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PREDICTING ENVIRONMENTAL KNOWLEDGE USING ATTITUDES TOWARD THE ENVIRONMENT: A CASE STUDY FROM A RURAL SOCIETY

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ABSTRACT

The purpose of this study was to assess rural populations' understanding of environmental protection. This study highlights the cognitive aspects of rural people regarding their surrounding environment. A paper-based, structured questionnaire was designed to collect data. A random sample of 317 participants was selected to represent the entire population. The questionnaire was distributed by posting it to their national addresses. A total of 270 valid responses were collected. The findings revealed that respondents had a moderate level of knowledge about protecting the rural environment from water pollution (67 %). Their knowledge of air pollution was low (94.4 %); however, their level of understanding about food pollution was high (79.6 %). The results indicate that 20 % of the variance in overall knowledge regarding the environment can be predicted from the combination of predictor variables (education, income, tendency to change, aspiration for a better environment, and tendency to protect the environment). Predictor variables, including the willingness to protect and improve the environment and the tendency to change, can positively affect overall environmental knowledge. In fact, participants' attitudes toward these variables are low. These factors are crucial to the dissemination of environmental information.

Keywords: environmental protection, pollution, Saudi Arabia.

INTRODUCTION

Environmental pollution affects the components of the environment, including plants, animals, people, and the composition of its non-living elements such as air, seas, rivers, and soil. Environmental pollution means damage to the components of the environment due to the presence of a substance or energy in an unsuitable place, time, or/and inappropriate quantities (Manisalidis *et al.*, 2020). Sometimes, pollution occurs when any internal materials change some or all the physical, chemical, or biological properties of the environment so that these materials are converted from useful to harmful elements, which causes damage to humans, animals, and the ecosystem (Stankovic *et al.*, 2014). Human lifestyles and activities are the primary sources of

pollution in the environment. Therefore, production systems must follow the means and regulations that ensure environmental conservation and sustainability (Fadlallah, 2001).

Protecting the environment from degradation and pollution requires developing awareness among communities, which hinders the treatment of many of the consequences of pollution. Environmental awareness can be achieved by raising the level of knowledge and skills regarding good practices when dealing with the environment. Environmental preservation is a collective responsibility and, thus, should be embedded in the behavior of individuals and groups within a community. Transferring knowledge and skills to behavior needs a process of persuasion to convince individuals and groups in society to play their roles (Stern, 2018). Preservation of the rural environment and the development of rural areas are the responsibilities of many relevant authorities and organizations that must make tangible impacts on the residents' knowledge, attitudes, and behaviors in rural communities by implementing awareness programs.

Previous studies determined the sociodemographic characteristics linked to environmental concerns (i.e., gender, age, educational level, or political ideology), while others focused on the more purely psychological determinants (i.e., values, attitudes, and beliefs). Dunlap and Catton (1979) highlighted the social aspects of the environment. They were among the first social scientists who called for a shift from "sociology of environmental issues" to a more explicit term like "environmental sociology" to emphasize the relationship between human activities and the environment (Johnson and Burke, 2021). That effort has encouraged and inspired many social researchers to examine and investigate environmental sociology issues such as human knowledge and perspectives on the environment, pollution, human activities, and people's environmental responsibilities (Kopnina, 2012).

In recent years, there has been an increase in interest in environmental concerns and issues, prompting initiatives to find people's interests, attitudes, knowledge, and opinions about environmental challenges. This is critical for protecting the ecosystem from neglect and destruction (ECOSOC, 2020). Many social studies have focused on studying the relationship between the rural community and the surrounding rural environment, as well as the importance of their knowledge, intellectual status, motivations, and behaviors in determining this relationship. Although the rural population is still facing challenges, the environmental awareness among them significantly influences their behaviors (Qing *et al.*, 2021). Mohamed and El-Daly (2002) sought to assess farmers' knowledge of ecological concerns and discovered a poor degree of awareness of environmental issues in their area. In his study, Muhammad (2016) found that the majority of rural people had low levels of understanding of the environment.

