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Original Research Article

KNOWLEDGE AND PRACTICE TOWARDS INDOOR AIR POLLUTION (IAP) AMONGST RESIDENTS OF DHANKUTA, EASTERN NEPAL

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ABSTRACT

Background: Various researches indicate that indoor air pollution in Nepal is responsible for a high degree of morbidity and mortality. Indoor air pollutants are increasingly being associated with respiratory illnesses.

Objectives: To assess the level of knowledge and practice about indoor air pollution and to find out the association between some risky behavior and respiratory problem in last one year.

Methods: The cross-sectional study was conducted among the 200 households in Dhankuta Municipality. In the first stage, 4 wards among 9 wards were randomly selected and equal number of households (50) from each ward was selected on the basis of simple random sampling. Odds ratio were calculated and chi-square test was applied to find out the association between some risky behavior and respiratory problem in last one year.

Results: More than 50 percent of the respondents believed that smokeless Chula, LPG/biogas and electricity are the best way of cooking. Majority of the respondents (82%) think that IAP affects human health. Those who are using general Chullah have higher risk of having respiratory problem as compared to LPG and smokeless Chula (P<0.001). Those households without ventilation in the kitchen were 12.5 times as likely to report respiratory problems. Almost 54.5% of the respondents think that IAP can be prevent by using LPG/disuse of biomass followed by decreased passive smoking (31%) and improve ventilation (26%) respectively.

Conclusion: The urban population of Dhankuta reflects their good knowledge but poor practice about IAP. Risky behavior like General Chullah, not having ventilation in kitchen, passive smoking, use of chemicals in house, and lantern use was found to be significantly related to prevalence of respiratory problems.

KEYWORDS: Knowledge, Practice, Indoor air pollution, Dhankuta

BACKGROUND

Indoor air pollution from biomass fuel use, as a source of household energy, poses serious threats to human health and contributes to environmental degradation. Worldwide, over 3 billion people, largely in developing countries, rely on biomass fuels (wood, dung and crop residues) for their household energy needs.[1] The indoor burning of biomass fuel releases smoke that contains numerous pollutants such as carbon monoxide (CO), particulate matter (PM) and other organic compounds into the living environment.[2]

It has recently been estimated that the indoor air pollution produced from cooking with solid fuels kills 4 million people annually and within South Asia is the third highest risk factor for causes of death.[3] Of particular concern is the association between indoor air pollution and child Acute Respiratory Infections (ARI).[4] Apart from public health impacts biomass fuel emissions are also implicated in other environmental concerns such as global warming.[5]

A study done in the Dhading district, Nepal attributed approximately 50% of ALRI in children to household use of solid fuel-burning stoves.[6] Improved cook stoves have shown to significantly reduce indoor air pollution and have understandably received most of the attention.[7] Behavioral change interventions in environmental health are notoriously difficult and reviews of the published evidence have shown that they fail far more often than they succeed.[8] The knowledge gained from this study could be used to design better behavioral change interventions in the field of cook stoves. Therefore, present study is designed to assess the level of knowledge and practice about indoor air pollution and to find out the association between some risky behavior and respiratory problem in last one year in Dhankuta Municipality.

METHODS

The cross-sectional study was conducted among the households in Dhankuta Municipality of Nepal from 5th April 2014 to 15th July 2014. Dhankuta is located in the eastern geographical region of Nepal. The major means of cooking within the community are firewood and charcoal.

Study conducted by Mishra et al revealed that the level of knowledge regarding indoor air pollution was 67% which was considered for sample size estimation. It was calculated as 200 by using the formula, sample size (n) =4 pq/L^2 [$(n=4 \times 67 \times 33/ (6.7)^2 = 196.9$] households as sample based on the prevalence of 67%, 95% confidence level and 10% allowable error. The required sample size is 200 households of mixed ages, above 17 years in Dhankuta Municipality (Mishra V in 2003).[9] The data was collected from 200 households of mixed ages, above 17 years in Dhankuta Municipality. Among 9 wards, 4 wards were randomly selected. The list of households of four selected wards was prepared and equal number of households (50) from each ward was selected on the basis of simple random sampling.

