, and medical and obstetric histories from the women. We used bathroom scales and a tape measure to obtain their weight and height. Most women did not know their weight before pregnancy. The two social workers extracted blood pressure, haemoglobin measurements, and other medical records from the medical reports.

Tobacco use

We included as users all women who had used a smokeless tobacco product at least once a day for the past six months. We categorised the frequency of use as light (one to four times per day) or heavy (five or more times per day). Women in the state of Maharashtra, including Mumbai, commonly use mishri (pyrolysed and powdered tobacco), and its initial use is as a dentifrice. Betel quid (paan) with tobacco, gutka, and paan masala are chewed and generally retained in the mouth for longer periods.

Follow up

Interviews took place on delivery, and birth weight and date of delivery were copied from the infant's immunisation card. In 10% (89) cases birth weight had to be obtained from hospital records. For 40 women, information from both sources was available and in agreement. Blood pressure and haemoglobin measurements were abstracted from antenatal records, and all women gave self reports of diagnosis of high blood pressure or anaemia during pregnancy.



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Outcome definitions

We used as outcomes low birth weight (< 2500 g), preterm birth (< 259 days or 37 weeks), early preterm birth (< 224 days or 32 weeks), and very early preterm birth (< 196 days or 28 weeks).

Data analysis

Of the 1217 recruited women, 208 (17.1%) reported using tobacco regularly during pregnancy. Use of smokeless tobacco predominated (99%, 206 women), mishri being the most common, (80%, 166). Forty six per cent of women (96) chewed tobacco once or twice a day and 24% (49) three or four times a day.

We followed up 1167 women (96%). After exclusions, 1110 singleton births after 20 weeks of gestation were available for analysis of gestational age, and 974 live and single births for analysis of birth weight.

We calculated gestational age as the number of days from the recalled start of the last normal menstrual period to the date of delivery. For 453 women, ultrasound scans before 30 weeks helped date the pregnancy (consistent with self reports in 70% (53 out of 76) of cases for preterm and 95% (359/377) for term deliveries).

Medical reports for haemoglobin (< 100 g/l) and self reports for anaemia were available for 889 women; 99.5% (n = 885) were consistent with self reports, and only self reports were available for the rest. Medical reports for blood pressure (\geq 140/90 mm Hg) and self reports for gestational hypertension were available for 825 (consistent with self reports in 54% (18/33) of cases for positive and 99.9% (791/792) for negative self reports); only self reports were available for the rest. Calculation of socioeconomic status included the educational and occupational status of the father and the per capita income of the family.

We evaluated the significance of the differences in means and distributions, and we calculated relative risks for the outcomes.

We examined differences in the distribution of sociodemographic, biological, and clinical variables among users and non-users of smokeless tobacco. We considered factors that differed significantly between the two groups as potential confounders and carried out stepwise logistic regression. The final model included only those variables that had independent, significant associations with use of smokeless tobacco (see *bmj.com*).

Results

The response rate from eligible women was 100%. Quality rechecks were 100% in agreement for tobacco use and more than 90% for most other variables.

Women using smokeless tobacco had relatively lower socioeconomic status, weight, and educational status and were less likely to have had optimal antenatal care. They were also more likely to be multiparous

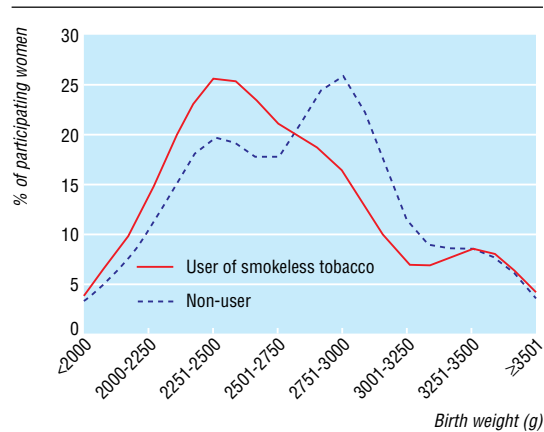


Fig 1 Distribution of birthweight (in g) by smokeless tobacco use of mothers

or anaemic. We considered these variables as potential confounders in the analyses and also considered the woman's age, a common confounder.

