



Knowledge, Attitude, and Practice on Health Behaviors Regarding Air Pollution from Burning Waste: A Cross-sectional Study Among Villagers in the North of Iran in 2020

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Abstract

Background: Incineration is a waste disposal technique employed to reduce the volume of waste, resulting in air pollution.

Objectives: This study aimed to determine the knowledge, attitude, and practice on health behaviors among Rasht villagers regarding air pollution from burning waste.

Methods: The present descriptive cross-sectional study was conducted among 260 rural households in Rasht. Data were collected using a questionnaire by interviewing participants. The participants were randomly selected and entered the study. Data were analyzed by SPSS version 16 using the *t*-test, one-way ANOVA, and Pearson correlation at a 95% confidence interval. The content validity index (CVI) and content validity ratio (CVR) were used to assess the instrument's validity. Cronbach's alpha coefficient was calculated to evaluate the questionnaire reliability.

Results: The findings confirmed the optimal validity and reliability of the instrument used in the study. The participants' age range was 19 to 78, with a mean age of 43.87 ± 12.66 years. The practice had a significant positive correlation with knowledge ($r = 0.216$). The correlation between practice and attitude was positive but not statistically significant. Education and information on burning wastes had a substantial relationship with knowledge. Participants received 80%, 29.3%, and 66.7% of the maximum achievable scores for knowledge, attitude, and practice components in the questionnaire, respectively.

Conclusions: The villagers' attitude in performing health behaviors regarding air pollution was not favorable, and there is a need to provide educational and behavioral interventions in this regard.

Keywords: Attitude, Incineration, Knowledge, Practice, Waste

1. Background

Air pollution is a significant health problem in the world (1). It is defined as the presence of one or more pollutants or compounds in the outdoor or indoor atmosphere in amounts and for a duration that may harm the human, plant, or animal lives or property or may unreasonably interfere with a comfortable life (2). Some studies have shown that air pollution may be much higher in small communities such as villages than in cities (3). One of the primary sources of air pollution in villages and deprived areas is burning biomass and agricultural products, which mainly produces outdoor air pollution. Sometimes, this operation creates a volume of pollutants that may travel long distances even to the nearby residential ar-

reas by wind.

On the other hand, villages face other environmental challenges, such as a lack of proper waste management, which sometimes leads to the easiest waste disposal method, namely outdoor incineration (4). Incineration is a method to reduce the waste volume and mass by 90% and 75%, respectively (5). Incineration eliminates microbial contamination; however, incomplete combustion can release potentially hazardous compounds, such as aldehydes, chlorinated hydrocarbons, polycyclic aromatic hydrocarbons, dioxins, and furans, most of which are carcinogenic (6). Respiratory problems, reduced male fertility, and low birth weight of newborns are other problems related to air pollution caused by incineration (7-9). These facts highlight the need for attention and planning to con-

control air pollution and prevent the effects of air pollution. In this regard, proper education and modifying behavior are considered effective ways to reduce exposure to air pollution and its adverse effects (10, 11). Unfortunately, incineration is used as a waste disposal method in some villages and cities of Iran. Also, it is used to remove straw from agricultural lands in some villages. People favor this practice and consider it beneficial; however, the resulting smoke and odor are generally unfavorable (12).

There has been no previous research on people's knowledge, attitude, and practice regarding waste incineration, while the importance of these factors should be regarded for educational purposes.

2. Objectives

For the first time in Iran, this study aimed to determine the villagers' knowledge, attitude, and practice about health behaviors regarding air pollution from burning waste in Rasht villages in 2020.

3. Methods

3.1. Participants and Procedure

This is a descriptive cross-sectional study conducted among rural households in Rasht. For sampling, first, Rasht was divided into four parts based on geographical areas (north, south, east, and west), each of which was considered a cluster. Then, two comprehensive rural health service centers were selected randomly from each cluster. The participants were chosen from the village households using a simple random sampling method, and the questionnaires were given to them. It should be noted that according to the statistics of Rasht Health Center, the city has a total of 16 comprehensive rural health service centers and 99 health centers. The research subjects were informed of the study, information confidentiality, and purposes, and all of them willingly entered the study. Finally, the collected data were entered into SPSS version 16 and analyzed using appropriate tests.

