

# Risk factors of chronic obstructive pulmonary disease among rural women, Chittagong, Bangladesh

Rajat S.R. Biswas, Fazlee K. Chowdhury

**Background** There are different risk factors for chronic obstructive pulmonary disease (COPD). Village women of developing countries such as Bangladesh are at a risk of COPD.

**Aim** The present study was aimed to find risk factors of COPD among rural women of Bangladesh.

**Patients and methods** This observational study was conducted in different villages of Chittagong, Bangladesh, among 250 women who were exposed to different risk factors of COPD

Women aged over 40 years were given a questionnaire adopted from a previous prevalence study of COPD in Bangladesh. Spirometry was performed in all subjects. A postbronchodilator ratio of the forced expiratory volume in 1 s (FEV1) to forced vital capacity (FVC) was calculated among all women who had FEV1/FVC ratio less than 0.70. Women having postbronchodilator FEV1/FVC ratio less than 0.70 were diagnosed to have COPD (GOLD criteria). After collection, all data were analyzed by SPSS-20.

**Results** Overall prevalence of COPD in rural women aged over 40 years was 20.4%. Most (76.9%) of them who did not have COPD were in the age group of 40–49 years and those who had COPD were in the age group of 60–69 years (51.0%). A majority (60%) of the women were poorly educated or not educated. Most women were housewives (86.4%). FEV1/FVC ratio significantly reduced in relation with

different risk factors of COPD. Multinomial logistic regression analysis showed that respiratory distress in family members [odds ratio (OR)=0.633], nature of kitchen (1.206), seasonal variation in cooking (OR=1.245), cough in childhood (OR=0.336), tobacco chewing habit (OR=12.491), type of stove (OR=0.191), history of cough (OR=0.130), and life-time smoking history (OR=0.376) influenced the development of COPD. Lung function also was significantly reduced ( $P<0.05$ ) among women who were using biomass compared with those using cleaner fuels such as natural gas/liquid petroleum gas.

**Conclusion** In the living conditions existing in the rural areas of Chittagong, Bangladesh, biomass smoke pollution, smoking, and cooking habits are some important risk factors of COPD in rural Bangladesh.

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Chattagram Maa-O-Shishu General Hospital, Agrabad, Chittagong, Bangladesh

Correspondence to Rajat S.R. Biswas, MD, Chattagram Ma Shishu O General Hospital, Agrabad, Chittagong, 4000, Bangladesh; Tel: + 880 181 980 8433; fax: 880-31-2525409; e-mail: rajatbiswas76@yahoo.com

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## Introduction

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death, and it affects more than 10 million persons in the USA [1]. In Bangladesh, age-adjusted death/100 000 is 66.4 [1,2]. COPD is also a disease of increasing public health importance around the world. Estimates suggest that COPD will rise from the sixth to the third most common cause of death worldwide by 2020 [3].

In Bangladesh, a large cluster study [4] [Burden of Obstructive Lung Disease (BOLD)] found that the population prevalence of COPD among people greater than 40 years and older is 21.6% and overall prevalence in general population is 4.32%. The disease hits hardest those who are still in the productive phase of life (42% of COPD between 40 and 50 years) [4]. The women in rural areas suffer more from COPD than those in urban areas. According to that study, exposure to biomass smoke (from open stoves/wood fires) appears to be a significant risk factor for the disease in village women [5].

Risk factors of COPD include both host and environmental factors in addition to the interaction between these factors. Other than a rare genetic influence of host factor, environmental factors are more important regarding the development of COPD. Among the various environmental factors, tobacco smoke, heavy exposure to occupational dust and chemicals, indoor/outdoor air pollution, and infection, especially childhood respiratory infection and socioeconomic status, are important [3].

