

Perception and Practices Regarding Stubble Burning in Rural Community of Haryana

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Abstract

Background: Agricultural emissions pose significant health risks, especially in countries like India with abundant agricultural waste. This study focuses on understanding stubble burning perceptions and practices in rural National Capital Region to inform targeted interventions for sustainable farming practices and improved public health. **Methods and Material:** This community-based cross-sectional study was conducted among the randomly selected households of rural Ballabgarh, Haryana. A pre-tested, semi-structured questionnaire was used to obtain information on perception and practices on stubble burning. Data were collected in Epicollect 5 and analyzed in STATA 14. **Results:** Of the 2000 households approached, 1813 responded with a response rate of 90.7%. Around 53% of the study participants believed that vehicular pollution is the main reason for air pollution, and 90% of them were unaware of the Government schemes related to stop stubble burning and with respect to the practices of stubble disposal. Around 70% of the participants mentioned that respiratory illness is the most severe effect of air pollution. **Conclusion:** The public was mostly unaware of the government's efforts to reduce stubble burning. Health promotion initiatives must be carried out to raise community knowledge about the programs available to combat stubble burning, therefore decreasing air pollution and its health implications.

Keywords: Air pollution, crop burning, perception, rural, stubble burning

INTRODUCTION

Ambient air pollution (AAP) is one of the most significant environmental risks to human health. As a result of AAP exposure, 4.2 million people die pre-maturely every year.^[1] Of these pre-mature deaths, 88% occurred in low- and middle-income countries, and the most significant number was observed in the World Health Organization (WHO) South-East Asia (1.3 million) and Western Pacific regions (1.2 million). Chronic exposure to AAP increases the risk of heart disease, stroke, chronic and acute respiratory infections, and lung cancer. AAP exposure during one's life is the fifth leading cause of all-cause death, accounting for 4.2% of worldwide disability-adjusted life years lost (DALYs).^[2]

Agriculture significantly contributes to air pollution, emitting greenhouse gases and particle pollutants.^[3] India, a major agro-economy, annually generates 500 million tons of agricultural waste, much of which is burned, releasing hazardous particles and gases.^[4] Crop residue burning links to bronchial asthma in children worsened lung functions in adults, with higher acute respiratory infection risks, especially

in children.^[5] This practice also burdens healthcare systems, increasing hospital visits and household healthcare spending. Satellite observations show a substantial rise in crop residue burning during November in northern Indian states like Punjab and Haryana. Eliminating agricultural emissions could prevent one-fifth of global PM_{2.5}-related fatalities, aligning with Sustainable Development Goals to reduce pollution-related mortality and morbidity by 2030.^[6]

Public acceptance of government initiatives to combat stubble burning in India, including legal measures and incentives, has been low, highlighting the issue's complexity.^[7] Despite the need, there is a scarcity on comprehensive data on awareness and perceptions in rural North India. Hence, we aimed to study

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the perceptions and practices regarding stubble burning among the rural community of National Capital Region (NCR) to provide valuable insights for policymakers to develop tailored interventions, mitigating its impact on air pollution.

MATERIALS AND METHODS

This was a community-based cross-sectional study, and the data were collected by trained health workers (HWs) during the month of December 2021. The study site was 28 villages in the Ballabgarh Block of district Faridabad, Haryana. Detailed site description is available elsewhere.^[8] The total population in these villages during the study period was approximately 100,000. The demographic information of residents of all 28 villages was available in the computerized Health Management Information System (HMIS). From the HMIS, we extracted the list of all the households in the intensive field practice area (IFPA), CRHSP, Ballabgarh, which was used as the sampling frame.

