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Original Article

Evaluation of Environmental Health Parameters for COVID-19 Disease in South Khorasan Province, Iran

Adeleh Esform[1], Hamid Salehinia[2], Ali Naghizadeh[3*]

[1]Student Research Committee, Birjand University of Medical Sciences and Health Services, Birjand, Iran
[2]Assistant Professor of Epidemiology, Social Determinants of Health Research Center, Birjand University of Medical Sciences, Birjand, Iran
[3]Associate Professor of Environmental Health Engineering, Medical Toxicology and Drug Abuse Research Center, Birjand University of Medical Sciences, Birjand, Iran

Abstract

Background & Aims: Prevention is the best solution to break the coronavirus disease 2019 (COVID-19) infection chain. The aim of the present study was to investigate the degree of adherence to environmental health parameters for COVID-19 prevention in South Khorasan Province.

Materials and Methods: This cross-sectional study was performed on 410 residents of South Khorasan in 2021. The data collection instrument containing a researcher-made questionnaire included demographic, knowledge, and performance questions. The validity and reliability of the questionnaire were confirmed, an online questionnaire was prepared, and the questionnaire link was sent via online networks. Data were entered into SPSS version 16 and analyzed using an independent t-test, analysis of variance, and correlation coefficient. *P* value ≤ 0.05 was considered as the significance level.

Results: The results showed that 35.9% and 64.1% of participants were women and men, respectively. A total of 82.9% of people wore masks outdoors, and 83.7% of people washed their hands with sanitizer or soap on a daily basis. Further, statistical analysis revealed no significant relationship between performance and demographic characteristics. However, knowledge was significantly associated with gender, job, and education ($P \leq 0.05$).

Conclusion: The participants had poor knowledge and performance, and there was a need to provide education in this regard in order to update COVID-19 knowledge and change the behavior of the general public towards this emerging disease.

Keywords: Knowledge, Environmental health, COVID-19

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1. Introduction

Over the past two decades, the prevalence of acute respiratory infections has become one of the newest global health-related hazards and challenges [1]. In late December 2019, an outbreak of a coronavirus disease was reported in Wuhan, China [2].

This disease, called respiratory syndrome or the coronavirus disease 2019 (COVID-19), is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [3]. Following the global outbreak of the virus, the World Health Organization (WHO) issued a statement on January 30, 2020, declaring the new coronavirus to be the sixth leading cause of public health emergency worldwide that threatens not only China but also all countries around the world [4]. According to the WHO declaration, the number of global infections and deaths until January 31, 2021 was 103 and 22 million cases, respectively. Further, the number of confirmed cases and deaths in Iran was 1.4 million and 57 807 people, respectively [5]. COVID-19 is a coated virus with a ribonucleic acid genome [6]. COVID-19 infection was initially associated with nonspecific and general symptoms such as boredom, fatigue, body aches, fever, and dry cough. Patients may also manifest symptoms of nausea and diarrhea immediately before the fever. A small number of patients may have headaches or vomit blood and even be relatively asymptomatic. In the acute form, the disease begins with shortness of breath, and the subsequent decreased oxygen saturation leads to complications such as acute respiratory distress, kidney failure, heart failure, and even patient's death [7]. People get infected when contaminated respiratory droplets spread through the infected person's sneezing or coughing, land in the mouth or nose of people in proximity, and are subsequently transmitted to their lungs. Until large-scale vaccine production for the world's general population is performed, the only ways to control this infection are personal protection, social distancing, and avoiding attending the contaminated environments [2].

Appropriate health measures are still considered primary disease prevention strategies in today's civilized society, and achieving the desired health status in any society is one of the outstanding achievements in public

*Corresponding Author: Ali Naghizadeh, Email: al.naghizadeh@yahoo.com

health [8]. Although measures have been taken to reduce contact with or eradicate many pathogens in recent decades, human susceptibility to several pathogenic microorganisms is undeniable. Therefore, the constant exploration of methods that can improve and maintain optimal health should be considered. Indeed, exposure to pathogenic microorganisms can occur because of contact with infected people, contaminated water or food consumption, contact with contaminated objects or surfaces, or people's unsanitary habits and behaviors. In addition, group behavior is regarded as an important factor in the process of disease transmission. Preventive behaviors that can eliminate the disease transmission cycle include washing hands with soap and water or disinfectant solution, avoiding shaking hands and kissing, disinfecting purchased items, wearing masks, and home quarantine [9].