Elements in the environment are integrated in a variety of ways. Abusing these elements may disrupt the ecosystem's balance, ultimately leading to environmental degradation. The increase in global production rates and human activities has

resulted in more environmental challenges worldwide. As a result, both emerging and developed countries around the world have prioritized environmental concerns. Many organizations have been established, hosting conferences and conducting studies. As a result, sets of environmental policies and regulations were created, new methodologies for good environmental practice were devised, and more research findings on environmental issues were published.

Environmental factors and pollution sources are studied thoroughly. However, there has been little research into the relationship between humans and their surroundings (air, water, and food). More attention should be paid to the cognitive aspects of the people who live in a particular environment. This includes knowledge, trends, and attitudes that influence people's behavior. Such research would be critical in establishing how individuals interact with their environment, as well as in educating rural communities about their surroundings and techniques for raising awareness. It could additionally assist those in charge of rural development in building policies and initiatives that foster a particular interaction between rural people and their surroundings.

The aim of this research is to determine rural people's awareness of the fundamentals of pollution prevention in Ahad Rafidah Governorate in the Asir region of Saudi Arabia. Furthermore, the study seeks to determine participants' opinions regarding the environment. It was assumed that socioeconomic characteristics could predict the overall environmental knowledge level of rural people. Therefore, we proposed the hypothesis as follows: H1: education predicts overall environmental knowledge of rural people; H2: income predicts overall environmental knowledge of rural people; H3: tendency to protect the environment predicts overall environmental knowledge of rural people; H4: aspiration for a better environment predicts overall environmental knowledge of rural people; and H5: tendency to change predicts overall knowledge level of rural people.

MATERIALS AND METHODS

Study area and sample collection

Ahad Rafidah is one of the governorates of the Asir region, located 32 km southeast of Abha city in Saudi Arabia (Figure 1). This region was selected for its agricultural activity, which includes crop and livestock production, as well as some commercial and industrial activity, which has a clear impact on the rural environment. The governorate is home to 14 299 adult residents. A simple random sample of 317 individuals was chosen to represent the research population. A paper-based structured questionnaire was distributed by posting to their national addresses, and 270 valid responses were collected (the response rate was 85 %).

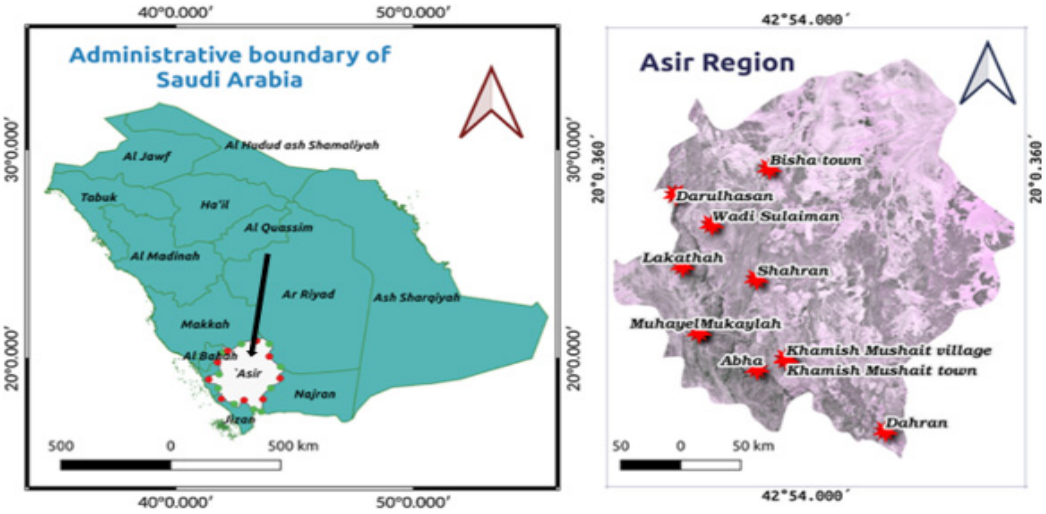

Figure 1. Map of the Asir region, Saudi Arabia (Al-Mutawa *et al.*, 2012).

