

## Study of exposure to second hand smoke in pregnant women and its impact on pulmonary functions and pregnancy outcomes

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### Abstract

**Introduction:** Adverse effects of exposure to second hand smoke during pregnancy are associated with decrease in pulmonary functions, small for gestational age babies & preterm delivery. Aim of our study was to observe the pregnancy outcome & pulmonary function tests in pregnant women exposed to second hand smoke (SHS) & in women not exposed to SHS.

**Objectives:** (1). To observe pulmonary function tests (PFT) in pregnant women exposed to second hand smoke & not exposed to SHS. (2) To observe the pregnancy outcome in both pregnant women exposed & not exposed to second hand smoke (SHS) like preterm delivery, caesarean section and small for gestational age (SGA) neonates.

**Materials and Methods:** It is a hospital-based prospective case control observational study done at department of obstetrics & gynecology, UCMS & GTB hospital, Delhi from October 2015 to March 2017. Total 204 antenatal women between 6 to 28 weeks of pregnancy were recruited. Out of these, 82 women had exposure to SHS (second hand smoke) & 122 women had no exposure to SHS. Spirometry of these women were done & FEV1, FEV6 & FEV1/FEV6 ratios were obtained. These patients were followed up till delivery for pregnancy outcome & small for gestational age babies.

**Results:** PFT parameters, FEV1 & FEV6 were reduced in women exposed to SHS as compared to non-exposed women (84.1% vs 64.8% & 73.2 vs 62.3% respectively). Ratio of FEV1/FEV6 (<0.70) was significantly reduced in women exposed to SHS (p value 0.001). Incidence of preterm birth was significantly higher among women exposed to SHS (36.6%, p value 0.003). There was statistically significant difference in incidence of small for gestational age babies in women exposed to SHS as compared to women not exposed to SHS (28% vs 9.8%).

**Conclusion:** The study concluded that pregnant women exposed to second hand smoke have many negative effects on their lung functions and pregnancy outcome.

**Keywords:** Pregnancy, Second hand smoke, Pulmonary function test, Small for gestational age.

### Introduction

Second hand smoking also known as involuntary smoking & passive smoking usually refers to the inhalation of smoke that is either exhaled by a smoker or released as side stream smoke from a burning cigarette.<sup>1</sup> Second hand smoke (SHS) constitutes about 85% of the smoke present in the room & contains many potentially toxic gases in higher concentrations than in the main-stream smoke.<sup>2</sup> Prenatal exposure of human fetus to tobacco smoke through maternal passive smoking has been linked to reduced birth weight, enhanced susceptibility to respiratory diseases. The underlying mechanisms for these effects are yet to be elucidated. It is possible that the carbon monoxide in the smoke could be combining with hemoglobin leading to fetal hypoxia. Nicotine in the smoke cause inappropriate stimulation of nicotinic cholinergic receptors causing vasoconstriction further aggravating fetal hypoxia.<sup>3</sup>

There is a biological plausibility that passive smoking can affect the pulmonary functions similar to the effects of active smoking. Exposure to second hand smoke also results in some decrements in lung volumes & flows. People exposed to second hand smoke have higher prevalence of respiratory symptoms, pulmonary function abnormality and greater annual rate of decline in FEV1 and greater COPD mortality rate than non smokers.<sup>4</sup> There are only a few cross

sectional & longitudinal studies that have shown passive smoking as an important risk factor for obstructive lung disease with a significant dose response relationship.<sup>5,6</sup>

Much of the evidence on the relation between passive smoking and reproductive outcome is from developed countries with little information from middle & lower income countries. Although the prevalence of smoking among women is often lower relative to men in developing countries, there is substantial evidence that women from these countries who do not smoke live in environments where they are subjected to high rates of second hand smoke (SHS).<sup>7</sup> Understanding the impact of passive smoking on reproductive health outcomes is therefore important to develop appropriate interventions to improve the health of mothers & their children who are exposed to passive smoking. Aim of our study was to observe the pregnancy outcome & pulmonary function tests in pregnant women exposed to passive smoking & in women not exposed to passive smoking.

### Materials and Methods

It was a prospective observational case control study done at department of obstetrics & gynecology, UCMS & GTB hospital, Delhi from October 2015 to March 2017. Total 423 antenatal women were screened and 243

were recruited for study but 39 patients were lost to follow up, hence 204 patients were taken. Out of 204 patients, 82 women had exposure to second hand smoke (SHS) & 122 women had no exposure to SHS. Pregnant women from 6 to 28 weeks of gestation with asymptomatic & uncomplicated pregnancy were recruited for the study.

#### Inclusion Criteria:

Asymptomatic pregnant women between 18-35 years of age group with period of gestation between 6-28 weeks.

