

PRESENT SCENERIO OF INDOOR AIR POLLUTION IN RURAL AREAS OF JESSORE DISTRICT

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ABSTRACT

This study was conducted in the rural areas of Jessore district in Bangladesh to investigate the sources of indoor air pollution and its impact on human health. A quantitative approach followed by questionnaire survey was employed to determine the critical factors responsible for indoor air pollution. Biomass cooking fuel (wood and cowdung) was found as significant source of indoor air pollution. Besides outdoor dust, emissions from nearby buildings, solidwaste debris, mosquito coils, aerosol spray, cigarette smoking also contribute highly to indoor air pollution in the study areas. Women and children were the worst sufferers of indoor air pollution. Asthma was found in women. According to the survey, 17% women suffer from asthma in which only 7% patients have asthma from childhood and the rest had asthma afterwards may due to the indoor air pollution. According to the Jessore sadar hospital, around 20% of the patients have been suffering from asthma from childhood and the rest patients suffer later in life. This study will assist to develop concern among the people especially in rural areas to reduce the harmful effects of indoor air pollution.

Keywords: Indoor air pollution, Asthma, Wood smoke, Smoking, Mosquito Coil.

1. INTRODUCTION

Indoor Air Quality (IAQ) refers to the air quality within and around buildings relating to the health and comfort of building occupants. Indoor air pollution (IAP) is one of the greatest health hazards in the developing countries and causes 180 fatalities in an hour (Smith *et al.*, 2005). Population exposure to various air pollutants can be higher in the indoor environment than outdoors due to the time spent indoor (Ian Colbeck *et al.*, 2010). There are noticeable differences in the types and strength of air pollution sources across the globe and they are closely linked to socio-economic developments. Higher indoor concentrations can occur in developing countries. The types, concentration, and sources of indoor air pollutants can vary considerably from one micro-environment to another. Hence, an understanding of the concentration of pollutants in different micro-environments is of great importance of improving exposure estimates for developing efficient control strategies to reduce human exposure and health risk.

Epidemiological studies have linked exposure to indoor air pollution from dirty fuels with at least four major categories of illness such as acute respiratory infections (ARI) in children, chronic obstructive pulmonary disease (COPD), lung cancer and pregnancy related problems. In addition, evidence has now emerged showing a link of IAP with a number of other conditions, including asthma, cancer of the upper airway, cataracts, low birth weight, otitis media, preinatal mortality (stillbirth and deaths in the first week of life), and tuberculosis (WHO, 2000). Besides these, a plethora of studies in both developed and developing countries have found the same associated relationship between IAP and certain diseases. For instance, the association of IAP with ALRI5, asthma (Smith *et al.*, 2004) COPD6, lung cancer (WHO, 2000) low birth weight (WHO, 2000; Donna and Harding, 2005) and tuberculosis (WHO, 2000; Bruce *et al.*, 2002) was found.

In Bangladesh, it is reported that there are significant negative health effects of indoor smoke exposure on women and children. Women with less monthly household income (below 5000 BD Taka) and minimum level of education, using solid fuels and mud-ovens in poor ventilated environment, are more likely to be exposed to IAP and, as a consequence, have greater health risks than others (Bijoy Krishna Banik, 2017). It is highly likely that millions of people are unaware of the threats in their homes, similar as millions of smokers were unaware of the hazards of tobacco until the 1960s (Donna and Harding, 2005). This study was done to see the current scenario of indoor air pollution in the rural areas of Jessore and its impact on health especially on women and children. It is expected that this study will assist to raise consciousness of indoor air pollution.

2. RESEARCH METHODS

The study was conducted in Sajiali, Pultadanga, Abdulpur villages (at ward 7, in Churamonkathi union), Dougacia and Ahsannagar villages (at ward 6, in Churamonkathi union), Kolabagan, Kapalipara, Bombelar math, Suparibagan, Sahapara in Nilgonj village (ward 9), Fatepur village, (at ward 7, in Fatepur union) and Satiantola village (in Dorajhat union) between November, 2016 to April 2017. A significant number of households (167) were surveyed from the villages to find out the sources of indoor air pollution and its impact on human health. These areas were selected because all the villagers especially women, children and elderly persons in households are prone to indoor air pollution in many ways which was found from a preliminary survey. It is prospected that the survey will be helpful to develop concern among the people especially in rural areas about the harmful effects of indoor air pollution.

