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Comparative Title Knowledge, Attitude, And Perception About Respiratory Diseases Associated With Biomass Smoke Exposure Among Rural Women In West Bengal

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ABSTRACT

Background: Biomass smoke is a primary source of indoor air pollution in many rural settings, contributing to an increased burden of respiratory symptoms and diseases. In West Bengal, India, women face disproportionate exposure due to traditional cooking practices using biomass fuels like wood, crop residue, and dung. Understanding their knowledge, attitude, and perception (KAP) of these health risks is crucial for designing targeted interventions.

Methods: This cross-sectional study was conducted among 400 rural women in a single selected district of West Bengal from April to October 2023. A multistage cluster sampling strategy was used to ensure representation of various administrative blocks and villages within the district. Structured interviews assessed socio-demographics, fuel use, ventilation, and KAP regarding respiratory diseases. Knowledge scores were derived from participants' understanding of common respiratory conditions (e.g., chronic cough, breathlessness). Descriptive statistics, chi-square tests, and logistic regression were performed using SPSS version 25.

Results: Approximately 38% of respondents showed adequate knowledge of the respiratory risks linked to biomass smoke, with 32% recognizing persistent cough and difficulty in breathing as common health effects. Although 55% believed that improved cookstoves or cleaner fuels could prevent respiratory problems, only 28% consistently used cleaner alternatives. The main barriers were financial limitations, inconsistent fuel supply, and low awareness. Secondary or higher education and exposure to health awareness programs were significantly associated with better KAP ($p < 0.05$).

Conclusion: This study highlights suboptimal KAP concerning biomass smoke–related respiratory diseases among rural women in a selected district of West Bengal. Enhancing educational outreach, improving cookstove availability, and ensuring affordable, cleaner fuels are recommended to reduce the respiratory health burden. A multifaceted intervention addressing socio-economic and cultural determinants is crucial for effective policy implementation.

Keywords: *Biomass smoke, respiratory diseases, rural women, West Bengal, indoor air pollution, knowledge-attitude-perception (KAP)*

1. INTRODUCTION

Indoor air pollution (IAP) resulting from biomass fuel combustion is a significant public health concern worldwide, causing an estimated 2.4 million premature deaths annually [1]. Approximately 2.6 billion people—mainly in low- and middle-income countries—rely on wood, crop residues, or dung as their primary cooking fuel [2]. In India, rural communities commonly use these traditional fuels due to limited access to cleaner alternatives [3]. West Bengal, in particular, continues to show high rates of biomass dependence [4].

Prolonged exposure to biomass smoke increases the risk of acute and chronic respiratory diseases, such as acute respiratory infections and chronic obstructive pulmonary disease (COPD) [5]. The incomplete combustion of biomass generates fine particulate matter ($PM_{2.5}$) and toxic gases that can compromise lung function [6]. Women, traditionally responsible for cooking and domestic chores, bear a disproportionate share of this exposure [7].

Although multiple initiatives have attempted to promote cleaner energy—ranging from liquefied petroleum gas (LPG) subsidies to improved cookstove programs—adoption has remained uneven [8]. Factors such as high costs, cultural preferences, and insufficient knowledge of long-term health risks sustain reliance on biomass fuels [2,6]. Women's awareness of respiratory symptoms and diseases, as well as their attitudes toward cleaner fuels, can critically influence household decisions and health-seeking behavior.

Against this backdrop, the current study assesses the knowledge, attitude, and perception (KAP) of rural women in one selected district of West Bengal regarding biomass smoke exposure and the associated respiratory conditions. We hypothesize that women with higher education and exposure to health awareness campaigns will demonstrate better KAP. Findings from this research can guide policy-makers and public health stakeholders in creating interventions tailored to local socio-economic and cultural contexts.

2. MATERIALS AND METHODS

Study Design and Setting: A cross-sectional study was conducted from April to October 2023 in a single selected district of rural West Bengal, chosen based on its elevated reliance on biomass for cooking.

Sample Size and Sampling Procedure: Using an assumed 50% prevalence of poor knowledge regarding biomass smoke, a 95% confidence interval, and a 5% margin of error, the required minimum sample was 384. To accommodate potential non-responses, 400 participants were ultimately surveyed.