We do not have previously published literature about knowledge and practice on stubble burning in India. We assumed the prevalence of knowledge about stubble burning as 50%, and with the absolute precision as 2.5%, the sample size was 1600. With a non-response rate of 20%, the final sample size came out to be 2000 after rounding off. A simple random sampling list of 2000 households was derived from the sampling frame of the HMIS database. A self-developed, pre-tested, interviewer-administered structured interview schedule was developed to obtain information on the knowledge, attitude, and practice regarding stubble burning and air pollution. The data were collected using electronic mobile device-based Epicollect 5 software. The Ethics Committee of All India Institute of Medical Sciences (AIIMS), New Delhi (IEC-100/04.02.2022), approved the study protocol.

We obtained a computer-generated simple random sampling line list with the help of the Health Management Information System (HMIS) database. The HWs conducted a house-to-house survey of those randomly selected households according to sub-centers and villages. Socio-demographic details of the family were collected, preferably from the head of the household, after obtaining informed consent. If absent, the data were collected from senior most adult family members present in the house at the time of data collection who can comprehend and respond to the interview schedule. The data were collected as a part of routine work to provide house-to-house service. The information on the basic socio-demographic details, knowledge, attitude, and practice regarding stubble burning and air pollution were collected from the eligible persons. Data entered in Epicollect 5 software were cleaned. Data analysis was performed using STATA software version 14.0. The variables related to knowledge and perceived health-related questions were described with frequency and percentages.

RESULTS

With a response rate of 90.7%, 1813 of the 2000 households consented to participate. Half of the research participants

were homemakers, and one-third were illiterate. Slightly more than 70% of the participants belonged to a household with at least one member involved in agriculture. Almost half of the research participants were between the ages of 21 and 40, with around 65% being female and 86% of the participants being married, as shown in Table 1.

Of the 1813 study participants, half (53%) perceived that vehicular pollution is the major cause of air pollution. One-third of them (33%) perceived stubble burning to be the cause of air pollution. Around 29%, 23%, and 9% of the study participants perceived industries/brick kilns, bursting of firecrackers, and construction as the major cause of air pollution. Almost 90% of the participants did not know about any scheme initiated by the Government of India (GOI) to stop stubble burning. In contrast, some participants knew a few schemes like cash incentives, outsourcing to company, new machines (happy seeder), and so on, as shown in Figure 1.

With respect to the practices of stubble disposal, around 70% of the participants answered removing and turning into cattle fodder, burning, selling, and ploughing back into the field were some of the common perceptions related to stubble disposal, as shown in Table 2. Almost two-thirds of the participants (68%) stated respiratory disorders were one of the potential health concerns of air pollution. Very few participants perceived air pollution as a health hazard for non-respiratory diseases, such as cardiovascular illness (2%), diabetes (1%), hypertension (1%), and disorders of mental health (1%). Around 45% of those interviewed stated that stubble burning contributes to air pollution, 44% said it does not contribute to air pollution, and 11% said it has a minimal contribution.

DISCUSSION

Our study detailed the perception and practices regarding stubble burning in rural communities in NCR. The response rate was 90.7%. Therefore, the sample size was adequate for estimating the knowledge and practice of stubble burning. The top three perceived causes of air pollution were vehicles,

Table 1: Distribution of participants based on socio-demographic characteristics (n=1813)

Characteristics	Frequency	Percentage
Age group (in years) [Median (IQR) 41.5 (33.5,52.5)]		
18-20	11	0.6
21-40	816	45.0
41-60	718	39.6
>60	268	14.8
Sex		
Male	635	35.2
Female	1178	64.9
Marital status		
Unmarried	99	5.5
Married	1574	86.8
Widow	140	7.7