A quantitative method approach followed by questionnaire survey from various data sources was employed to investigate how many factors are responsible for indoor air pollution and what percentage of women, children and elderly persons are suffering from diseases which can be caused by indoor air pollution in Bangladesh. A numerical data will give us a more conspicuous conception about all the respects of the study like which factors contribute the most for indoor air pollution, which diseases govern among people due to indoor air pollution. The houses surveyed were categorized in four types. Kaca, Semipacca, Pacca Type-1 and Pacca Type-2. Kaca houses were defined as the houses made of Palm-leaves, Straw or Hay and Tin. Semipacca houses were defined as the houses made of Brick and Tin. Pacca Type-1 houses were made of Bricks only and Pacca Type-2 houses are made of concrete. 20.96% houses surveyed were kaca, 43.71% were semipacca. Pacca Type-1 and Pacca Type-2 houses were 26.35% and 8.98% respectively. Questions were asked about the outdoor and indoor sources of indoor air pollution and health condition of women to find the impact of indoor air pollution on their health.

3. RESULTS AND DISCUSSION

3.1 Outdoor sources of IAP

Dust, vehicles, landfill, nearby buildings and solidwaste debris were found as outdoor sources of IAP. Presence of dust was found 100%. That means in every houses presence of dust particles was found. The sources of dust were yard and nearby roads. So, dust played a very significant role in contributing to indoor air pollution in those areas. Solidwaste debris was found outside in 75% cases out of 167 numbers which also plays a big role as far as IAP is concerned. A multi response was found the survey given in Table-1. It is found that in every house there is presence of dust which is a significant pollutant causing Asthma. Industrial pollutants aren't found although it was taken into consideration. Because the survey was conducted in rural areas and there was no such industries in those areas.

Table 1: Percentage of Sources of IAP outside the Building

Sources Outside the building	Nos	Total	%
Dust	167	167	100
Industrial Pollutants	0	167	0
Vehicles	10	167	6.0
Landfill	2	167	1
Nearby Houses	16	167	10
Solidwaste Debris	126	167	75

3.2 Indoor sources of IAP

Mosquito coil, aerosol spray and cigarette were found as indoor sources of IAP. 83% people used mosquito coils out of 167 in their houses (Table 2). Most of them use coils in their bedrooms whereas one family was found to use coils in the cowhouse too. Mosquito coils are considered to be safe insecticides for humans and mammals, although some studies highlight concerns when they are used in closed rooms. Coils sold in China and Malaysia were found to produce as much smoke $PM_{2.5}$ as 75-137 burning cigarettes and formaldehyde emission levels in line with 51 burning cigarettes (Liu, Weili et al, 2003). The findings from the previous studies suggest that exposure to the smoke of mosquito coils can pose significant acute and chronic health risks. On the other hand 6% families used aerosol spray in their houses.

Table 2: Percentage of Sources inside the Building

Sources Inside the building	%
Mosquito Coil	83
Aerosol spray	6
Cigarette	38

Smoke of cigarettes is one of the vital sources of indoor air pollution. That's why question about smoking cigarette was included in the survey. 38% families were found where cigarette smoking prevailed (Table 2). 63 families were found to consume cigarettes. 54 families consumed 2 to 10 cigarettes a day (Table-3). Maximum 30 cigarettes were found to be consumed and 104 families did not consume cigarette.

Table-3: Numbers of cigarettes consumed per day

No of cigarettes consumed per day			
Range	2 to 10	>10 to ≤20	>20 to ≤30
No of houses	54	7	2

Cooking place plays a very significant role for indoor air pollution. Women and children are the most vulnerable in this case. Many times it was seen that women were directly exposed to smoke coming from cooking fuel. Sometimes children were also seen exposed to smoke coming from cooking fuel. In the survey, smoke condition (Poor/Moderate/ Good) were included and 85.63% ventilation systems of cooking place were found moderate (presence

of medium amount of smoke in the kitchen while cooking). 6.59% ventilation systems of cooking place were found good (presence of little or no smoke in the kitchen while cooking) and 7.78% ventilation systems of cooking place were found poor (presence of intolerant smoke in the kitchen while cooking).

Cooking time per day is shown in table 4. 49.70% women were exposed to smoke for 1 to 2.5 hours a day. Maximum cooking hour was found 6.0 hours, minimum cooking hours were found 1.0 hour and the average cooking duration was found 2.54 hours per day. More cooking hours mean more time of exposure to harmful ingredients of woodsmoke and increased risk of diseases.