The required sample size in the present study was calculated using the following formula (13):

$$n = \frac{\sigma^2 \times z_{1-\frac{\alpha}{2}}^2}{d^2}$$

According to a pilot study, the standard deviations of knowledge, attitude, and practice were 1.22, 7.32, and 4.43, respectively. The highest standard deviation for the attitude was adopted to estimate the maximum sample size. Considering the significance level (alpha) of 5% and an error rate of one unit, the sample size required for the study

was estimated to be 206. Based on a 25% rejection rate, the sample size was estimated at 260. Out of 260 respondents, 257 (98.8%) signed the consent form to participate, as approved by the institutional review board of Shahid Beheshti University of Medical Sciences.

The inclusion criteria included households covered by Rasht comprehensive rural health service centers. Reluctance individuals and those with incomplete responses to the study items were excluded.

3.2. Measures

In this study, the data collection tool was a two-part questionnaire completed via interviewing the participants. The first part gathered the participants' demographic information and the second part included a researcher-made questionnaire on the knowledge, attitude, and practice.

The reliability of the questionnaire was confirmed by a pilot study on 20 people in the study group using the Alpha coefficient method for attitude and practice and the split-half method for knowledge. Table 1 shows some examples of the scale items. The face validity of the questionnaire was also confirmed according to the expert group's opinion.

3.3. Data Analysis

Cronbach's alpha coefficient was calculated to evaluate reliability. In this study, the data were analyzed by SPSS version 16 using appropriate statistical tests. The relationship between quantitative data was examined using *t*-tests, one-way analysis of variance, and Pearson correlation at a 95% confidence level.

4. Results

The mean age of the respondents was 48.87 years (SD: 12.66), ranging from 19 to 78 years. More details of the demographic characteristics of the participants are shown in Table 2.

Our findings showed that the villagers' source of information about burning waste was mostly the village health workers (59.1%). Also, most of the participants (172 people, 66.9%) burnt waste once a week.

Table 3 shows the mean, standard deviation, achievable score range, and average percentage of the maximum possible score for the studied components, including knowledge, attitude, and practice. The findings show that the participants obtained 80%, 29.3%, and 66.7% of the maximum achievable scores for knowledge, attitude, and practice, respectively.

Table 1. Samples of KAP Items and Reliability Values Using Cronbach's Alpha

Components	No. of Items	Sample	Alpha Coefficient
Knowledge	8	What is the most crucial way to reduce the volume of waste?	0.71
Attitude	14	Waste segregation helps control air pollution.	0.89
Practice	9	I use a face mask while burning waste.	0.73

Table 2. Distribution of Demographic Characteristics Among Participants

Variables	No. (%)
Gender	
Female	142 (55.3)
Male	115 (44.7)
Economic status	
Weak	34 (13.2)
Medium	144 (56.1)
Good	79 (30.7)
Education level	
Primary	111 (43.2)
Secondary	84 (32.7)
Diploma	49 (19.1)
University	13 (5)
Family size	
One or two people	60 (23.3)
Three people	82 (31.9)
Four people	83 (32.3)
Five people or more	32 (12.5)
Have you ever learned how to burn waste?	
Yes	178 (69.3)
No	79 (30.7)

The correlations between studied components are given in [Table 4](#). As the findings show, the practice had a significant positive correlation with knowledge. The correlation between practice and attitude was positive but not statistically significant.

The relationships between contextual variables and knowledge, attitude, and practice among participants are given in [Table 5](#).

5. Discussion

This study aimed to determine villagers' knowledge, attitude, and practice regarding health behaviors concerning air pollution from burning waste among Rasht villages in 2020. The findings showed that the participants obtained 80% of the maximum achievable score for the

knowledge component. These findings indicate that the state of knowledge among the study population was sufficient. The results also showed that the practice of villagers had a significant positive correlation with their knowledge. Consistent with our study findings, Odonkor and Mahami reported in their study of households in Ghana that most subjects had good knowledge of the air pollution effects on health (14). As mentioned, knowledge is a skill level in the human mind defined as the ability of a person to learn, retain, and recall information in particular situations, playing an essential role in performing health behaviors (15). Although most of the subjects in the present study (75.9%) had below tertiary education, the findings showed that their knowledge was adequate.

Most of the participants mentioned that they had been taught about waste disposal methods by the villages' health workers. This finding can be considered in the design of educational interventions. Since there is a close relationship between health workers and villagers, their presence and intervention can effectively provide educational material.

