



Tobacco handling by pregnant bidi workers : As hazardous as smoking during pregnancy

Sardesai Suman P, Shinde Namdeo S, Patil Shailesh B, Rayate Mukta N, Muley Bharat

Dr. V.M. Government Medical College & S.C.S.M. General Hospital, Solapur, Maharashtra, India

OBJECTIVE(S) : To determine the effects of tobacco handling in pregnant bidi workers, mainly birth weight reduction, placental histopathological changes and urine cotinine levels.

METHOD(S) : A three phase prospective study was done

Phase 1 : Birth weight estimation of babies in 276 bidi workers and 276 control group of women at term.

Phase 2 : Comparison of birth weight, fetoplacental ratio and placental histopathology in study group women (n=100) at term with these in control group (n=100).

Phase 3 : Estimation of urine cotinine levels by Radio Immunoassay in bidi workers (n=76) pregnant or otherwise.

RESULTS : There was lowering of birth weight of babies in bidi workers by 310g. There was increased fetoplacental ratio in the study group along with significant placental changes like villous fibrosis (21%), basement membrane thickening (43%), calcification (61%), and moderate blood vessel thickening (41%). Urine cotinine levels were significantly high in 58.90% of bidi workers.

CONCLUSION(S) : Tobacco handling by pregnant bidi workers is as hazardous as smoking during pregnancy.

Key words : pregnant bidi workers, birth weight, placental changes, urine cotinine levels.

Introduction

Smoking during pregnancy is associated with increased pregnancy complications such as decreased birth weight and increased perinatal morbidity and mortality. Many studies have been done on the effect of cigarette smoking during pregnancy. In South East Asia smoking among women may be rare but use of smokeless tobacco is common. The smokeless tobacco can be used as misri or tobacco chewing. One of the forms of smokeless tobacco exposure is tobacco handling while preparing bidis. The tobacco in this form will be inhaled as dust and then absorbed or it may be absorbed through intact skin. Tobacco chewers had babies with

consistent birth weight deficit of 100-200g¹. However no study has been done so far to see the effect of tobacco handling in pregnant workers employed in bidi industries.

Bidi is a rolled up tendu leaf containing tobacco ubiquitous to the Indian subcontinent. It is a cheaper alternative to cigarette. Women employed in bidi industries take the raw material tobacco and tendu leaves home and after sorting out tendu leaves they roll up bidis with tobacco.

In India there are a large number of bidi industries spread across the length and breadth of the country. There are 28 bidi industries in the city of Solapur, where this study was done and around 45,000 women are employed in these industries. Majority of these women belong to low socioeconomic status which compels them to work and earn money to supplement their family income.

Nicotine is readily absorbed from the respiratory tract, buccal mucous membrane and skin. While preparing bidis ingredients

Paper received on 19/12/2006; accepted on 20/06/2007

Correspondence :

Dr. Sardesai Suman P

Soham Residency, Flat No.9,

23/1, Railway Lines, Solapur - 413 001.

Tel. 91-0217-2322750.

tobacco is likely to be absorbed through intact skin of the hands and inhaled as fine dust.

The aim of this study was to see the effect of tobacco handling in pregnant bidi workers in the form of birth weight, fetoplacental ratio, and histopathological changes in the placenta. To confirm the nicotine absorption while tobacco handling, estimation of urine cotinine was done in these bidi workers pregnant or otherwise.

Methods

The study of effect of tobacco handling in bidi workers at term was done in women who reported to labor wards for delivery.

The study was done in 3 phases -

Phase 1 : The first phase was a pilot study to see the effect of tobacco handling in bidi workers if any, in the form of birth weight of babies at term and compare it with birth weight in controls. As there is no reference available regarding this form of tobacco exposure on pregnancy outcome, this pilot project was taken up. A total of 276 bidi workers and an equal number of controls were studied. The two groups were comparable in all demographic variables including mean maternal age, parity and socioeconomic status.

Phase 2: In the second phase 100 bidi workers at term and an equal number of controls were recruited. Besides birth weight, placental study was done. Membranes were trimmed off the placenta, blood was squeezed out and cord was cut close to its insertion. Gross examination of maternal and fetal surfaces was done and following things were noted.

1. Weight of placenta and fetoplacental ratio.
2. Calcification and infarction over maternal and fetal surfaces.
3. Suspicious areas were biopsied and sent for histopathological study.