Low birth weight

Babies born to mothers using smokeless tobacco were on average 105 g lighter (2672 g *v* 2777 g, 95% confidence interval for difference 30 g to 181 g; *P* = 0.006) than those of non-users (median decrease 150 g, *P* = 0.02). The entire birth weight distribution in users was shifted to the left (fig 1; two tailed *P* = 0.02), indicating that infants who were already compromised might have been pushed into even higher risk categories.

The odds ratio for low birth weight remained significant with varying confidence intervals after we adjusted for independent significant confounders, including gestational age at birth by logistic regression (table).

Compared with non-users, the mean decrease in birth weight in light users was 63 g (26 g to 153 g, *P* = 0.2), and in heavy users 189 g (66 g to 312 g, *P* = 0.003). The trend of increasing low birth weight with increasing use of smokeless tobacco was highly significant (χ^2 test 10.3, *P* = 0.006).

Preterm delivery

Women using smokeless tobacco gave birth an average of 6.2 days earlier than women not using tobacco (271.1 days *v* 264.9 days; 95% confidence interval 3.0 days to 9.4 days; *P* = 0.0001); preterm deliveries were earlier by 11.6 (4.4 to 18.8) days (*P* = 0.002). The gestational age distribution in users was shifted significantly to the left and more pronounced at lower gestational ages (fig 2; two tailed *P* = 0.03).

The odds ratios for preterm delivery remained significant (1.5, 1.009 to 2.2; *P* = 0.05), after adjustment for age, education, socioeconomic status, and anaemia by logistic regression; the significance level dropped to

Adjusted odds ratios (95% confidence intervals) for low birth weight and preterm delivery in women who used smokeless tobacco

	Low birth weight*	Preterm delivery†		
		<37 weeks	<32 weeks	<28 weeks
Crude odds ratio	1.6 (1.1 to 2.4)	1.6 (1.1 to 2.3)	4.2 (2.1 to 8.5)	8.0 (2.6 to 24.8)
Adjusted odds ratio	1.6 (1.008 to 2.4)	1.4 (1.0 to 2.1)	4.9 (2.1 to 11.8)	8.0 (2.6 to 27.2)
<i>P</i> value	0.05	0.06	0.0001	0.0004

*Adjusted for age, educational and socioeconomic status, weight, anaemia, number of antenatal visits, and preterm delivery.

†Adjusted for age, educational and socioeconomic status, weight, anaemia, and number of antenatal visits.

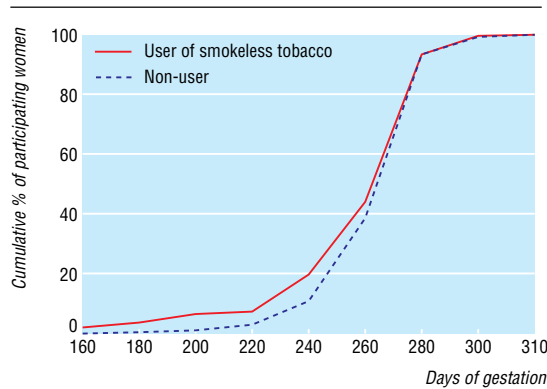


Fig 2 Distribution of gestational age by smokeless tobacco use of mothers (the cumulative percentage for a gestational age is the number of mothers who have given birth up to that gestational age divided by the total number of mothers)

P=0.06 after adjustment for weight and antenatal care. The odds ratios for delivery before 32 and 28 weeks remained strong and significant after adjustment for all variables (table).

Compared with non-users, light users gave birth an average of 4.9 days earlier (271.1 days *v* 266.2 days; 95% confidence interval 1.2 days to 8.6 days; P=0.01) and heavy users 8.9 days earlier, (271.1 days *v* 262.2 days; 3.9 days to 13.8 days; P=0.0001). The trend of increasing preterm births with increasing smokeless tobacco use was highly significant (χ^2 12.7, P=0.002).