However, the surveyed villagers did not favor performing the right behaviors to reduce exposure to air pollution while burning waste; only 29.3% of the maximum achievable score for the attitude component was obtained. Attitudes stem from a person's positive or negative beliefs about performing a particular behavior (15). Numerous studies have also highlighted the importance of attitudes in health behaviors related to waste management. For example, the study by Davis and Morgan in the United Kingdom (16), the study by Largo-Wight et al. in the United States (17), and the study by Ramayah et al. in Malaysia (18) reported that attitudes had a significant relationship with waste management. This finding can be a warning sign for health planners and the need for further research to determine the reasons for the low attitude towards health behaviors while burning waste in the study population.

It should be noted that in Iran, according to the law, mass media (for example, the Broadcasting Organization of the Islamic Republic of Iran) and other educational and cultural organizations are responsible for promoting and educating citizens about appropriate methods of waste management (19). This legal potential can be used in designing appropriate interventional programs. Neverthe-

Table 3. Mean, Standard Deviation, Achievable Score Range, and Average Percentage of the Maximum Achievable Score of Studied Components

Components	Mean	Standard Deviation	Achievable Score Range	Average Percentage of Maximum Achievable Score
Knowledge	6.40	1.61	0 - 8	80
Attitude	20.56	6.58	14 - 70	29.3
Practice	30.05	5.90	9 - 45	66.7

Table 4. Correlation Between Studied Components

Components	Knowledge	Attitude
Knowledge	1	
Attitude	0.559 **	1
Practice	0.216 **	0.072

less, it is worth noting that if public participation is low, the implementation of these efforts will not be successful.

Another finding of our study was that the correlation between practice and attitude, although positive, was not statistically significant. This finding contradicts the results reported by Pakpour et al. In their study among households in Qazvin, they stated that the attitude was a good predictor of waste separation behavior from the source among Iranian families (19). As mentioned previously, there is a need to conduct more studies to determine the reasons for the poor attitude of the study population about performing health behaviors regarding air pollution from burning waste.

Our findings showed a significant relationship between education level and knowledge. Consistent with our results, studies by Odonkor and Mahami in Ghana (14) and Jatau among residents of a Nigerian City (20) reported a significant positive relationship between education level and the knowledge of waste management.

Obtaining information about waste incineration had a statistically significant relationship with knowledge, attitude, and practice. People who had information about burning waste had higher knowledge, better attitude, and more appropriate practice. These findings show the effective and positive role of educational interventions in promoting health behaviors related to knowledge, attitude, and practice, especially on burning waste. In his study, Bickerstaff says that understanding the risk and the social responsibilities can effectively control air pollution (21). Considering the significant relationship between knowledge, attitude, and practice in the present study, we can expect better practice from villagers through proper education about waste incineration.

Our study had a few limitations. First, data collection based on the questionnaire always faces the risk of recall bias. Second, data collection only among a sample of ru-

ral households in Rasht cannot generalize results to other Iranian rural households.

5.1. Conclusions

It seems that the knowledge of appropriate waste management procedures is already being formed by health workers. However, since attitude affects practice, comprehensive health education programs need to emphasize the psychological factors mediating and predicting behaviors. In designing educational interventions, if knowledge is raised about the correct methods of waste incineration, villagers' health behaviors will improve, resulting in air pollution reduction. Also, due to the study group's low attitude toward incineration, it is proposed to provide educational interventions to improve attitudes toward healthy behaviors.

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Footnotes

Authors' Contribution: Study concept and design: S. KH.; Analysis and interpretation of data: F. J. and S. KH.; Drafting of the manuscript: S. KH.; Critical revision of the manuscript for important intellectual content: L. SH. and M. A.; Statistical analysis: F.J.

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Data Reproducibility: The data presented in this study are openly available in one of the repositories or will be available on request from the corresponding author by this journal representative at any time during submission or after publication. Otherwise, all consequences of possible withdrawal or future retraction will be with the corresponding author.

Ethical Approval: The Research Ethics Committee of Shahid Beheshti University of Medical Sciences

Table 5. Relationships of Contextual Variables with Knowledge, Attitude, and Practice Among Participants