Research methods

The research data were obtained using a questionnaire that was specifically created to meet the research objectives. The questionnaire was divided into three sections: the first contained information about the participants' characteristics (age, social standing, educational level, work status, and income); the second asked participants to determine their attitudes toward the primary source of environmental information, social engagement, tendency to change, exposure to environmental extension, level of aspiration for a better environment, and tendency to protect the environment; and the third part included 30 items divided into three areas of pollution (water, air, and food). The sum of the scores obtained by a participant represents their level of knowledge about the rural environment.

To verify its validity, the questionnaire was reviewed by experts in the field from the College of Food and Agricultural Sciences at King Saud University (KSU). Notes and revisions were taken into consideration about the type of questions, writing style, clarity, and suitability for the study. The pilot study collected data from 30 respondents by posting the questionnaire to their national addresses. Cronbach (1951) provided a measure to calculate internal consistency or reliability between several items or measurements (range 0 to 1). The reliability of the questionnaire was verified using the Cronbach Alpha coefficient, obtaining a value of 0.76, which is a good indicator of the stability of the questionnaire.

After obtaining permission from the Standing Committee for Scientific Research Ethics at KSU, the questionnaire was distributed to the research population sample and collected during March and April 2020. The data were processed using statistical methods such as frequencies, percentages, means, standard deviation, correlations, and multiple regression. Statistical analysis was performed using SPSS (IBM SPSS Statistics).

RESULTS AND DISCUSSION

Participants' demographic characteristics

According to the participant data (Table 1), 11.5 % were between the ages of 18 and 27 years, 16.7 % were 28–37 years, 21.5 % were 38–47 years, 27.8 % were 48–57 years, and 22.6 % were beyond the age of 58. The majority of the participants (71.1 %) were married. More than three-quarters (77 %) of the participants stated that they had finished elementary, secondary, or high school as their highest educational level, whereas 17.1 % of them had at least a bachelor's degree. Regarding work status, 41.5 % of the participants identified themselves as public employees, while 24.8 % were private-sector workers, 11.9 % were self-employed, and 12.6 % were farmers. In terms of income, more than half of the participants (60.7 %) indicated that their monthly income exceeded 7000 SAR.

Table 1. Demographic characteristics of participants from Ahad Rafidah Governorate, Asir Region, Saudi Arabia (n = 270).

Characteristic	Categories	Frequency	%
Age (years)	18–27	31	11.5
	28–37	45	16.7
	38–47	58	21.5
	48–57	75	27.8
	58 and above	61	22.6
Social status	Married	192	71.1
	Single	28	10.4
	Widower	26	9.6
	Divorced	24	8.9
Educational level	Illiterate	16	5.9
	Elementary	33	12.2
	Secondary	56	20.7
	High school	119	44.1
	Bachelor's	38	14.1
	Graduate studies	8	3.0
Work Status	Public employee	112	41.5
	Private sector employee	67	24.8
	Self-employed	32	11.9
	Farmer	34	12.6
	Unemployed	25	9.3
Income (SAR)	Less than 4000	32	11.9
	4000 to less than 7000	74	27.4
	7000 to less than 10,000	134	49.6
	10 000 or more	30	11.1

According to the information on attitudes toward the environment (Table 2), more than half of the participants (53 %) rely on television as their primary source of environmental information, followed by social media (17.4 %) and radio (15.2 %). Regarding social

Table 2. Participants' attitudes toward the environment in the Ahad Rafidah Governorate, Asir Region, Saudi Arabia (n = 270).