Pretested semi structured questionnaire and an observational checklist were used for data collection. Questions were focused on; household characteristics, type of fuel usage and decision in choice, awareness of association between different risky behavior and cooking fuel with general health, and uses of various methods to reduce cooking smoke.

Ethical clearance was taken by Institutional Ethical Review Board of B. P. Koirala Institute of Health Sciences, Dharan, Nepal. A written permission was taken from the concerned authority and each participants of the study. Those individuals who were available after three visits and willing to give written consents were included in the study available after three visits means the households was selected randomly on the basis of serial number provided by Municipality. Selected households were followed up to three visits and in the case of unavailability next households were taken. The confidentiality and privacy of the study was maintained; name of the individuals or participating group was not disclosing after the study.

The collected data was entered in MS Excel 2000. The quantitative data was analyzed using Statistical Package for the Social Sciences (SPSS) software package version 11.5. Odds ratio were calculated and chi-square test was applied to find out the association between some risky behavior and respiratory problem in last one year. The probability of significance was set at $P< 0.05$ with 95% Confidence Interval.

RESULTS

Table 1: Study population by socio-demographic characteristics

Characteristics	Frequency	Percent
Age		
17-39 years	79	39.5
40-49 years	80	40.0
More than 50 years	41	20.5
Gender		
Male	96	48.0
Female	104	52.0

Religion		
Hindu	181	90.5
Others (Buddhist, Christian, Muslim)	19	9.5
Ethnicity		
Brahmin/ Chhetri	89	44.5
Kirati	66	33.0
Janajati	22	11.0
Dalit	23	11.5
Education of respondents		
Illiterate	76	38.0
Below SLC	73	36.5
SLC and above	51	25.5
Occupation of respondents		
Service	18	9.0
Business	18	9.0
Farmer	134	67.0
Housewife	3	1.5
Others (students, abroad)	27	13.5
Total	**200**	**100.0**

SLC: School leaving certificate

Table 1 showed the study population consists of almost 48% of male and 52% of female. By ethnicity Brahmin/Chhetri were 44.5% followed by Kirati (33%), Dalit (11.5%) and Janajati ethnic group (11%) respectively. Regarding respondents's education, 38% of the respondents were illiterate, and only one fourth of the respondents completed School Leaving Certificate level. As agriculture based economy of Nepal 67 percent were involved in agriculture sector.

Table 2: Respondent's knowledge about indoor air pollution (n=200)

Characteristics	Frequency	Percent
Heard about smokeless chula		
Yes	94	47.0
No	106	53.0
*If yes, how smokeless chula is better than general chula (n=94)		
Reduces amount of smoke	86	91.5
Better efficiency	9	9.6
Limit health hazards	42	44.7
Best way of cooking		
General chula	89	44.5
Others (Smokeless chula, LPG/biogas, electricity	111	55.5
Effect human health		
Yes	164	82.0
Don't know	36	18.0
*If yes, diseases due to IAP (n=164)		
Respiratory problem	89	54.3
Eye problem	107	65.2

Headache & irritability	50	29.8
Who is the most vulnerable to IAP		
Woman	128	64.0
Children	27	13.5
Elderly	36	18.0
Don't know	9	4.5
*Causes of IAP		
Cooking fuel	113	56.5
Improper ventilation	80	40.0
Smoking	68	34.0
*Prevention of IAP		
Use of LPG/disuse of biomass	109	54.5
Improve ventilation	52	26.0
Decreased passive smoking	62	31.0
*Constrains of preventive measures		
Economic constrains	145	72.5
Lack of knowledge	67	33.5
Negligence	25	12.5
*Minimize IAP		
LPG/biogas	125	62.5
Smokeless chula	22	11.0
Electrical equipment	69	34.5

*percentages are based on multiple responses

LPG: Liquified petroleum gas

General Chullah: Way of cooking using biomass fuel i.e. wood, dung and crop residue etc.

Table 2 showed only 47% of the respondents heard about smokeless chula, among them majority (91.5%) think it reduces the smoke. Majority of respondents (82%) think that IAP affects human health, like eye problems (65%), respiratory problems (54.3%) and Headache & irritability (29.8%) respectively. Regarding prevention, 54.5% of the respondents think IAP can be prevent by using LPG/ disuse of biomass followed by decreased passive smoking (31%) and proper ventilation (26%) respectively.