Variables	Knowledge	Attitude	Practice
Gender ^a			
Female	6.36 (1.59)	20.36 (6.80)	30.14 (6.17)
Male	6.45 (1.64)	20.80 (6.32)	29.95 (5.57)
Test statistics	-0.424	-0.535	0.251
Significance	0.672	0.593	0.802
Education rate ^b			
Primary	6.45 (1.69)	21.13 (6.14)	30.41 (5.43)
Secondary	5.92 (1.60)	19.09 (7.46)	29.51 (4.78)
Diploma	6.81 (1.36)	21.91 (5.99)	29.55 (7.95)
University	7.53 (0.51)	20.07 (4.97)	32.46 (7.09)
Test statistics	6.008	0.066	1.217
Significance	0.001	0.066	0.304
Economic status ^b			
Weak	6.32 (1.59)	21.14 (6.99)	30.29 (5.98)
Medium	6.28 (1.64)	20.44 (6.99)	29.61 (5.65)
Good	6.65 (1.55)	20.53 (5.81)	30.77 (6.30)
Test statistics	1.422	0.157	1.018
Significance	0.243	0.855	0.363
Family size ^b			
One or two people	6.51 (1.68)	21.86 (6.15)	30.20 (6.03)
Three people	6.17 (1.61)	19.63 (6.17)	29.45 (6.12)
Four people	6.40 (1.59)	20.45 (7.40)	30.09 (5.65)
Five people or more	6.78 (1.49)	20.78 (5.97)	31.25 (5.79)
Test statistics	1.257	1.352	0.734
Significance	0.290	0.258	0.532
Knowledge on how to burn waste ^a			
Yes	7.29 (0.96)	23.27 (6.00)	30.48 (6.75)
No	4.39 (0.72)	14.45 (2.42)	29.10 (3.08)
Test statistics	26.737	16.754	2.251
Significance	< 0.001	< 0.001	0.025

^a Two-group independent *t*-test^b One-way analysis of variance

and Health Services approved this study (ethics code: IR.SBMU.SME.REC.1399.014).

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Informed Consent: The research subjects were informed of the study approach, information confidentiality, and study purpose, and all of them willingly entered the study.

References

- Mirzaei-Alavijeh M, Jalilian F, Dragoi EN, Pirouzeh R, Solaimanizadeh L, Khashij S. Self-care behaviors related to air pollution protection questionnaire: a psychometric analysis. *Arch Public Health*. 2020;**78**:1–8. doi: [10.1186/s13690-020-00400-7](https://doi.org/10.1186/s13690-020-00400-7). [PubMed: [32308980](https://pubmed.ncbi.nlm.nih.gov/32308980/)]. [PubMed Central: [PMC7146995](https://pubmed.ncbi.nlm.nih.gov/PMC7146995/)].
- Abtahi M, Koolivand A, Dobaradaran S, Yaghmaeian K, Mohseni-Bandpei A, Khaloo SS, et al. National and sub-national age-sex specific and cause-specific mortality and disability-adjusted life years (DALYs) attributable to household air pollution from solid cook-fuel use (HAP) in Iran, 1990-2013. *Environ Res*. 2017;**156**:87–96. doi: [10.1016/j.envres.2017.03.026](https://doi.org/10.1016/j.envres.2017.03.026). [PubMed: [28340488](https://pubmed.ncbi.nlm.nih.gov/28340488/)].
- Gates JS; Chehebar. *System and method for waste management*. United States Patent Application US; 2014.