Women of rural areas of Bangladesh are the most underprivileged community, and most of them are engaged in household work. Among them, a large number are using the biomass fuel for cooking. Most of them are nonsmokers. This practice is responsible for different health hazards such as

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COPD, tuberculosis, and bronchial carcinoma [6]. Different studies in many countries established that COPD is the leading respiratory problem in nonsmokers who are using biomass fuel, but in Bangladesh this field is yet to be explored largely especially among rural women. Therefore, this study is aimed at finding the common risk factors of COPD among rural women of Chittagong, Bangladesh.

## Patients and methods

This observational study involved the five rural (villages) areas of Chittagong, Bangladesh during a 1-year study period from March 2010 to February 2011. There are a total of 14 upazilas (Fig. 1) in Chittagong. The areas are virtually indistinguishable from each other in terms of socioeconomic status, economy, diet, and access to healthcare. They are matched on these key characteristics and thus minimized the potential for confounding factors. Of those 14 upazilas, five upazilas were randomly selected first by lottery methods. Then from those five upazilas one village from each was selected again randomly, and then three to four paras (small community clusters) were selected from each village. Starting from the beginning of a road of a selected para, every alternate house was visited and women above 40 years

as per National ID Card and residing there and fulfilling inclusion criteria were included in the study after informed consent. At least 25 women from each para were interviewed using a case record form with a pretested questionnaire (Bengali version). The questionnaire was validated by a small pilot study. Finally, a total of 250 women were included in the data analysis after exclusion. Classically, COPD is mainly found after 40 years, and an age bar of 40 years was taken as inclusion criteria.

After getting consent, all selected women were asked to complete the questionnaire to obtain sociodemographic data related to personal information, smoking history, cooking practice, information related to respiration and allergy, cough, sputum, and respiratory distress. Patients were asked for history of suffering from pulmonary tuberculosis, and those who had a positive history or documentation of health records of Pulmonary tuberculosis (PTB) were not included in the study. Clinical examination was performed, and pulmonary function was assessed using a spirometer (CMS-SP 10, CONTEC; China). Postbronchodilator reversibility test was performed on those who had abnormal findings on initial spirometry without bronchodilator. After prebronchodilator spirometry, four puffs of salbutamol (400 mcg) were given by a metered dose inhaler with a spacer device. After 15 min, a postbronchodilator spirometry result was taken. Women who had forced expiratory volume in 1 s (FEV1)/forced vital capacity (FVC) less than 0.70 and who were found to be irreversible in postbronchodilator spirometry were selected as having COPD. Patients who documented history of respiratory disease were excluded from the study. Those having suspicious history of bronchial asthma were selected for the study initially. However, after performing reversible postbronchodilator spirometry they were excluded. The questionnaire introduced in the current study was revised from a study on 'Burden of Chronic Obstructive Lung Disease–Bangladesh (BOLD-BD)' conducted by Hasan *et al.* [4]. Exposure to biomass smoke was defined as using biological material (mainly wood, charcoal, grass, and crop residues or dung) for cooking or heating for greater than or equal to 10 years. Poor ventilation referred to places that did not have any opening in the kitchen. Subjects with a parent or sibling diagnosed with chronic bronchitis, emphysema, asthma, or COPD were deemed as having a family history of respiratory diseases. In the study, a portable spirometer was used and procedure of spirometry was performed as recommended by the American Thoracic Society. Selected subjects had

Figure 1



Different upazilas of Chittagong, Bangladesh.

bronchodilation tests within 15–20 min of being given a dose of 400 µg of salbutamol (Ventolin; GlaxoSmithKline, Uxbridge, UK) inhaled through a 500-ml spacer.

### Statistical analysis

Data were analyzed with SPSS (version 20; IBM, Armonk, New York, USA). Mean with confidence interval (CI) of quantitative variables was analyzed by *t*-test. Risk of COPD with exposure to biomass fuel and others was calculated by multiple logistic regression technique and calculation of odds ratio (OR).