1. 1. Objective of the study

Considering the above statements, the critical COVID-19 disease conditions, and its negative effects on health, economic, and social aspects that will ultimately have adverse effects on the health and well-being of people in the society and due to the need to perform protective behaviors against COVID-19 and observe health protocols, the aim of the present study was to investigate the degree of adherence to environmental health parameters for COVID-19 prevention in South Khorasan province.

2. Materials and Methods

The present cross-sectional study was performed on 410 people residing in South Khorasan province. Data collection was carried out using online questionnaires considering the COVID-19 pandemic and its high transmission risk. According to a study by Haghdoost, when the prevalence or condition is not known, the outcome frequency can be considered 0.5 to estimate the maximum sample size. Therefore, due to the absence of a similar study, considering the outcome value of 0.5 and 95% confidence interval, the sample size was considered 400 people [10]. After the approval of the research project by the Research Council and obtaining the ethics code of IR.BUMS.REC.1399.257, a questionnaire using PorsLine program, which is a kind of tool to create online questionnaire software, was prepared, and the questionnaire link was sent to the online groups. The completed questionnaires were analyzed after reviewing the inclusion and exclusion criteria. The inclusion criterion included voluntary answering of all questionnaire items, and the exclusion criteria included questionnaires that were completed more than twice using the same ID and completion of the questionnaire less than 5 minutes. The data collection tool included a researcher-made questionnaire containing demographic questions as well as questions related to the knowledge and practice of individuals regarding the adherence to environmental health parameters for COVID-19 prevention. The questionnaire validity was confirmed using the qualitative content analysis method and the opinion of experts including 7 health professors and 2 methodologists. To assess the questionnaire reliability, it was given to 30 qualified people and Cronbach's alpha was calculated.

2. 1. Data analysis

In the present study, the collected data entered SPSS version 16, and data analysis was carried out using descriptive statistics (mean, standard deviation, and frequency), analytical statistics, an independent t-test, analysis of variance, Mann-Whitney test, and Kruskal-Wallis test. Moreover, P value ≤ 0.05 was considered as the statistically significant level.

3. Results

The study population included 410 subjects, of whom 35.9% were women and 64.1% were men. Table 1 shows the demographic information of the study population. According to the results, 59.8% and 40.2% of the participants were married and single, respectively. Further, 36.3% of cases had diploma, and 32.4% of cases were self-employed.

The overall mean and standard deviation of participants' knowledge scores regarding the observance of environmental health parameters for COVID-19 prevention was 32.99 ± 5.01. Moreover, 55.4% of the participants had COVID-19 disease, 82.9% of them wore masks outdoors, and 75.1% did not wear gloves outdoors. Table 2 illustrates the frequency distribution of answering questions related to the knowledge regarding the level of adherence to environmental health parameters for COVID-19 prevention.

Table 1. Frequency distribution of participants' demographic information in South Khorasan province (n = 410)

Variable	Categories	Number	Percentage
Gender	Female	147	35.9
	Male	263	64.1
Marital status	Married	245	59.8
	Single	165	40.2
Education	Elementary	60	14.6
	Middle school	54	13.2
	Diploma	149	36.3
	Bachelor	113	27.6
	Above Bachelor	34	8.3
Job	Employee	93	22.7
	Self-employed	133	32.4
	Manual worker	80	19.5
	Housewife	43	10.5
	Unemployed	10	2.4
	Student/university student	51	12.4

Table 2. Frequency distribution of responses regarding the knowledge about the level of adherence to environmental health parameters for COVID-19 prevention