Characteristic	Categories	Frequency	%
Main source of information	Television	143	53.0
	Social media	47	17.4
	Radio	41	15.2
	Press	23	8.5
	Local community	16	5.9
Social engagement	High	16	5.9
	Medium	124	45.9
	Low	130	48.1
Tendency to change	High	41	15.2
	Average	119	44.1
	Low	110	40.7
Exposure to environmental extension	strong	53	19.6
	Average	108	40.0
	Weak	109	40.4
Level of aspiration for a better environment	High	32	11.9
	Average	117	43.3
	Low	121	44.8
Tendency to environmental protection	strong	45	16.7
	Average	86	31.8
	Weak	139	51.5

engagement, nearly half of the participants (48.1 %) indicated that they had a low level of engagement with local communities in activities related to the environment, and 45.9 % had a medium level of engagement. Only 5.9 % of them were fully engaged. This situation is almost the same in terms of the tendency to make a change. Only 15.2 % of the participants stated that they had a high tendency level. In contrast, 40.7 % of them indicated that they had a low level of tendency to make a change. Additionally, 40.4 % of the participants had weak exposure to extension programs and outreach activities, and 40 % indicated that their exposure to these activities was average. Of the participants, 43.3 % had ordinary and 44.8 % had modest aspirations for a better environment. Regarding their tendency to protect their environment, the participants were between weak (51.5 %) and average (31.8 %).

The participants' understanding of the rural environment (Table 3) was medium for 68.5 %, low for 23.7 %, and high for only 7.8 %.

Participants had a greater understanding of the environment when it comes to food pollution than the other categories tested, with water pollution coming in second. The participants knew the least about topics concerning air (Table 4). The results revealed that 79.6 % of the participants had a high degree of knowledge about protecting their

Table 3. Participants' overall knowledge scores of the rural environment in the Ahad Rafidah Governorate, Asir Region, Saudi Arabia.

Knowledge level (score)	Number	%	Mean	Standard Deviation
Low (10–14)	64	23.7	16.38	2.34
Medium (15–19)	185	68.5		
High (20–24)	21	7.8		
Total	270	100		

Table 4. Participants' knowledge scores regarding environment pollution (water, air, food) in rural areas in the Ahad Rafidah Governorate, Asir Region, Saudi Arabia.

Environment	Knowledge level score						Mean (score)	SD
	Low (1–4)		Medium (5–7)		High (8–10)			
	F	%	F	%	F	%		
Food	-	-	55	20.4	215	79.6	8.70	1.23
Water	60	22.2	181	67	29	10.8	5.64	1.46
Air	255	94.4	15	5.6	-	-	2.04	1.49

F: frequency; SD: standard deviation.

environment from contaminated food, while 20.4 % of the participants had a medium level of knowledge. Regarding water pollution, the level of knowledge was high for only 10.8 % of the participants, medium for 67 %, and low for 22.2 %. The situation with the air pollution was not better; 64 % of the participants indicated that they had a low level of knowledge, 94.4 % had a medium level, and only 5.6 % had a high knowledge score.

The Spearman correlation between the participants' knowledge of various types of environmental pollution and a set of independent variables related to their demographic characteristics (Table 5) shows the educational level was significantly and positively correlated with participants' knowledge of food (0.18) and water (0.21) pollution, but not with air pollution. Income was significantly and negatively correlated with air pollution (-0.23). The tendency to change was significantly and positively correlated with participants' knowledge of food (0.14) and water (0.27) pollution. Aspiration for a better environment and the tendency to protect the environment were significantly and positively correlated with participants' knowledge of all studied types of pollution. Overall, participants' overall knowledge was significantly associated with all evaluated demographic characteristics. This means the more education, the tendency to change, the aspiration for a better environment, and the tendency to preserve the environment,

Table 5. Relationship between level of knowledge on different types of pollution and participants' demographic characteristics in the Ahad Rafidah Governorate, Asir Region, Saudi Arabia.

Demographic characteristics	Knowledge on pollution			
	Air	Water	Food	Overall knowledge
Educational level	0.19	0.21**	0.18**	0.20**
Income	-0.23**	-0.04	-0.06	-022**
Tendency to change	-0.02	0.27**	0.14*	0.16**
Aspiration for a better environment	0.13*	0.22**	0.14*	0.27**
Tendency to protect the environment	0.37**	0.14*	0.23**	0.27**

*$p < 0.05$; **$p < 0.01$.

the more knowledge an individual has regarding their environment. However, these correlations had a small effect size, according to Cohen (1988).