### Results

Among 250 women in the study, most (76.9%) of them who did not have COPD were in the age group of 40–49 years and those who had COPD were in the age group of 60–69 years (51.0%). Majority (60%) were uneducated. Most (86.4%) of them were housewives (Table 1). FEV1/FVC significantly reduced in relation to risk factors such as respiratory distress in the family ( $P<0.05$ ), cough in childhood ( $P<0.05$ ), tobacco chewing habit ( $P<0.05$ ), type of stove ( $P<0.05$ ), history of cough now ( $P<0.05$ ), and fuel type ( $P<0.05$ ) (Table 2). Respiratory distress in family members (OR=0.633), nature of kitchen (OR=1.206), seasonal variation in cooking (OR=1.245), cough in childhood (OR=0.336), tobacco chewing habit (OR=12.491), type of stove (OR=0.191), history of cough (OR=0.130), and life-time smoking history (OR=0.376) were found to be some important risk factors of COPD (Table 3).

**Table 1 Personal and demographic profile**

Variables	COPD [n (%)]		Total [n (%)]
	Present	Absent	
Age group			
40–49 years	5 (9.8)	153 (76.9)	158 (63.2)
50–59 years	15 (29.4)	35 (17.6)	50 (20.0)
60–69 years	26 (51.0)	8 (4.0)	34 (13.6)
>70 years	5 (9.8)	3 (1.5)	8 (3.2)
Level of education			
Not attended school	32 (62.7)	41 (20.6)	73 (29.2)
Primary	10 (19.6)	67 (33.7)	77 (30.8)
SSC	2 (3.9)	67 (33.7)	69 (27.6)
HSC	7 (13.7)	21 (10.6)	28 (11.2)
Graduate	0 (0)	3 (1.5)	3 (1.2)
Occupation			
House wife	37 (72.5)	179 (89.9)	216 (86.4)
Day labor	10 (19.6)	9 (4.5)	19 (7.6)
Office work	4 (7.8)	11 (5.5)	15 (6.0)
Total	51 (100.0)	199 (100.0)	250 (100.0)

COPD, chronic obstructive pulmonary disease; HSC, higher secondary school; SSC, senior secondary school.

### Discussion

In the current study, a majority (63.2%) of the women were in the age group of 40–49 years. However, those suffering from COPD were found to be in the elderly group (>60 years, 51%). It may be because of direct effects of different risk factors along with decreased lung compliances. A prevalence study conducted in Bangladesh [4] also found that increasing age in rural women was an important contributing factor to COPD.

Most of the studied women were mainly housewives (216, 86.4%), as expected in relation with sociocultural practice of our country. Day laborer (7.6%) and office work (6%) were also found as some other occupations. The present findings are consistent with the study conducted earlier [4], in which it was found that most women in Bangladesh were housewives.

Most of the women were found as not attending school (29.2%) or completed only primary education (30.8%). COPD was found to be associated with less educational qualification than the women who

**Table 2 Relation of forced expiratory volume in 1 s/forced vital capacity ratio with different risk factors**

Risk factors of COPD	N	Mean	SD	P-value
Respiratory distress in the family				
Absent	178	0.7596	0.08516	0.001
Present	72	0.7067	0.11008	
Nature of kitchen				
Closed	159	0.7361	0.09863	0.073
Open	91	0.7587	0.08951	
Seasonal variation of cooking				
Seasonal	73	0.7614	0.08468	0.069
Always	177	0.7371	0.09971	
Cough in childhood				
No	215	0.7553	0.8983	0.001
Yes	35	0.6771	0.10532	
Tobacco chewing habit				
Present	148	0.7781	0.6770	0.001
Absent	102	0.6943	0.10903	
Type of stove				
Indoor	176	0.7262	0.10202	0.001
Outdoor	74	0.7874	0.6089	
History of cough now				
No	200	0.7895	0.4582	0.001
Yes	50	0.7142	0.10805	
Smoking history				
Current smoker	13	0.6469	0.09877	0.064
Past smoker	24	0.7192	0.11504	
Fuel type				
Biomass	150	0.7315	0.08635	0.009
LPG/NG	100	0.7636	0.09992	

COPD, chronic obstructive pulmonary disease; LPG, liquid petroleum gas; NG, natural gas.