Table-4: Duration of Cooking (hours) per day

Range	1.0-2.5	>2.5 to ≤4.0	>4.0 to ≤6.0
No of Houses	83	74	10
Percentage (%)	49.70	44.31	5.99

3.3 Health effects

Asthma, nose bleeds, irritation of eyes/nose/throat, headache and blood pressure were observed among women. 135 numbers of women had health issues out of 167. Among them 40% women had headache, 17% women had been suffering from asthma, 15% had blood pressure and the rest had nose bleeds and irritation of eyes/nose/throat.

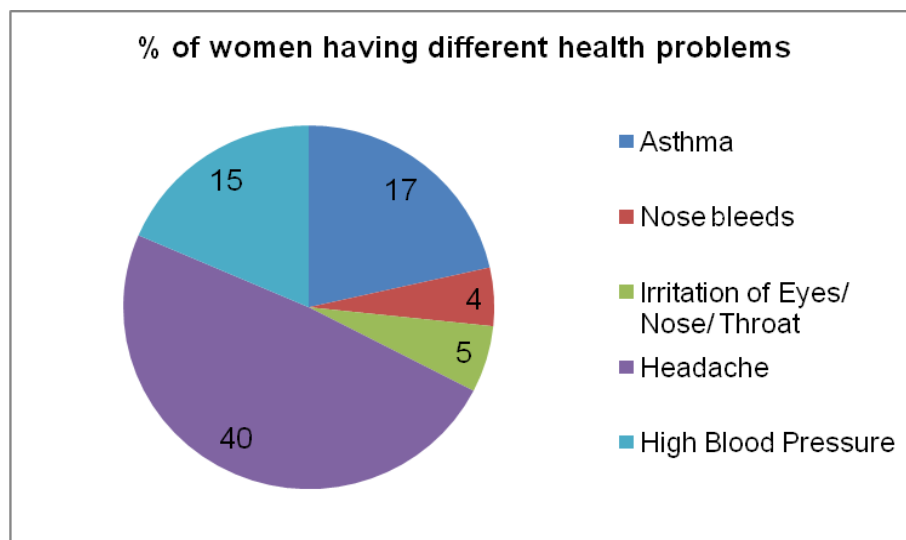


Figure 1: Percentages women having different health problems

Children had also been suffering from various health issues. 13% children had cough, wheeze, 9% had asthma and the rest had bronchitis, chronic sinus infection and pneumonia. (Figure 2). While 9% children have have asthma, 17% women were found having asthma. This value shows that the number is increasing with age and indoor air pollution plays a very significant role here.

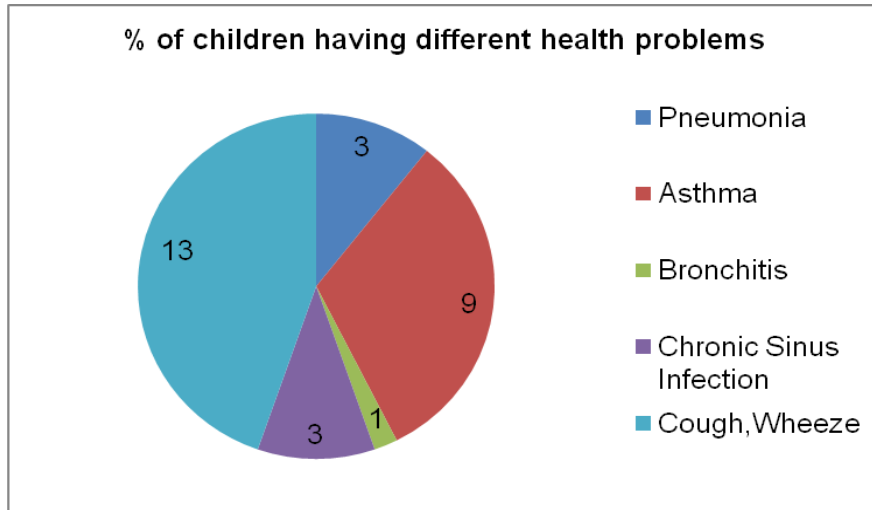


Figure 2: Percentages children having different health problems

According to the Jessore sadar hospital, it has been found that about 40 to 50 numbers of patients get admitted to the hospital per month. About 20% of the patients have been suffering from asthma from childhood which means 80% patients suffer from this disease later in life. The main reasons of asthma are considered the family positive history and allergic history of the patients. According to the survey, 17% people had been experiencing asthma in which only 7% patients had asthma from childhood and 93% had afterwards (figure 3).