A **multistage cluster sampling** approach was adopted to ensure coverage of various sub-blocks and villages:

1. The district was divided into administrative blocks.
2. Two blocks were randomly chosen.
3. From each chosen block, several villages were selected by simple random sampling.
4. Within each village, households were visited systematically, and one eligible adult woman (≥18 years) per household was recruited.

Data Collection Instrument: A structured, Bengali-language questionnaire—pretested on 30 participants—was used to gather:

1. **Socio-demographic data** (age, education level, household income).
2. **Household energy usage** (type of fuel, ventilation, improved cookstove use).
3. **KAP on respiratory diseases**
    - **Knowledge**: Items measuring awareness of common respiratory conditions (chronic cough, difficulty breathing, pneumonia, etc.) linked to biomass smoke. Participants were asked if they recognized these conditions as smoke-related.
    - **Attitude**: Beliefs about the importance of cleaner fuels, willingness to switch, perceived benefits of prevention.
    - **Perception**: Personal risk evaluation, perceived severity of respiratory diseases, cultural attitudes toward cooking fuel choices.

Knowledge Score Details: A scoring system (range 0–10) was designed, assigning 1 point per correct answer about:

- The role of smoke in causing respiratory symptoms/diseases.
- Preventive measures like improved ventilation or cleaner fuels.
- Awareness of chronic consequences (e.g., COPD).
- Scores ≥7 were categorized as "Good Knowledge," 4–6 as "Moderate," and 0–3 as "Poor."

Ethical Considerations: Informed consent was obtained from each participant, ensuring confidentiality and the option to withdraw at any stage without penalty.

Data Management and Analysis: Data were entered into Microsoft Excel and analyzed using SPSS (version 25; IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, frequencies, percentages) summarized participant characteristics and KAP indicators. Associations between KAP outcomes (good vs. poor) and potential predictors (education

level, health awareness exposure) were examined via chi-square tests. Logistic regression modeled the predictors of good knowledge and positive attitudes ($p < 0.05$ considered statistically significant).

3. RESULTS

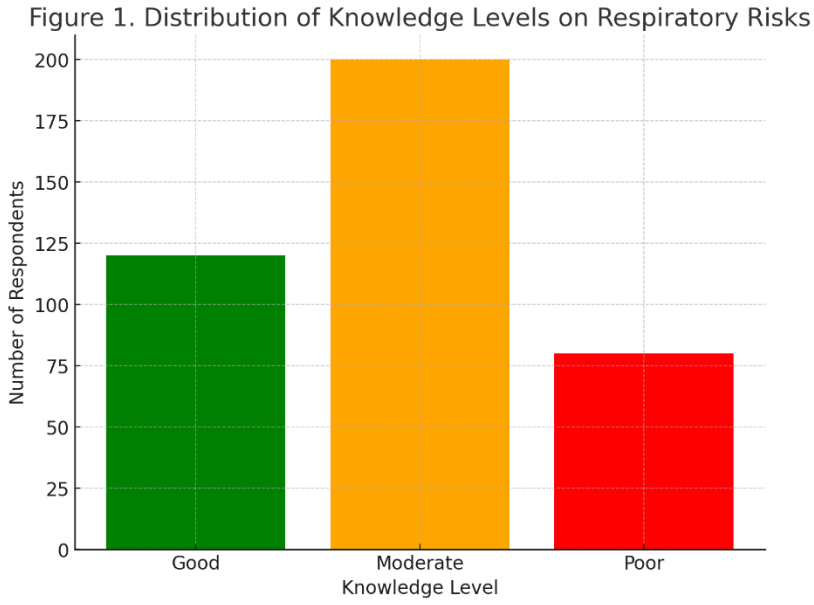
Overall Participant Characteristics: All 400 participants completed the study (mean age 34.8 ± 9.3 years). About 57% had no formal or only primary education, whereas 43% attained secondary or higher schooling. Approximately 79% reported monthly household incomes below INR 10,000.

Household Fuel Use and Cooking Environment: Most respondents (72%) used wood or crop residues as their primary cooking fuel, with 28% having access to LPG—often used sporadically. Adequate kitchen ventilation was lacking in 49% of households, and only 15% reported adopting any improved cookstove or chimney.