Table 3: Respiratory problems in last one year with some selected variables

Characteristics	**Respiratory problem**		**Total**	**Odds Ratio**	**95% CI**	**P-value**
	Yes	**No**				
Cooking food						
General Chullah	108 (68.4)	50 (31.6)	158	28.0	8.27-95.23	<0.001
LPG/biogas, smokeless chula	3 (7.1)	39 (92.9)	42			
Ventilation in kitchen						
Yes	24 (25.8)	69 (74.2)	93	12.5	6.38-24.49	<0.001
No	87 (81.3)	20 (18.7)	107			
Smoking						
Yes	106 (73.1)	39 (26.9)	145	27.1	10.10-	<0.0

No	5 (9.1)	50 (90.9)	55		73.13	01
Use chemicals in the house						
Yes	94 (71.2)	38 (28.8)	132	7.4	3.81-14.44	<0.0
No	17 (25.0)	51 (75.0)	68			01
Lantern use						
Yes	98 (62.8)	58 (37.2)	156	4.0	1.95-8.31	<0.0
No	13 (29.5)	31 (70.5)	44			01
Total	**111 (55.5)**	**89 (44.5)**	**200**			

More than two third of the respondents used General Chula for cooking purpose. Those who are using general chula have higher risk of having respiratory problem as compared to LPG and smokeless chula (P<0.001), those households without ventilation in the kitchen were 12.5 times as likely to report respiratory problems. Those who are using chemicals and lantern in the house have higher risk of having respiratory problems as compared to not using chemicals and lantern (P<0.001) (Table 3).

DISCUSSION

Although many people associate public exposure to air pollution primarily with urban outdoor settings, indoor environments are also contaminated both from pollution penetrating from outside and indoor sources which are perhaps less generally understood by the communities. However, the largest exposures to health damaging indoor pollutants occur in the developing world. As a result, much of the ill health impacts from indoor pollutants occur amongst the poorest and most vulnerable populations; largely women and their young children.[10]

Still more than two fifth of respondents think General Chullah i.e. biomass fuel (wood, dung and crop residue) is best way of cooking. Moreover, from combustion of traditional fuels the toxic pollutants released has been implicated and are risk for most respiratory diseases (such as tuberculosis, asthma, acute respiratory infections, chronic obstructive pulmonary diseases, etc.), cancers, adverse pregnancy outcomes, eye problems, accidental problems, etc., particularly among women who are usually regarded as responsible for household work management and cooking in Indian and Nepali cultural values.[11] Inefficient burning of these fuels results in household air pollution (HAP) that includes particulate matter and toxic chemicals, such as hydrocarbons, oxygenated organic compounds, free radicals and carbon monoxide.[12] HAP is the fourth leading risk factor for the global burden of disease, accounting for 3.5 million premature deaths in adults and children annually.[3] Although 55.5% of the respondents think smokeless Chula, liquified petroleum gas (LPG), biogas and electricity

were the best way of cooking. A study conducted by Ali et al in Pakistan in which 82 percent respondents reported the natural gas and liquified petroleum gas are best fuel for cooking.[13]

Majority of respondents believed that indoor air pollution may cause eye problem (65.2%) followed by respiratory problem (54.3%) and headache & irritability combined (29.8%) which is similar to the study conducted by Osagbemi et al in Ilorin.[14] Our study reported that only 54.3% of respondents were aware about respiratory problems. The causes of which is very low as compared to the study conducted by Tun et al in which almost 75.6% of respondents have good knowledge about causes of acute respiratory infections.[15]

Majority of respondents think that woman was the most vulnerable to indoor air pollution (64%) followed by elderly (18%) and children (13.5%). But in contrast a study conducted by Ali et al in Pakistan in which vast majority of respondents reported that cooking with biomass fuel first affect their children health (87.2%).[13] The resulting indoor air pollution is a major threat to health, particularly for women and young children who may spend many hours close to the fire.[11] Due to their dynamic physiological development, children are often more susceptible than adults to contaminants in air, water or food, which can lead to the overwhelming of the child's immature organs and internal systems.[16] Other studies also mentioned elderly and children are at higher risk from the associated health effects.[14, 17]