Questions	Answers	Number	Percent
Do you use masks outdoors?	Yes	340	82.9
	No	70	17.1
Do you use gloves outdoors?	Yes	102	24.9
	No	308	75.1
Do you observe 1 to 2 meters social distancing outdoors?	Yes	323	78.8
	No	87	21.2
Do you wash your hands with hand sanitizer or soap on a daily basis?	Yes	343	83.7
	No	67	16.3
Is your home air conditioned properly?	Yes	410	100
	No	0	0
How air conditioning work in your workplace?	Natural ventilation	171	41.7
	Ventilator, fan or air conditioner	76	18.5
	Both cases	163	39.8
Do you wear a mask when traveling by public transportation (such as buses and taxis)?	Yes	227	55.4
	No	92	22.4
	I do not use	91	22.2
Do you disinfect your hands after using a personal or public vehicle (such as buses and taxis)?	Yes	216	52.7
	No	180	43.9
What kind of mask do you wear outdoors?	Surgical mask	172	42.0
	Filtered mask	101	24.6
	Cloth mask	65	15.9
	I do not use	66	16.1
What kind of gloves do you wear outdoors?	Plastic	99	24.1
	Latex	4	1.0
	Fabric	9	2.2
	I do not use	298	72.7
Do you wash your hands daily with soap or hand sanitizer at workplace?	Yes	239	58.3
	No	67	16.3
Do you wear a mask at workplace?	Yes	282	68.8
	No	128	31.2
Do you wear gloves at workplace?	Yes	81	19.8
	No	329	80.2
Is the air conditioning working properly in your workplace?	Yes	389	94.8
	No	21	5.2
Do you use alcohol to disinfect work surfaces?	Natural ventilation	142	34.6
	Ventilator, fan or air conditioner	94	22.9
	Both cases	174	42.4
How air conditioning work in your workplace?	Yes	283	69.0
	No	127	31.0
Do you use household detergents to disinfect your work surfaces?	Yes	152	37.1
	No	257	62.7

Note. COVID-19: Coronavirus disease 2019.

The overall mean ± standard deviation of participants' performance scores regarding the observance of environmental health parameters in order to prevent COVID-19 infection was 28.49 ± 4.60. A total of 48% of participants kept a safe distance of about 1 to 2 meters in a day in a few percent of cases, and 52% of them avoid shaking hands. Table 3 displays frequency distribution of answering questions related to performance regarding environmental health parameters for COVID-19 prevention.

Statistical analysis revealed no significant relationship between performance and demographic characteristics. However, there was a significant relationship between knowledge and gender ($P = 0.006$), education level ($P = 0.003$), and job ($P = 0.000$). Table 4 shows results of knowledge scores and the performance of participants in terms of adherence to environmental health parameters for COVID-19 prevention regarding demographic variables.

4. Discussion

The aim of the present study was to evaluate the level of adherence to environmental health parameters for COVID-19 prevention in South Khorasan. The COVID-19 prevention has become one of the most important goals of the health system worldwide. Unfortunately, due to the lack of reliable and accessible information in most developing countries, there is the greatest disagreement about the root causes of the pandemic and how it changes over time among different affected societies. However, this information is crucial for strategic decisions about COVID-19 prevention, but unfortunately, this disease is spread through contact with asymptomatic carriers. Therefore, defining comprehensive and targeted COVID-19 prevention approaches is essential. The study population included 410 people, of whom 35.9% were women and 64.1% were men. Table 1 shows the demographic characteristics of the study population. Preventing COVID-19 requires adherence to personal hygiene by all members of society [11]. In addition to hand hygiene and safety distancing, one of the critical and effective preventive measures against COVID-19 is using masks. The present study revealed that 82.9% of the participants wore masks outdoors. According to a study by Lai et al, the use of masks can reduce the spread of respiratory droplets from COVID-19 patients and help control the disease [4]. Further, among the participants, 42% of people wore medical masks (surgical masks). According to the WHO guideline, surgical masks led to a significant reduction in the risk of infection among health workers [12].

SARS-CoV-2 is transmitted through respiratory droplets and close contact with people inflicted by COVID-19 [14]. Therefore, one of the practical measures to prevent the incidence of COVID-19 is creating desirable indoor air quality via natural or mechanical methods [14]. According to the results, 100% of the participants

Table 3. Frequency distribution of responses regarding level of performance for environmental health parameter for COVID-19 prevention