A multiple linear regression analysis was performed. Educational level, income, tendency to change, aspiration for a better environment, and tendency to protect the environment were selected as independent variables to determine if the overall knowledge can be predicted from the combination of these variables (Table 6). A significant correlation was found between dependent and independent variables. All predictor variables were significantly correlated with the participants' general knowledge ($p < 0.01$).

Using all predictors simultaneously, the multiple correlation coefficient (R) value is 0.45, and the adjusted R^2 is 0.2 (Table 7), which indicates that 20 % of the variance in the overall knowledge regarding the environment can be predicted from the combination of the predictor variables. According to Cohen (1988) guidelines, this is a medium effect in social and behavioral research. Moreover, all regression coefficients

Table 6. Means, standard deviation, and inter-correlations for the overall environmental knowledge and predictor variables (n = 270).

Overall knowledge	16.4	2.34	0.20**	-0.22**	0.16**	0.27**	0.27**
		Predictor variables					
Education	3.57	1.14	---	---	---	---	---
Income	2.60	0.84	0.19**	---	---	---	---
Tendency to protecting the environment	1.74	0.71	0.05	0.05	---	---	---
Aspiration for better environment	1.67	0.68	0.77**	0.12*	0.15*	---	---
Tendency to change	1.65	0.75	0.66**	0.11	0.01	0.59**	---

*$p < 0.05$; **$p < 0.01$.

Table 7. Simultaneous multiple regression analysis summary for education income, tendency to protecting the environment, aspiration for a better environment, and tendency to change predicting overall environmental knowledge.

Variables*	B	SE B	β	t	*p*
Education	0.11	0.18	0.55	0.65	0.52
Income	-0.74	0.16	-0.26	-4.66	0.00
Tendency to protect the environment	0.80	0.18	0.26	4.57	0.00
Aspiration for a better environment	0.69	0.27	0.20	2.53	0.01
Tendency to change	0.24	0.24	0.07	0.99	0.32
Constant	14.99	0.60	---	25.17	0.00

*R = 0.45; adjusted R^2 = 0.2; F (5264) = 14.5 ($p < 0.05$). B: Unstandardized coefficient; SE B: Standard error for the Unstandardized Beta; β: Standardized coefficient; t: *t*-test statistic.

are statistically significant ($p < 0.01$) except education and tendency to change (Table 7), suggesting that H2, H3, and H4 were supported. Among all predictors, income, tendency to protect the environment, and aspiration for a better environment have a high contribution to the overall environmental knowledge of rural people in the studied area.

The unstandardized Beta (B) in table 7 demonstrates the slope of the line between the predictor variable and the dependent variable. The Standardized beta β works like a correlation coefficient. It ranges from 0 to 1 or 0 to -1. It depends on the direction of the relationship. Moreover, SEB shows Standard Error for the Unstandardized Beta. It works similar to standard deviation for a mean. The *t*-test statistic calculated for the individual predictor. It is also used to calculate p value.

This study found significant interrelationships between overall environmental knowledge and education, income, the tendency to protect the environment, aspiration for a better environment, and the tendency to change. These findings are aligned with results and conclusions from other studies. In meta-analysis within the environmental behavior literature, it was indicated that education is a vital factor for positive behavior toward the environment (Olli *et al.*, 2001). People with a higher level of education are more open and concerned about the environment and understand better environmental information. Other studies also confirmed that education changed people's attitudes and relationships with the environment (van der Ploeg *et al*., 2011; Kaiser *et al*., 2007). Furthermore, Rahman (2016) noticed that educational development among people could enhance environmental sustainability and improve knowledge about the environment. People with formal education are environmentally conscious (Villalba *et al*., 2020). For instance, Ito and Kawazoe (2018) suggested that education and income are significantly related to knowledge about environmental.