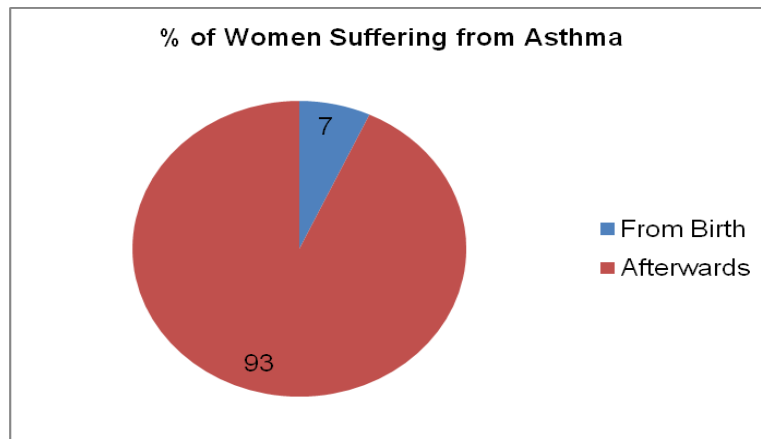


Figure 3: Percentages of women having different Asthma

Among Women having asthma 58.62% used wood as cooking fuel, 31.03% used wood and cowdung together as cooking fuel, 3.45% and 6.90% women used gas and cowdung simultaneously and only gas as their cooking fuel respectively (Figure 4). Women having asthma afterwards are mostly exposed to wood and cowdungstick smoke. So, it can be concluded that, woodsmoke and cowdung smoke can cause asthma afterwards.

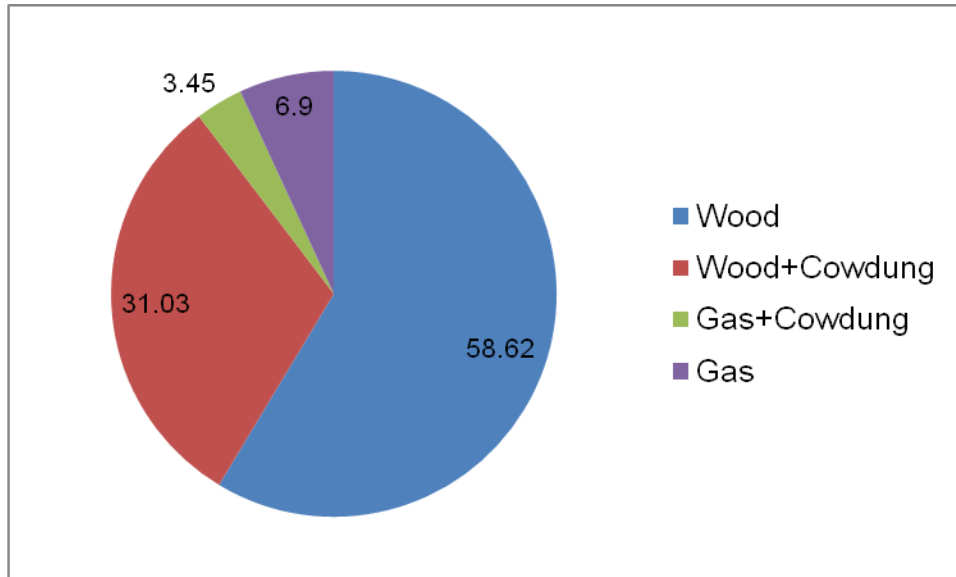


Figure 4: Percentage of types of fuel used by women having Asthma

4. CONCLUSIONS

Outdoor dust, Vehicles, landfill, emissions from nearby buildings, solidwaste debris, use of mosquito coil, aerosol spray, cigarette smoking and use of biomass as cooking fuel were found as the sources of indoor air pollution. Among these biomass fuel was considered as the crucial factors for indoor air pollution. Use of mosquito coil (83%), cigarette smoking (38%) and use of biomass as cooking also contributed significantly to indoor air pollution. Women were exposed to the pollution more than others. Asthma was found as a critical disease for women and children. Most women having asthma (58.62%) use wood and 31.03% wood and cowdung together, as their cooking fuel. The concerned authority should take necessary initiatives and consciousness must be raised among the general people to mitigate the harmful effects of indoor air pollution on human health.

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