Questions	Answers	Number	Percent
What many time do you observe the safe social distancing (1 to 2 meters) in a day?	(Rarely) 0-25%	101	24.7
	(Sometimes) 25-50%	197	48.0
	(Most of the time) 50%	97	23.7
	(Always) 100%	15	3.6
How much do you avoid shaking hands in a day?	(Rarely) 0-25%	45	11.0
	(Sometimes) 25-50%	105	25.5
	(Most of the time) 50%	213	52.0
	(Always) 100%	32	7.8
	I do not comply	15	3.7
How many times a day do you wash your hands with soap and water?	2 times or less	99	24.1
	2-4 times	218	53.2
	4-6 times	59	14.4
	6-8 times	34	8.3
How many times do you observe the separation of indoor and outdoor clothes?	(Rarely) 0-25%	104	25.4
	(Sometimes) 25-50%	112	27.3
	(Most of the time) 50%	96	23.4
	(Always) 100%	98	23.9
How many times have you traveled in and out of the city or attended a party during quarantine conditions?	Rarely	106	25.9
	5-10 times	110	26.8
	10-20 times	103	25.2
	More than 20 times	91	22.0
How many times have you avoided contact with people who have a cold or a fever during the pandemic?	Once or I did not pay attention	153	37.3
	2 times	100	24.4
	3 times	82	20.0
	More than 4 times	75	18.3
How much do you observe basic hygiene items such as avoiding shared utensils last week?	(Rarely) 0-25%	81	19.8
	(Sometimes) 25-50%	84	20.5
	(Most of the time) 50%	109	26.6
	(Always) 100%	130	31.6
	I do not comply	6	1.5
How much better is your adherence to hand and face hygiene no than pre-pandemic period?	(Rarely) 0-25%	29	7.1
	(Sometimes) 25-50%	74	18.0
	(Most of the time) 50%	225	54.9
	(Always) 100%	82	20.0
How much do you deal with the client in your daily work?	less than 10 people	82	20.0
	11-20 people	83	20.2
	21-30 people	101	24.6
	More than 30 people	51	12.4
	I have no client	93	22.8
How many hygiene items do you have access to and use in a typical day at work (hand washing - gloves - mask - disinfecting surfaces at workplace)?	None	16	3.9
	1 Item	197	48.0
	2 Items	103	25.1
	3 Items	84	20.6
	4 Items	10	2.4
How many minutes are you in crowded places on the way to work on a typical day?	10 min	80	19.5
	10-20 min	99	24.1
	20-40 min	95	23.2
	40-60 min	46	11.2
	Over 1 h	1	2.0
	None	89	21.7
How many times a day do you use alcohol or other household detergents to disinfect surfaces at workplace?	I do not use at all	116	28.3
	1-3 times a day	280	68.3
	3-5 times	12	2.9
	More than 5 times a day	2	5.0
How many times a day do you use alcohol or other household detergents to disinfect surfaces at home?	I do not use	102	24.8
	1-3 times a day	263	64.2
	3-5 times a day	35	8.5
	More than 5 times a day	10	2.5
Since the onset of Covid-19 disease, how many times have you taken and are you aware of Covid-19 prevention measures?	(Rarely) 0-25%	98	23.9
	(Sometimes) 25-50%	101	24.7
	(Most of the time) 50%	116	28.3
	(Always) 100%	95	23.1

Note. COVID-19: Coronavirus disease 2019.

had desirable ventilation conditions at home with natural ventilation accounting for 41.7% of the cases. In addition, 94.8% of people had a favorable ventilation status at workplace, where ventilation was performed by natural and mechanical methods in 42.4% of the cases. A study conducted in Moin hospital in Tehran demonstrated the presence of this virus in the air of the wards and bed surfaces of infected patients. Given the contamination of the studied ICU with COVID-19, it is necessary to take specific measures, including the implementation of air isolation procedures such as using respiratory protection equipment (e.g., N95 masks) and electric air purifier masks as well as examining ventilation systems to ensure the safety of healthcare providers [15]. A study on the prevention of coronavirus in industrial environments revealed that in crowded workstations, strengthening ventilation systems had a significant role in controlling the spread of coronavirus [16].

Timely and planned health activities include reducing contact, observing the infected person's contact with others, quarantine, and physical distancing (the safest physical distancing suggested to prevent disease transmission is in the range of 1.5 to 2 meters) which is very effective for the disease control [13]. The results of the present study demonstrated that 78.8% of the participants observed safe social distancing (1 to 2 meters) in the outdoor environment. The results also showed that 73.9% of them had traveled in and out of the city, attended party, and did not meet the quarantine protocols. Therefore, this finding is inconsistent with Stock et al qualitative study entitled "Risk assessment of COVID-19 in China". They showed that the most

Table 4. Results of Knowledge scores and the performance of participants in terms of adherence to environmental health parameters for COVID-19 prevention based on demographic variables