Phase 3. In the third phase urine cotinine levels were estimated in 76 bidi workers pregnant or otherwise, to see the extent of absorption of nicotine by skin or by inhalation as dust while rolling bidis. Urine cotinine estimation was done by radioimmuno assay of (RIA) double nicotine metabolite.

For statistical analysis of the differences between study and control group z-test was applied.

Results

Birth weight of babies in study and control group

The mean birth weight of babies in the study group was 2.350 ± 0.420 (S.D.) kg as compared to 2.660 ± 0.350 (S.D.) kg in the control group. There was highly significant reduction in mean birth weight of babies in the study group by 310g ($P < 0.001$) (Table 1).

Table 1. Birth weight and fetoplacental ratio in study group and control group

	Mean birth weight (kg) \pm SD	Mean placental weight (gm) \pm SD	Fetoplacental ratio \pm SD
Study Group (n=100)	2.510 ± 433.41^a	497 ± 31.28^b	0.2029 ± 0.028^c
Control Group (n=100)	2.798 ± 331.43^a	495 ± 18.17^b	0.1798 ± 0.017^c

^a $P < 0.001$ ^b $P > 0.05$

The effect of tobacco on pregnancy in terms of birth weight is dose related. There is a definite correlation of amount of tobacco exposure and birth weight in the study group.

Birth weight and fetoplacental ratio in study and control group.

Birth weight and fetoplacental ratio is compared in two groups in Table 2. This second phase of our study also showed reduction in mean birth weight in the study group by 288g as compared to that in the control ($P < 0.001$). The fetoplacental ratio in the study group was 0.2029 ± 0.028 and in control group it was 0.1798 ± 0.017 ($P < 0.001$).

Placental histopathological changes

The placental histopathological changes are depicted in Table 3. There was statistically significant increase in the incidence of basement membrane thickening, villous fibrosis, and calcification in study group ($P < 0.05$). Other compared parameters such as intervillous fibrin deposits, intravillous fibrinoid changes, syncytial knotting, blood vessel thickening, and presence of inflammation showed no significant differences in the two groups.

Urine cotinine levels in bidi workers

Urine cotinine estimation was done in 76 bidi workers pregnant or otherwise. These women had no tobacco exposure in active or passive form. The results of urine cotinine estimation are shown in Table 4. Urine cotinine was not detected in 22 (28.95%) bidi workers, while it was detected in negligible amount of $< 10\text{ng/mL}$ in six (7.69%) bidi workers. It was present in 48 women, in levels ranging from $> 10\text{ng/mL}$ to 3300 ng/mL . There were eight pregnant women among 76 study group cases. Their urine cotinine levels ranged from 10ng/mL to 500 ng/mL .

Table 2. Placental histopathological changes

Placental	Bidi worker (n=100) Number	Control group (n=100) Number
Intervillous fibrin deposits**		
No deposits	25	18
I	68	82
II	07	00
III	00	00
Intravillous fibrinoid change**		
None	11	06
I (< 5%)	79	92
II (≥ 5%)	10	02
Basement membrane thickening *		
None	57	84
Mild	40 ^a	16 ^a
Moderate	03	00
Villous fibrosis *		
None	79	96
I (0 - 3%)	21	04 ^b
II (> 3%)	00	00
Syncytial knots **		
None	10	10
0 -29	68	78
30-59	22	12
60-89	00	00
≥ 90	00	00
Blood vessel thickening **		
None	72	79
Mild	24	21
Moderate **	04	00
Calcification *		
Absent	39	56
Present	61 ^c	44 ^c
Inflammation **		
Absent	81	87
Present	19	13

^{a,b,c} P < 0.05

Table 3. Urine cotinine levels

Urine cotinine (ng/mL)	No. of Patients	Percentage
Not detected	22	28.95
<10	06	07.89
10-100	13	17.10
101-500	22	28.95
>500	13	17.10
Total	76	100.00

Discussion

The association between smoking by the pregnant women and reduction in birth weight has been reported, when all other variables known to influence birth weight were taken into account². Maternal smoking in pregnancy is associated with adverse pregnancy outcome including an increased risk of preterm birth, placental abruption, placenta previa, and low birth weight. The reduction in neonatal weight observed with maternal smoking may have life long consequences because evidence points to significant pediatric and adult morbidity associated with reduced birth weight². Birth weight reduction ranging from 115g to 395g due to tobacco exposure either in the form of smoking or chewing is reported by various authors^{1,2,6,7}. We hypothesize that tobacco handling while preparing bidis in pregnant women has same deleterious effect as smoking and this study proves it.