TABLE 1. SOCIO-DEMOGRAPHIC DETAILS AND COOKING PRACTICES (N = 400)

Variable	Frequency (%)
Age (mean ± SD)	34.8 ± 9.3 years
Education: Primary or None	228 (57%)
Education: Secondary +	172 (43%)
Monthly Income < INR 10,000	316 (79%)
Main Cooking Fuel (Biomass)	292 (73%)
Main Cooking Fuel (LPG)	108 (27%)
Improved Cookstove Users	60 (15%)
Adequate Ventilation	204 (51%)

Knowledge Scores: Thirty-eight percent of participants exhibited "Good Knowledge" (≥7 points). The most frequently recognized smoke-related symptoms were **persistent cough (52%)** and **breathlessness (44%)**. Only a minority acknowledged more severe conditions (like COPD or pneumonia). Women with secondary or higher education were almost twice as likely to have good knowledge (OR = 1.98; 95% CI: 1.25–3.14; $p < 0.01$).



illustrates the distribution of knowledge levels on respiratory risks among respondents. The chart categorizes the knowledge levels into "Good," "Moderate," and "Poor," showcasing how respondents are distributed across these categories based on their understanding of respiratory risks.

Attitude and Perception: Despite 55% agreeing that "Cleaner fuels can reduce respiratory disease risk," only 28% were seriously considering an imminent shift to cleaner fuels. Key barriers included cost (64%), limited local supply, and

traditional cooking norms. Many participants (around 40%) still believed that a chronic cough or breathing difficulties were a normal part of aging, indicating a low perceived susceptibility to serious respiratory disease.

Predictors of Good KAP: In logistic regression, **secondary or higher education** (OR=2.20; 95% CI: 1.41–3.52; p<0.01) and **exposure to health awareness programs** (OR=1.77; 95% CI: 1.08–2.92; p=0.02) significantly predicted good knowledge and a positive attitude. Neither age nor monthly income demonstrated a consistent, independent effect after adjusting for covariates.

4. DISCUSSION

Our findings underscore the persistent knowledge gap regarding respiratory illnesses associated with biomass smoke in rural West Bengal. Although cough and breathlessness were commonly mentioned, deeper awareness of potential chronic diseases remains limited, aligning with studies elsewhere in low-resource contexts [9]. Moreover, educational level emerged as a robust determinant of improved knowledge, reflecting consistent global patterns [10].

Despite moderate awareness of preventive measures—such as cleaner fuels or improved cookstoves—the transition away from biomass remains slow, chiefly owing to financial barriers and cultural norms. Government-led LPG initiatives show promise yet encounter obstacles like unreliable supply and the up-front costs of stove modifications [11,12]. This shortfall highlights that technology diffusion alone is insufficient; concurrent socioeconomic support and community education are vital [13].

Additionally, the normalization of chronic respiratory symptoms points to low perceived susceptibility, diminishing the urgency to seek medical advice or invest in cleaner fuel options [14]. Strengthening grassroots initiatives, including door-to-door counseling and demonstrations, could shift community perceptions. Our results also show that women engaged in health awareness events displayed significantly better KAP—reinforcing that community-driven interventions by local health workers and self-help groups can meaningfully influence behavior [15].

Policy formulations must, therefore, be multifaceted—targeting financial incentives, education, infrastructure improvement, and cultural acceptance [16,17]. By integrating knowledge dissemination into ongoing rural health campaigns and providing microfinancing or subsidies for cleaner stoves, stakeholders may more effectively reduce the respiratory health risks posed by biomass smoke in vulnerable households.

5. CONCLUSION

Rural women in a selected district of West Bengal demonstrated limited comprehension of the respiratory risks of biomass smoke. Although many respondents believed cleaner cooking methods could mitigate respiratory ailments, actual uptake was low, constrained by economic and cultural hurdles. Education and health awareness initiatives proved crucial for improving KAP. Future programs should combine robust community education with subsidies, reliable fuel supply chains, and cultural tailoring to accelerate the adoption of cleaner cooking solutions. Only through a comprehensive approach can the burden of biomass smoke–associated respiratory diseases be effectively reduced in these communities.

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