Cooking fuel, improper ventilation and smoking are responsible for indoor air pollution as seen our study, but a study from Ilorin reported that indoor air pollution is due to overcrowding (70%) followed by use of pesticides (43.8%), smoke from mosquito coils (65.6%) and filthy environment (73.4%) respectively.[14] The ventilation in households plays an important role in air quality. A higher air exchange may improve thermal comfort and air quality.[18] The carbon dioxide (CO_2) levels indicate ventilation conditions.[19] The concentrations of various pollutants, especially CO_2, its concentrations positively correlated to the number of family member and negatively correlated to the ventilation rates suggest the need for corrective interventions, such as reducing air pollutant sources and improving ventilation.[19, 20]

People perceived that use of LPG/disuse of biomass, decreased passive smoking and improve ventilation can prevent the effect of indoor air pollution. A similar study reported that IAP can be prevented by better ventilation (90.2%), use of chimney (72.3%) and kitchen separate from the house (15%) respectively.[13] Similar study from Pakistan reported that IAP can be minimized by using improved ventilation (87.9%) and chimney (52%), improvement in the position and environment of the kitchen, dry fuel use (77.8%), combination of LPG with biomass fuels (15.2%) along with kitchen design and placement of stove (10%).[13] Some

evidence suggests that increasing ventilation alone is ineffective at reducing chronic health burdens. Other strategies, such as pollutant source control and the use of particle filtration, should also be considered.[21]

Likewise, in our study almost 73 percent of respondents think respiratory problems may develop due to smoking, whereas study conducted by Tun et al reported that almost 90 percent of respondents think respiratory problems may develop due to smoking and indoor air pollution can causes ill health.[15]

It is seen that there is a positive association between respiratory problems and using traditional chulahs which is similar to the study conducted by Venmathi et al.[17] Although detailed epidemiological and toxicological research on the health effects of IAP is still at an early stage, there is increasing evidence that it is a causal agent of acute respiratory infections (ARI), chronic obstructive pulmonary disease, lung cancer, tuberculosis, nasopharyngeal and laryngeal cancers, and asthma. It may also cause low birth weight and prenatal mortality.[22] A critical review of the quantitative literature and data sources in nine countries found consistent evidence indicating a significant increase in the risk of Acute Lower Respiratory Infection (ALRI) for children exposed to IAP. Since ALRI is a chief cause of death of children in developing countries.[23] Many studies whether they are conducted in different places one thing is similar that people have a good knowledge on IAP and its health impacts but they are not serious to prevent it.[14]

Household cooking data remain scarce and relatively poor in quality, owing to the difficulties of measuring household fuel use in developing countries and emerging economies. From household survey questions that are too general to generate accurate projections, to emission factors that are sensitive to local meteorological or fuel conditions (such as wood moisture content), to poor data on emerging control strategies (such as advanced biomass cook stoves), the data used to create the results presented here have weaknesses. Furthermore, as noted above, the lack of urban and rural disaggregation of energy use and sectoral emissions data make it difficult to account for demographic trends that may influence exposure.[24]

Limitations of this study: Firstly, this study includes the cross-sectional nature of data which precludes from drawing causal inferences. Like smoking is sometimes associated with social stigma. Therefore, some of the individuals may under-report their smoking habits. Secondly, data were based on self-report, which might be subject to recall bias.

CONCLUSION

Urban residents who are living in relatively Dhankuta reflect good knowledge on IAP but poor practice to prevent IAP. Very few were aware about liquified petroleum gas and natural

gas is better ways of reducing pollution as well as decreasing the incidence of diseases. Risky behavior like General Chullah, not having ventilation in kitchen, passive smoking, use of chemicals in house, and lantern use was found to be significantly related to prevalence of respiratory problems. Raising awareness on indoor air pollution remains one of the most pragmatic ways that can work effectively in preventing and mitigating the effects of indoor air pollution. Capacity building of the community members may help to improve their economic wellbeing thereby improving access to alternative cooking methods.

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