**Table 3 Association or risk factors with chronic obstructive pulmonary disease**

Risk behaviors	COPD [n (%)]	OR	CI	P-value
Respiratory distress in family members		0.633	0.263–1.523	0.307
Present	25 (10)			
Absent	26 (10.4)			
Nature of kitchen		1.206	0.471–3.092	0.696
Open	13 (14.3)			
Closed	38 (23.9)			
Seasonal variation in cooking		1.245	0.448–3.465	0.675
Seasonal	9 (12.3)			
Always	42 (23.7)			
Cough in childhood		0.336	0.115–0.981	0.046
Present	17 (6.8)			
Absent	34 (13.6)			
Tobacco chewing habit		12.941	3.388–49.44	0.001
Present	40 (16)			
Absent	11 (4.4)			
Type of stove		0.191	0.075–0.485	0.001
Outdoor	3 (1.2)			
Indoor	48 (19.2)			
History of cough now		0.130	0.023–0.616	0.001
Present	49 (19.6)			
Absent	2 (0.8)			
Life-time smoking history		0.376	0.138–1.026	0.056
Present	16 (6.4)			
Absent	35 (14.01)			
Fuel type		0.316	0.119–0.833	0.02
Biomass	41 (16.4)			
NG/LPG	10 (4)			

CI, confidence interval; COPD, chronic obstructive pulmonary disease; LPG, liquid petroleum gas; NG, natural gas; OR, odds ratio.

had no COPD. It signifies that the more the educational qualification, the less the COPD. In a study conducted by Hasan *et al.* [4], it was also found that the more the time spent in learning the less the prevalence of COPD in illiterate, primary and below, secondary and below, higher secondary, and below and above higher secondary population - 49.77% (OR=1.279), 22.24% (OR=1.051), 17.42% (OR=0.728), 04.82% (OR=0.893), and 05.75% (OR=0.796), respectively.

The overall prevalence of COPD in the areas studied among women above 40 years was 20.4%. The prevalence of COPD was higher in women who use biomass (16.4%) and then in women who use natural gas or liquid petroleum gas (LPG) (4%). In Bangladesh, most of the villages use traditional stoves for cooking with biomass (Fig. 2), which might influence the development of COPD. FEV1/FVC was also significantly reduced among those who were using biomass compared with those using LPG or natural gas. Similar studies conducted in turkey [6] found that the prevalence of COPD in the exposed group was higher than that in the LPG group (28.5 vs. 13.6% crude OR=2.5,

**Figure 2**

Traditional stoves for cooking with biomass.

CI=1.5–4.0,  $P=0.001$ ). The fraction of COPD attributed to exposure to biomass smoke after adjusting for possible confounding factors was 23.1% (95% CI: 13.4–33.2). A study conducted in China [7] also found the use of biomass as a risk factor of COPD. The nonsmoking women who are using biomass has higher prevalence of COPD

than those who are using LPG (7.2 vs. 2.5%). Logistic regression analysis also showed statistically significant result among the biomass and LPG users (OR=3.11, CI=1.63–5.94,  $P \leq 0.001$ ). Life-time smoking history was common among the subjects of COPD. This might be an important factor in relation with influence to biomass fuel with COPD. FEV1/FVC ratio was found to be significantly reduced among the current and past smokers, as expected.

Multinomial logistic regression analysis showed that respiratory distress in family members (OR=0.633), nature of kitchen (OR=1.206), seasonal variation in cooking (OR=1.245), cough in childhood (OR=0.336), tobacco chewing habit (OR=12.491), type of stove (OR=0.191), history of cough (OR=0.130), and life-time smoking history (OR=0.376) might have some influence on the development of COPD in rural women.

Therefore, it can be concluded that the use of biomass fuel, smoking, and cooking practice might influence the development of COPD among rural women of Bangladesh.

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#### Conflicts of interest

There are no conflicts of interest.

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