Discussion

Smokeless tobacco use in pregnant women reduces birth weight and increases the number of low birthweight babies. It shortens the gestational period and increases the number of preterm deliveries. These adverse outcomes are dose dependent and similar to those associated with maternal smoking.

Limitations

Confounding due to weight gain and over-reporting of gestational hypertension could not be eliminated, which limits the conclusions of our study. Recorded birth weights may not have been highly accurate, but a systematic bias is unlikely. Although menstrual dating of babies' gestational age in 59% of women (n=657) was subjective, the findings were consistent with those from women for whom ultrasound results were available. The adjusted odds ratio for preterm birth based only on ultrasound estimates (393 non-users *v* 60 users) was 2.1 (1.0 to 4.1).

In a study from the United States, the association between smoking and preterm delivery before 33 weeks' gestation was stronger than for later preterm delivery.⁵ In our study we observed a similar stronger association for early preterm births, independent of possible confounders.

With a prevalence of smokeless tobacco use of 17% and a relative risk of 1.6, 9.3% of low birthweight and preterm deliveries in this population could be attributed to smokeless tobacco use. For babies born before 32 weeks and 28 weeks, the attributable fractions would, however, be 37% and 50%.

Tobacco in smokeless form contains several carcinogenic and toxic substances.⁶ Exposure to cotinine has been shown in fetuses of mishri users,⁷ which indicates that nicotine and other toxic substances can cross the placental barrier.

Outlook

High rates of smokeless tobacco use in young people have been reported worldwide; more so among girls.⁸ Use of smokeless tobacco should receive specific attention as a part of routine prenatal care.

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Competing interests: None declared.

Ethical approval: The study conforms to the guidelines laid down by the Indian Council of Medical Research for research on human subjects.

What is already known on this topic

Maternal cigarette smoking reduces birth weight and increases risk of preterm delivery

Smokeless tobacco is being marketed as a less harmful form of tobacco use

Use of smokeless tobacco by women is common in the developing world

Reports show an association of low birth weight with maternal use of smokeless tobacco

What this study adds

Maternal use of smokeless tobacco decreases birth weight and gestational age

Infants of users have a greater risk of having low birth weight (<2500 g) and being delivered preterm (<37 weeks of gestation), independent of confounders.

Maternal smokeless tobacco use is associated with high risks for preterm delivery, independent of confounders

Maternal use of smokeless tobacco should receive specific attention as a part of routine prenatal care

- Pindborg JJ, Murti PR, Bhonsle RB, Gupta PC. Global aspects of tobacco use, its implications for oral health. In: Gupta PC, Hamner JE, Murti PR, Eds. *Control of tobacco related cancers and other diseases, proceedings of an international symposium*. Tir, Bombay: Oxford University Press, 1990:13-23.
- Gupta PC. Socio-demographic characteristics of tobacco use, among 99 598 individuals in Bombay, India, using hand-held computers. *Tobacco Control*, 1996; 5:114-20.
- Krishna K. Tobacco chewing in pregnancy. *Br J Obstet Gynecol*; 1978; 85:726-8.
- Mehta AC, Shukla S. Tobacco and pregnancy. *J Obstet Gynecol India*; 1990; 40:156-60.
- Shiono PH, Klebanoff MA, Rhoads GG. Smoking and drinking during pregnancy: their effects on preterm birth. *JAMA* 1986;255:82-4.
- International Agency for Research on Cancer. *Tobacco habits other than smoking; betel-quad and areca-nut chewing; and some related nitrosamines*. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Vol. 37. Lyons: IARC, 1984.
- Sarkar S, Bhide MB, Bhide AM, Raghavan S, Maru GB, Bhide SV. Transplacental exposure of human fetuses to nicotine/cotinine in masheri addict mothers and consequent loss of weight in babies at birth. In: O'Neil IK, Bartsch H, eds. *Nitroso compounds: biological mechanisms, exposures and cancer etiology*. Kailua-Kona, Hawaii: IARC, 1991. (IARC Technical Report No 11).
- Global Youth Tobacco Survey Collaborative Group. Differences in worldwide tobacco use by gender: findings from the global youth tobacco survey. *J Sch Health* 2003;73:207-15.

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