#### Exclusion Criteria:

1. <18 & >35yr of age group
2. History of chronic medical illness (eg. Diabetes mellitus, hypertension, renal disorders etc.)
3. Respiratory conditions like TB, COPD & asthma
4. Active smoker & occupational exposure to smoke, dust & factory workers
5. Any complication of pregnancy
6. Multiple pregnancy

All patients who fulfilled the criteria of study, their written informed consent was taken & predesigned structured questionnaire & pregnancy outcome was filled. In detail inquired about how many person in your household smoke bidi or cigarette and how many bidi or cigarette per day and also documented the relation of person with pregnant woman like husband, brother in law father in law, mother in law or father, who all live in same household. Pulmonary function tests (PFT) of these women were done

and following spirometric indices: FEV1 (forced expiratory volume in one second), FEV6 (forced expiratory volume in 6 seconds) & FEV1/FEV6 ratio were observed. In pulmonary function testing, FEV1/FEV6 ratio of <0.70 is commonly considered diagnostic of COPD. FEV1 & FEV6 less than 80% were considered abnormal (GOLD criteria 2014).<sup>8</sup> These patients were followed up till delivery for pregnancy outcome & small for gestational age babies.

#### Statistical Analysis

We performed all statistical analyses using SPSS 23.0 and Epi info 7 for windows. Univariate analysis (chi square test) was done to find statistical significance ( $P < 0.05$ ) and unadjusted odds ratio.

#### Results

Table 1 shows the socio-demographic characteristics & antenatal profile of study participants. Mean age & parity of participants in both groups were comparable. The women exposed to second hand smoke (SHS) were less educated as compared to women not exposed to SHS (38% vs. 28% illiterates and 19.5% vs 29% graduates or above, respectively) & fewer were employed. There was no statistically significant difference for antenatal problems (anemia, hypertension, abruptio placentae, placenta previa) in both the groups.

**Table 1: Sociodemographic profile & antenatal profile of pregnant women exposed to second hand smoking & not exposed to smoking**

| Characteristics                | SHS Not exposed (n=122) | SHS Exposed (n=82) |
|--------------------------------|-------------------------|--------------------|
| <b>Age: years Mean±SD</b>      | 24.4 ± 4                | 24.23 ± 3.5        |
| <b>Education:</b>              |                         |                    |
| Illiterate                     | 28(22.9%)               | 38(46.34%)         |
| Primary & middle education     | 58(47.5%)               | 28(34%)            |
| Secondary & high education     | 36(29%)                 | 16(19.5%)          |
| <b>Socioeconomic Status:</b>   |                         |                    |
| Upper & upper middle           | 48(39.3%)               | 18(21.9%)          |
| Middle                         | 42(34.4%)               | 20(24.3%)          |
| Lower                          | 32(26.2%)               | 44(53.65%)         |
| <b>Gravida</b>                 |                         |                    |
| Primigravida                   | 57(46.7%)               | 34(36.6%)          |
| Multigravida                   | 65(53.3%)               | 48(58.5%)          |
| <b>Occupation</b>              |                         |                    |
| Employed                       | 70(57.3%)               | 28(34.1%)          |
| Not employed                   | 52(42.6%)               | 54(65.8%)          |
| <b>Antenatal complications</b> |                         |                    |
| Hypertension                   | 18(14.7%)               | 13(15.8%)          |
| Anemia                         | 40(32%)                 | 32(40%)            |
| Abruptio placentae             | 0                       | 0                  |
| Placenta previa                | 1(0.8%)                 | 0                  |

Effect on pulmonary function tests & reproductive outcome and in both the groups are shown in table 2. Pulmonary function tests were significantly decreased in women exposed to second hand smoke (SHS) as compared to non- exposed women. Values of FEV1 & FEV6 were less than 80 percent in more number of women with second

hand smoking as compared to non- exposed women (84.1% vs 64.8% & 73.2 vs 62.3% respectively). Ratio of FEV1/FEV6(<0.70) was significantly reduced in women exposed to second hand smoke as compared to non- exposed women (p value 0.001).

Incidence of preterm birth was significantly higher among women exposed to second hand smoke (36.6%, p value 0.003). Mode of delivery (caesarean section & vaginal delivery) were similar in both groups. There was statistically

significant difference in incidence of small for gestational age babies in women exposed to second hand smoke as compared to women not exposed to passive smoke (28% vs 9.8%).

