HEALTH HAZARD OF INDOOR AIR POLLUTION
FROM BIOMASS FUEL USE IN INDIA
At least two billion people of the developing nations in Asia, sub-Saharan Africa, and Latin America still use unprocessed, solid biomass such as wood, cow dung and agricultural wastes for daily household cooking and room heating. Biomass fuel is cheap and is readily available in the remote countryside. But it is less combustible and highly polluting than liquid petroleum gas (LPG) or electricity. When biomass burns it emits smoke that leads to indoor air pollution (IAP) that is 3-5 times more than air pollution in the cities from road traffic and industries.

Biomass fuel usage in India

Biomass fuels including wood, cow dung, hay, paddy husk, jute stick and dried leaves are being extensively used in about two-third of the households in India and other south Asian countries (1; Table 1). The number of people dependent on these fuels in India alone is around 800 million. Annual consumption of biomass in India is 577 million tons of which wood constitutes 52%, dung cake 21% and agricultural wastes 20% [Fig. 1].

Table 1. Biomass fuel use in Indian subcontinent

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Sri Lanka</td>
<td>19</td>
<td>67</td>
</tr>
<tr>
<td>Pakistan</td>
<td>153</td>
<td>72</td>
</tr>
<tr>
<td>India</td>
<td>1055</td>
<td>74</td>
</tr>
<tr>
<td>Nepal</td>
<td>25</td>
<td>80</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>148</td>
<td>88</td>
</tr>
</tbody>
</table>

Besides cooking and room heating, biomass fuels are used in small-scale and cottage industries in India (Table 2).

Table 2. Biomass usage other than as cooking fuel

- Rice mill (paddy husk)
- Sugar, gur (crop residue)
- Brick making (wood)
- Lime (wood)
- Plantation/cash crop (cardamom, tobacco, rubber, pepper, coffee, cashew nut) processing
- Tea stalls, eateries (wood, crop residue)
- Bakery (wood, dung)
- Pottery (wood, dung)
- Ceramic and tiles
- Raw silk processing
- Other uses
- Crematorium (wood)

Biomass smoke: a mixture of hazardous chemicals

Biomass smoke contains thousands of pollutants in solid, liquid or gas form. Many are harmful for human health. They include fine and ultrafine particulate matters (UFP), carbon monoxide, oxides of nitrogen and sulphur, respiratory irritant phenols, cancer-causing benzene (a) pyrene and benzene, and tissue damaging transitional metals Cu, Fe, Ni, Cr and Zn (2).

Women are worst affected

Women in rural India usually spend 2-4 hours every day in kitchen preparing family meals. They inhaled large quantities of smoke in the process. Other victims are elderly members of the family who spent most of their time inside the home and very young children who accompany their mothers in the kitchen and often attend to fires [Fig. 2]. The extent of harmful pollutant exposure can be judged from the fact that during cooking with biomass a woman inhales carcinogens equivalent to smoking 2-20 packs of cigarettes per day (2).

Figure 1. Biomass fuel use in India (million tons/year)

Figure 2a. Woman cooking with biomass fuel in traditional oven

Kitchen type and air pollution

Poor people in the villages usually cook in traditional stoves that are not vented outside. Their kitchens in most cases are poorly ventilated because of low ceiling height and absence of chimney or even windows that hinders cross ventilation and dispersion of smoke. Besides, half of the households
Figure 5: Collection of dried leaves as cooking fuel.

Figure 4: Biomass fuel collection by rural woman.

Health: Figure 3b: A child commemorates the memory in the visual image of the burning cycle. This image also highlights the importance of using clean biomass fuels in the community.

Health: An environmental concern due to the low-level of emissions from biomass cooking and heating. The consequence is the risk of exposure to smoke in the form of smoke, which can lead to respiratory issues.

Health: Figure 2: A child commemorates the memory in the visual image of the burning cycle. This image also highlights the importance of using clean biomass fuels in the community.