Environmental behavior is strongly correlated with an individual's attitude, knowledge, commitment, educational level, and income (Olli *et al*., 2001). Therefore, these factors

could lead to friendly environmental behavior. A few researchers found that income level and environmental knowledge were significantly influencing attitudes toward the environment in rural areas (Ma *et al.*, 2009). They also recommended providing rural areas with grants for training, knowledge dissemination, and technical services to sustain the environment in rural communities. The aspiration of people for a better environment showed a significant relationship with their overall knowledge about the environment. This result is similar to that of Conner and Armitage (2006), who found that knowledge about the environment and aspiration influenced each other.

Regarding income, the results showed that an increase in income decreased knowledge about the environment. These results are opposed by Wang *et al.* (2021), who found that people with high incomes hold high knowledge about the environment. Yang *et al.* (2022) noted that the economic stability of a community improves environmental knowledge as people become rich, requiring better environmental quality (Franzen and Vogl, 2013), whereas Lu *et al.* (2022) revealed that rural people hold low knowledge about the environment because of weak infrastructure and poor public services.

Regarding information sources, this study found that 76.7 % of the participants depend on television, radio, and the press to get environmental information, supporting other studies reporting that these were the primary sources of ecological knowledge (Haron *et al.*, 2005). This must be taken into consideration when designing materials and delivering environmental content. Veisi and Zarandian (2011) depicted that 45.71, 75.71, and 58.57 % of people received environmental knowledge from the press, television, and radio, respectively. The developments in information and communication technology (ICT) changed the information-seeking behavior among rural people. Dhaka and Chayal (2010) found a positive attitude among Indian rural people towards ICT. Similarly, the rural people in the current study area should be facilitated with ICT tools for improving environmental knowledge. However, many of the participants in their study were not familiar with most scientific terms related to the environment.

Vasudevan (2012) found a significant positive correlation between environmental behavior, engagement in activities related to the environment, and participants' knowledge. Almost 7.8 % of the respondents in the study area held high knowledge, as compared to people living in the coastal area of Kerala, of whom 4.84 % had a high level of knowledge. Furthermore, the findings indicated that relying solely on technocratic solutions to address environmental challenges would be ineffective. An institutional structure should be stronger, and environmental preservation programs should be arranged. However, programs related to the environment improve knowledge levels among rural people (Duerden and Witt, 2010).

Furthermore, some studies mentioned that awareness and responsibility impacted rural people's behavior and knowledge. Lado (2004) showed that rural community residents, such as farmers, have learned from their natural environment. However, they need to be exposed to updated knowledge about modern development and pollution to be aware of emerging environmental issues. Berenguer (2010) concluded

that people in rural areas expressed more responsibility toward their environment, enabling them to protect it.

In this regard, rural people should acquire information to improve their knowledge about the environment. Understanding environmental concepts helps recognize the relationship between functions and facts that interact with the biophysical and social elements (Veisi and Zarandian, 2011). The present study contributes to the ongoing literature in different ways. First, we explored the environmental knowledge of rural people in the study area, providing an in-depth understanding of the relationships between the level of knowledge on different types of pollution and participants' demographic characteristics. Second, our study promotes a mechanism by which institutions would act to design materials related to environmental knowledge.

CONCLUSIONS

Rural residents in this study are dependent on traditional sources of information to obtain knowledge regarding the environment. Although participants had a high degree of awareness of food pollution, their understanding of water pollution was medium, and their knowledge of air pollution was poor. In rural communities where the environment has unique challenges such as the use of agricultural fertilizers and pesticides, people need to be aware and well-educated about their surroundings. This can be achieved by planning and implementing extension programs and outreach activities.

According to the findings of this study, predictor variables, including the tendency to protect the environment, aspiration for a better environment, and the tendency to change, can positively affect overall environmental knowledge. At the same time, participants' attitudes toward these variables are low. Aspiration, seeking a better environment, and being willing to protect the environment are crucial factors for disseminating environmental knowledge. Organizations and projects aiming to influence people's attitudes must consider these aspects, and more effort should be made to launch awareness campaigns and engage local communities. The current study was limited to the province of Ahad Rafidah; hence, the findings cannot be applied to other parts of Saudi Arabia. Another study should be conducted to gain a more in-depth grasp of rural people's environmental knowledge.

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