Variable	Categories	Knowledge			Performance		
		Mean	Standard deviation	*P* value	Mean	Standard deviation	*P* value
Gender	Female	31.99	5.33	0.006	28.86	4.58	0.231
	Male	33.56	4.74		28.29	4.61	
Marital status	Married	32.87	4.91	0.542	28.84	4.63	0.064
	Single	33.18	5.18		27.98	4.53	
Education	Elementary	34.13	4.42	0.003	28.05	4.21	0.165
	Middle school	33.90	4.27		30.00	4.90	
	Diploma	32.69	5.36		28.10	4.62	
	Bachelor	31.90	5.20		28.45	4.79	
	Higher education	32.70	2.37		29.19	4.27	
Job	Employee	31.14	4.82	0.000	28.32	4.69	0.453
	Self-employed	33.61	5.20		28.69	4.51	
	Manual worker	33.68	4.47		28.36	4.75	
	Housewife	33.34	4.79		29.13	4.74	
	Unemployed	28.50	3.30		25.80	4.89	
	Student/university student	43.23	4.97		28.47	4.23	

Note. COVID-19: Coronavirus disease 2019.

important control measure to reduce the risk of the outbreak was arrival screening or travel restrictions [14]. Stock et al pointed to public health tools, including social distancing, respiratory and hand hygiene, and quarantine protocols, as very appropriate and effective measures in delaying the COVID-19 peak [15].

The results revealed that 83.7% of people wash their hands daily with liquid soap or soap, and there are better hand and face hygiene conditions in 53% of cases as compared to the pre-pandemic period. The results of the present study are consistent with a study by Kanadiya et al. The majority of them believed that washing hands with soap and water reduced the risk of influenza, a type of infectious disease of the respiratory tract [16]. Likewise, Farahat et al found that hand washing as a preventive behavior had the greatest effect [17].

According to the results, participants used alcohol or other household detergents to disinfect surfaces at home and workplace in 64.2% and 68.3% of cases, respectively. Cadnum et al also found that ethanol solution and diluted sodium hypochlorite disinfectant, which is electrostatically sprayed, are effective and useful forms of disinfection of equipment and surfaces [18]. Table 4 depicts the relationship between knowledge and performance scores regarding the level of adherence to environmental health parameters for COVID-19 prevention with demographic variables. Results demonstrated a significant relationship between knowledge and gender, level of education, and job. The results also indicated that the men had higher knowledge than women regarding the adherence to environmental health parameters for COVID-19 prevention, but women's performance score was better. In a study, Fallahi et al revealed that women had better performance in observing home quarantine, which is one of the COVID-19 preventive behaviors, and women had a better understanding of social issues than men [19].

Moreover, housewives outperformed self-employed women in terms of COVID-19 prevention. Indeed, housewives accounted for 10.5% of the study population. Further, 32.4% of self-employed people were men. This being the case, it can be concluded that among other contributors to the outperformance of women is their occupation because men had to work outside. In addition, 34.33% of studied people had a higher knowledge level. Daniel et al found in their study that students and parents are anxious about the current state of the COVID-19 outbreak. Uncertainty about when life will return to its normal status exacerbates their anxiety symptoms [20]. Accordingly, it can be stated that due to the closure of schools and universities or their reopening only with a limited number of students attending the classes, students were more aware of the COVID-19 preventive behaviors than other groups. Statistical analysis revealed no significant relationship between performance and demographic characteristics, suggesting that factors such as gender, marital status, and education level cannot contribute to preventive behaviors. This is inconsistent with Rahman & Sathi and Zhong et al studies, which found that marital status, education level, and occupation significantly predicted preventive behaviors [21, 22].

5. Conclusion

The results of the present study demonstrated a significant relationship between knowledge and gender, level of education, and job. The results also indicated a

low level of knowledge and performance; therefore, it is vital to raise awareness in this regard and change the behavior of the general public. Decreased knowledge and performance regarding disease prevention methods can reduce effective performance and increase the incidence rate. The study limitations included access of the target group to online media due to the nature of the study' accordingly, attempts were made to overcome this limitation by using different online media. The results of the study were also obtained based on self-administered questionnaires, which may affect the results despite the fact that the validity and reliability of the questionnaire have been confirmed, so further research is needed to confirm the findings of the present study.

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Authors' contribution
Adeleh Esform wrote the draft of the paper.
Hamid Salehnia has been the statistical consultant of this project.
Ali Naghizadeh has been the Scientific supervisor of this research project.

Conflict of Interests
The authors of the article state that there is no conflict of interests in the present study.

Ethical Considerations
This study was approved by Research Council of Birjand University of Medical Sciences and Health Services under ethics code of IR.BUMS.REC.1399.257

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