Health: Figure 1: An environmental concern due to the low-level of emissions from biomass cooking and heating. The consequence is the risk of exposure to smoke in the form of smoke, which can lead to respiratory issues.
Adverse effects on female reproduction

Figure 3. Impact of biomass smoke on female reproduction

Table 3. Prevalence (%) of respiratory symptoms in rural women

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Lpg user (%)</th>
<th>Biomass user (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>7.1</td>
<td>10.5</td>
</tr>
<tr>
<td>Eye irritation</td>
<td>3.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Headache</td>
<td>2.0</td>
<td>1.2</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>6.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Cough</td>
<td>1.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Common cold</td>
<td>2.3</td>
<td>2.5</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Runny or stuffy nose</td>
<td>2.9</td>
<td>3.4</td>
</tr>
</tbody>
</table>

In India, in relation to cooking fuel use

38% had abnormal liver function against 116% of LPG users. Moreover, about 66% of women who used to cook with biomass had anemia, and 38% had abnormal liver function against 116% of LPG users. Moreover, 66% of women who used to cook with biomass had anemia, and 38% had abnormal liver function against 116% of LPG users.

Figure 7. Alveolar macrophages of biomass users

Biomass smoke and compromised immunity

Figure 6. Making of cow dung cake

Improvement of respiratory health

Figure 5. Changes in respiratory function

Figure 4. Changes in respiratory function
The initial change in the affected cell is known as a mutation. The cancer develops over steps that take 10-15 years to complete, with each step increasing the risk of cancer in the lung, nose, throat, and uterus. The process of cancer development is understood to involve the accumulation of mutations in DNA that lead to the growth of cancerous cells. These mutations can be caused by exposure to environmental factors such as smoke, radiation, and some chemicals.

**Figure 1:** Mortality from indoor air pollution: Global scenario.

**Table 4:** Neurobehavioral symptoms.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>LpG user</th>
<th>Biomass user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty in concentrating</td>
<td>22.7</td>
<td>0</td>
</tr>
<tr>
<td>Memory loss</td>
<td>24.9</td>
<td>10.7</td>
</tr>
<tr>
<td>Anxiety</td>
<td>24.4</td>
<td>9.1</td>
</tr>
<tr>
<td>Depression</td>
<td>18.5</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Figure 5:** Changes in plasma catecholamine levels.

- Adrenaline: LpG user > Biomass user
- Dopamine: LpG user < Biomass user
- Noradrenaline: LpG user < Biomass user

**Table 1:** The changes in plasma catecholamine levels.

- Adrenaline: LpG user > Biomass user
- Dopamine: LpG user < Biomass user
- Noradrenaline: LpG user < Biomass user

The damage has been found to result in a substantial part of the DNA damage being used without repair measures being taken. DNA damage can contribute to and increase in the rate of chromosomal and genomic abnormalities. DNA damage can lead to increases in chromosomal and genomic abnormalities. DNA damage can lead to the development of cancer. Cancer is a gene that is affected in DNA damage. Biomass smoke contains several chemicals capable of inducing changes in DNA damage, including several chemicals capable of inducing changes in DNA damage.

**Figure 10:** Pulmonary function tests in progress.
By NEWS in West Bengal

Figure 12. Villagers waiting patiently for health check up in a camp organized by the NHB.

References


Discussion

Of the diseases described in the current issue, lung cancer is the most prevalent cancer and is also the leading cause of mortality. The incidence of lung cancer in women is increasing, and it is now the second most common cancer in women worldwide. The risk factors for lung cancer, such as smoking, have been well documented. However, the role of occupational exposure to certain industries has been recognized and is a major concern in women. The use of hormone therapy and exposure to certain chemicals in the workplace can also increase the risk of lung cancer in women. It is important to note that lung cancer is a serious disease, and early detection and treatment are crucial for improving survival rates. Therefore, routine screening and education on the importance of quitting smoking and avoiding exposure to hazardous substances are essential to reduce the incidence of lung cancer in women.