4. Wang Y, Cheng K, Wu W, Tian H, Yi P, Zhi G, et al. Atmospheric emissions of typical toxic heavy metals from open burning of municipal solid waste in China. *Atmospheric Environment*. 2017;**152**:6-15. doi: [10.1016/j.atmosenv.2016.12.017](https://doi.org/10.1016/j.atmosenv.2016.12.017).
5. Chadar S, Keerti C. Solid waste pollution: A hazard to environment. *Recent Adv Petrochem Sci*. 2017;**2**(3).
6. Maitre A, Collot-Fertey D, Anzivino L, Marques M, Hours M, Stoklov M. Municipal waste incinerators: air and biological monitoring of workers for exposure to particles, metals, and organic compounds. *Occup Environ Med*. 2003;**60**(8):563-9. doi: [10.1136/oem.60.8.563](https://doi.org/10.1136/oem.60.8.563). [PubMed: [12883016](https://pubmed.ncbi.nlm.nih.gov/12883016/)]. [PubMed Central: [PMC1740590](https://pubmed.ncbi.nlm.nih.gov/PMC1740590/)].
7. World Health Organization. *Indoor air pollution from solid fuels and risk of low birth weight and stillbirth: Report from a symposium held at the Annual Conference of the International Society for Environmental Epidemiology (ISEE)*. Johannesburg, South Africa: World Health Organization; 2005. Contract No.: 9241595736.
8. Bell ML, Ebisu K, Belanger K. Ambient air pollution and low birth weight in Connecticut and Massachusetts. *Environ Health Perspect*. 2007;**115**(7):1118-24. doi: [10.1289/ehp.9759](https://doi.org/10.1289/ehp.9759). [PubMed: [17637932](https://pubmed.ncbi.nlm.nih.gov/17637932/)]. [PubMed Central: [PMC1913584](https://pubmed.ncbi.nlm.nih.gov/PMC1913584/)].
9. Cogut A. *Open burning of waste: a global health disaster*. R20 Regions of Climate Action; 2016.
10. Dixon JK, Hendrickson KC, Ercolano E, Quackenbush R, Dixon JP. The environmental health engagement profile: What people think and do about environmental health. *Public Health Nurs*. 2009;**26**(5):460-73. doi: [10.1111/j.1525-1446.2009.00804.x](https://doi.org/10.1111/j.1525-1446.2009.00804.x). [PubMed: [19706129](https://pubmed.ncbi.nlm.nih.gov/19706129/)].
11. Giles LV, Barn P, Kunzli N, Romieu I, Mittleman MA, van Eeden S, et al. From good intentions to proven interventions: effectiveness of actions to reduce the health impacts of air pollution. *Environ Health Perspect*. 2011;**119**(1):29-36. doi: [10.1289/ehp.1002246](https://doi.org/10.1289/ehp.1002246). [PubMed: [20729178](https://pubmed.ncbi.nlm.nih.gov/20729178/)]. [PubMed Central: [PMC3018496](https://pubmed.ncbi.nlm.nih.gov/PMC3018496/)].
12. Shams A, Vedadi E, Ahmadi Z. Study of farmers' attitude towards sustainable agriculture and its relation with their chemical input use in Asadabad Township. *Iran Agric Exten Educ J*. 2015;**11**(1).
13. Pallant J. *SPSS survival manual*. Berkshire, England: McGraw-Hill Education; 2013.
14. Odonkor ST, Mahami T. Knowledge, Attitudes, and Perceptions of Air Pollution in Accra, Ghana: A Critical Survey. *J Environ Public Health*. 2020;**8**(2). doi: [10.1155/2020/3657161](https://doi.org/10.1155/2020/3657161). [PubMed: [32104187](https://pubmed.ncbi.nlm.nih.gov/32104187/)]. [PubMed Central: [PMC7040415](https://pubmed.ncbi.nlm.nih.gov/PMC7040415/)].
15. Eldredge LK, Markham CM, Ruiter RA, Fernández ME, Kok G, Parcel GS. *Planning health promotion programs: an intervention mapping approach*. John Wiley & Sons; 2016.
16. Davis G, Morgan A. Using the Theory of Planned Behaviour to determine recycling and waste minimisation behaviours: A case study of Bristol City, UK. *Special Edition Papers*. 2008;**20**(1):105-18.
17. Largo-Wight E, Bian H, Lange L. An Empirical Test of an Expanded Version of the Theory of Planned Behavior in Predicting Recycling Behavior on Campus. *Am J Health Educ*. 2013;**43**(2):66-73. doi: [10.1080/19325037.2012.10599221](https://doi.org/10.1080/19325037.2012.10599221).
18. Ramayah T, Lee JW, Lim S. Sustaining the environment through recycling: An empirical study. *J Environ Manage*. 2012;**102**:141-7. doi: [10.1016/j.jenvman.2012.02.025](https://doi.org/10.1016/j.jenvman.2012.02.025). [PubMed: [22446140](https://pubmed.ncbi.nlm.nih.gov/22446140/)].
19. Pakpour AH, Zeidi IM, Emamjomeh MM, Asefzadeh S, Pearson H. Household waste behaviours among a community sample in Iran: An application of the theory of planned behaviour. *Waste Manag*. 2014;**34**(6):980-6. doi: [10.1016/j.wasman.2013.10.028](https://doi.org/10.1016/j.wasman.2013.10.028). [PubMed: [24252373](https://pubmed.ncbi.nlm.nih.gov/24252373/)].
20. Jatau AA. Knowledge, Attitudes and Practices Associated with Waste Management in Jos South Metropolis, Plateau State. *Mediterr J Soc Sci*. 2013;**4**(5):119. doi: [10.5901/mjss.2013.v4n5p119](https://doi.org/10.5901/mjss.2013.v4n5p119).
21. Bickerstaff K. Risk perception research: socio-cultural perspectives on the public experience of air pollution. *Environ Int*. 2004;**30**(6):827-40. doi: [10.1016/j.envint.2003.12.001](https://doi.org/10.1016/j.envint.2003.12.001). [PubMed: [15120202](https://pubmed.ncbi.nlm.nih.gov/15120202/)].