**Table 2: Pulmonary function tests & reproductive outcome in pregnant women exposed to second hand smoke & not exposed to second hand smoke (SHS)**

| Characteristics           |       | SHS Not exposed (n=122) | SHS Exposed (n=82) | X <sup>2</sup> | P value |
|---------------------------|-------|-------------------------|--------------------|----------------|---------|
| FEV 1                     | <80%  | 79 (64.8%)              | 69 (84.1%)         | 9.260          | 0.002   |
|                           |       |                         |                    |                |         |
| FEV 6                     | <80%  | 76 (62.3%)              | 60 (73.2%)         | 2.610          | 0.106   |
|                           |       |                         |                    |                |         |
| V1/V6                     | <0.70 | 7 (5.7%)                | 18 (22%)           | 11.98          | 0.001   |
|                           |       |                         |                    |                |         |
| Preterm delivery (<37 wk) |       | 22 (18%)                | 30 (36.6%)         | 8.887          | 0.003   |
| Mode of Delivery          | LSCS  | 26 (21.3%)              | 15 (18.3%)         | 0.278          | 0.598   |
|                           | NVD   | 96 (78.7%)              | 67 (81.7%)         |                |         |
| SGA neonates              |       | 12 (9.8%)               | 23 (28%)           | 11.44          | 0.001   |

The univariate logistic regression analyses for reproductive outcome & changes in pulmonary function test in relation to exposure with second hand smoke is shown in table 3. Exposure to second hand smoke during pregnancy was significantly associated with decrease in FEV1 (OR 1.6; 95% CI: 1.4-5.8) & FEV1/FEV6 (OR 4.6; 95% CI:1.8-11.6).

The crude odds ratios were significant for preterm birth & small for gestational age babies.

**Table 3: Logistic regression analyses to assess the odds of changes in pulmonary function tests & adverse pregnancy outcome in relation to the SHS exposure**

| Variable          | Crude OR | 95% CI   |
|-------------------|----------|----------|
| FEV1              | 2.9      | 1.4-5.8  |
| FEV6              | 1.6      | 0.9-3.0  |
| FEV1/FEV6         | 4.6      | 1.8-11.6 |
| Preterm birth     | 2.6      | 1.4-5.0  |
| Caesarean section | 1.2      | 0.6-2.4  |
| SGA neonate       | 3.6      | 1.7-7.7  |

## Discussion

Second hand smoke involves exposure to the same range of tobacco toxins experienced by active smokers. Pregnant women who breathe in the second hand smoke of the other people are at an increased risk of serious pregnancy complication. With regard to demographic data our study revealed that majority of women exposed to second hand smoke were less educated (46%) & unemployed (65.8%). These results agree with studies by Hadayat et al<sup>1</sup> and Mohmoud et al<sup>9</sup> who reported that most of passive smoker women were less educated, unemployed in their studies.

Pulmonary function tests were significantly decreased in women exposed to second hand smoke as compared to non exposed women in our study. FEV1 was less than 80% in 84% of women exposed to SHS in our study.

FEV1/FEV6 ratio was less than 0.70 in 22% women exposed to second hand smoke as compared to 7% in non exposed group. FEV6 was also decreased in women exposed to second hand smoke. There are only a few studies that have shown SHS exposure as an important risk factor for obstructive lung disease & causing decrements in lung volume in pregnant women. Xu X & Li B.<sup>6</sup> (1995) & Anand Mistry et al (2014)<sup>10</sup> reported a significant association between exposure to ETS & reduced levels of FEV1 & FVC in adults which is in agreement to our results. Dayal et al reported that passive smoking is a significant risk factor for obstructive respiratory disease in adult population.<sup>5</sup> But none of studies have been done on pregnant women. These results agree with our results however larger longitudinal trials on pregnant women are needed to evaluate progression of lung function impairment with continued exposure to SHS.

Our study showed 36.6% of pregnant women exposed to second hand smoke had premature delivery. Similar results were observed by Goel et al<sup>2</sup> and Blomberg et al<sup>11</sup> who reported that exposure to passive smoking increase the risk of preterm birth.

A well-recognized & documented adverse effect of maternal tobacco exposure is that on birth weight & anthropometric measurements of the newborn leading to high prevalence of low birth weight (LBW) & small for gestational age (SGA) infants.<sup>12</sup> Regarding the effect of second hand smoke (SHS) on neonatal outcome, our study revealed that 28% of neonates born to women exposed to SHS were SGA (small for gestational age) as compared to only 9.8% SGA neonates born to non- exposed women & the difference was statistically significant. Similar findings were reported by Gupta et al<sup>13</sup> & Mohmoud et al<sup>9</sup> who observed strong relationship between maternal passive smoking & SGA neonates.

## Conclusion

The study concluded that pregnant women exposed to second hand smoke have many negative effects on their lung functions, pregnancy & newborn outcomes. There was a poor knowledge and awareness about SHS in our population.

## Recommendation

Study findings emphasize the need for awareness and action against maternal tobacco exposure to protect mother as well as fetus. Education & counseling of pregnant women should be done to save them from hazards of second hand smoke.

**Conflict of Interest:** None.

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