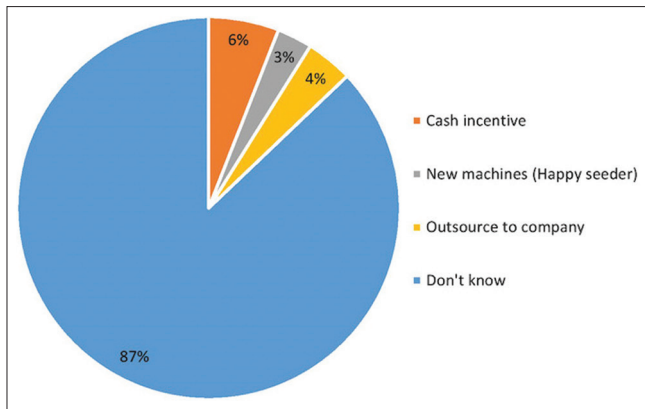


Figure 1: Knowledge of Government schemes to stop stubble burning

Table 2: Practices of stubble disposal in the study area (n=1813)

Stubble disposal methods	Frequency (n)	Percentage (%)*
Burning	278	15%
Ploughed back into the field	251	14%
Removing and turning to cattle fodder	1279	71%
Removing and composted to make manure	261	14%
Sold off	314	17%
Removed and made to floor/wall in cattle shed	224	12%
Used as fuel for chulla/bonfire in winter	37	2%
Don't know	343	19%

*Practices are not mutually exclusive

stubble burning, and industries/brick kilns. The majority of the study population had very little knowledge of the schemes under the GOI to promote alternatives for stubble burning. Removing the crop residue and turning it into cattle fodder was the main perceived practice of stubble disposal. Almost two-thirds of the participants said the potential health hazard of air pollution was respiratory diseases.

In India's northern regions, farmers burn rice stubble due to time constraints between rice and wheat planting. This practice contributes significantly to air pollution, releasing hazardous gases. Lack of awareness about alternative technologies leads to this common yet harmful method of stubble management.^[9] Haryana and Punjab produce 28.1 million tons of paddy straw (2018 estimates), with 40% (11.3 million tonnes) burned on the fields and 60% handled through soil incorporation and other techniques. These two Indian states were responsible for 12% and 88% of the straw burning, respectively.^[10] Particulate air pollution caused by crop residue burning has an impact on the local population as well as those downstream. Seasonal rice residue burning is estimated to contribute to up to 26% of the air pollution in the country's capital (Delhi) during winter.^[11]

The invention of the zero-tillage drill allows for direct seeding of wheat without needing prior tillage and removing rice residue from fields. Furthermore, the enhanced version of zero

tillage drills with the Turbo Happy Seeder may sow wheat seed directly in the standing and lost rice stubbles immediately after rice harvesting. These ideas both are commercially feasible and enhance the efficiency with which water is used.^[12] The Happy Seeder was first commercially marketed in northwest India over 15 years ago. Farmers have successfully accepted this technique after several revisions. According to the 2018–19 report, about 2400 and 9800 Happy Seeder units are operational in Haryana and Punjab, covering an area of 0.053 and 0.45 million hectares of wheat, respectively.^[13] Overall, the area covered by Dry direct-seeded rice (DDSR) and zero-till wheat/Happy Seeder in India has been reported to be over 7.2 million ha and 0.8 million ha, respectively.^[14]

Governments in Haryana, Punjab, Uttar Pradesh, and Delhi offer subsidies on agricultural equipment to reduce residue burning. Awareness campaigns and increased service providers have improved stubble management. However, our study highlights the need for more awareness about government strategies to promote eco-friendly residue management.^[15] To the best of our knowledge, it was the first attempt to document perceptions and practices regarding stubble burning in a rural community of NCR. In this community-based study, the households were selected with equal probability from a population-based sampling frame, standard data collection methods with an adequate sample size and a high response rate, ensured minimization of selection bias, and encouraged to extrapolate the findings.

CONCLUSION

Most of the population knew about the relationship between stubble burning and air pollution. The majority of study participants dispose of stubble by methods other than burning. However, the knowledge regarding the government schemes to stop stubble burning was very poor. There is a need to conduct health promotion initiatives to educate and inform the public about the many programs available in India to combat stubble burning, which helps to lower the level of air pollution generated by stubble burning and hence the health implications of it.

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Conflicts of interest

There are no conflicts of interest.

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