The first and the second phase of our study show statistically highly significant reduction in birth weight of babies of bidi workers by 288 & 310g respectively (P<0.001).

In the second phase fetoplacental ratio was high and this high fetoplacental ratio denotes fetal hypoxia which is consistent with the fetoplacental ratio seen in smokers^{3,4}. The histopathological changes like calcification, basement membrane thickening, villous fibrosis and moderate blood vessel thickening were significantly more in bidi workers. These placental changes are very similar to what has been reported by Christianson³ in smokers. Structural changes in placenta can undoubtedly impair its function and affect fetal growth. Calcification and infarction reduce uteroplacental circulation resulting in low birth weight babies. These histopathological changes seen in the study group are due to persistent exposure to tobacco while preparing bidis.

In order to see the extent of absorption of nicotine while preparing bidis, urine cotinine estimation was done in the third phase. Cotinine, a nicotine metabolite, is used to quantify exposure to tobacco, which readily gains access to fetal circulation. Fetal cotinine concentration in pregnant smokers is on an average 90% of maternal values throughout gestation and these values remain higher in fetal circulation for longer period⁵. This principle is also applicable to bidi workers who are exposed to tobacco for long hours of the day even during pregnancy.

Urine cotinine was detected in 48 bidi workers (63.16%) in the range of 10ng to 3300ng/mL. There was no other source of tobacco exposure in these women in the form of either tobacco chewing or smoking. It was not detected in 22 women (28.95%).

According to Haddow et al⁶ women who smoked more than

25 cigarettes per day had infants 289g. lighter than nonsmokers. Ellard et al ⁷ also reported a smoking related deficit of 279g in the birth weight when comparisons were made between biochemically proved smokers and nonsmokers. In our study there was consistent reduction in birth weight in bidi workers by 310g. This reduction in birth weight in Indian babies is very significant and amounts to the effect of smoking 25 cigarettes per day by the mother.

Estimation of serum cotinine levels along with the cord blood cotinine will probably be the better evidence linking exposure to tobacco while bidi making and resultant low birth weight babies. Doppler flow studies will throw some light on the changes in the fetoplacental circulation that are similar to those seen in fetal growth retardation and are indicative of increased placental vascular resistance ⁸.

Conclusion

Pregnant bidi workers have low birth weight babies, increased fetoplacental ratio. Bidi workers show significant urine cotinine levels indicating tobacco absorption.

Acknowledgement

The authors wish to thank Dr. Mashal and Dr. Mrs. Kanetkar from the Department of Pathology for their assistance in

doing histopathological studies of placentas and Muley Laboratories for estimation of urine cotinine levels.

References

1. Gupta PC, Sreevidya S. Smokeless tobacco use, birth weight and gestational age. Population based prospective cohort study of 1217 women in Mumbai, India. *BMJ* 2004; 328: 1538.
2. Bernstein IM, Mongeon JA, Badger GA et al. Maternal smoking and its association with birth weight. *Obstet Gynecol* 2005; 106: 986-91.
3. Christianson RE. Gross differences observed in the placentas of smoker and nonsmokers. *Am J Epidemiol* 1979; 110: 178-87.
4. Wingerd J, Roberta Christianson R, Lovitt WV et al. Placenta ratio in white and black women: relation to smoking and anemia. *Am J Obstet Gynecol* 1976; 124: 671-5.
5. Donnenfeld AE, Pulkkinen A, Palomaki GE et al. Simultaneous fetal and maternal cotinine levels in pregnant women smokers. *Am J Obstet Gynecol* 1993; 168: 781-2.
6. Haddow JE, Knight GJ, Palomaki GE et al. Cigarette consumption and serum cotinine in relation to birth weight. *Br J Obstet Gynaecol* 1987; 94: 678-81.
7. Ellard GA, Johnstone FD, Prescott RJ et al. Smoking during pregnancy: the dose dependence of birth weight deficits. *Br J Obstet Gynaecol* 1996; 103: 806-13.
8. Morrow RJ, Knox Ritchie JW, Bull SB Maternal cigarette smoking: the effects on umbilical and uterine blood flow velocity. *Am J Obstet Gynecol* 1988; 159: 1069-71.