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Flood Risk Perception among the Inhabitants of a Flood-prone Area in Iran

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Abstract

Background: Misunderstanding of disaster hinders people from devoting enough attention to disaster preparedness programs. Flood is one of the main natural hazards in Iran.

Objectives: The present study aimed to determine flood risk perception among residents of a flood-prone area in Iran in 2021.

Methods: This cross-sectional study was conducted on 201 inhabitants of three villages along the Hesar-Golestan River in northeast Iran. A researcher-made questionnaire was used to assess their flood risk perception and opinions about the causes of the flood. Flood risk perception was assessed using ten questions with a 5-point Likert scale. Risk perception was calculated at three levels: low (scores 10 to 23), medium (scores 24 to 37), and high (scores 38 to 50). Multi-stage sampling technique was used for sampling.

Results: The majority of participants (81%) had a moderate risk perception. The mean risk perception score was 30±5, which indicates a moderate risk perception. According to the participants, the three main causes of floods were environmental degradation and soil erosion, unplanned development and construction in flood-prone areas, and heavy seasonal rainfall, respectively. There was a significant relationship between gender and age with some opinions about the causes of floods.

Conclusion: The risk perception of participants was at a moderate level. Low or moderate flood risk perception can lead to insufficient attention, inaction, or insufficient efforts to reduce the risk and increase preparedness for floods. Taking measures such as educating people about the causes and consequences of floods using appropriate and effective methods can help to manage disasters better.

Keywords: Disasters, Disaster management, Floods, Risk perception

1. Background

The Islamic Republic of Iran, the tenth most disaster-prone country in the world, has always been at risk of floods (1). In terms of the number of deaths from natural disasters, floods are ranked second after earthquakes in this country. It has been reported that 30% of the total economic losses from natural disasters are related to floods. In this respect, drought has the first place in Iran (2). The severity and frequency of natural hazards, particularly floods, have constantly been on the rise in Iran (3). Although the direct human damage caused by floods is generally less than that of earthquakes, later health consequences and indirect human damages have been far more significant than immediate and direct damage (4, 5). Nonetheless, direct human casualties were significant in deadly floods, such as the one that occurred in April 2017 in western Iran. According to the Forensic Medicine Organization of Iran, 78 people were killed in this flood, and 23 provinces were affected (6).

Based on flood maps, 20% of areas across Iran are highly prone to flooding (7). Khorasan Razavi is one of the most flood-prone provinces in the country. Statistics from the Ministry of Energy demonstrate that 125 floods occurred in this province in 25 years, with an average of 5 floods per year, which ranks first in the number of floods among all provinces in the country (8). Hesar-Golestan river bank in this province is one of the most dangerous areas in terms of floods (9). Although most natural hazards are inevitable, and human interventions and demographic changes have made communities increasingly vulnerable to hazards, it is possible to prevent the risks and reduce vulnerability (4).

Damages of floods can be significantly reduced by effective prevention measures and programs which reduce vulnerability and increase preparedness and response to the damage (10). Nevertheless, the experiences of past disasters in Iran, including the recent flood in the western part of the country (mentioned earlier) and considering hundreds of injured and dead and thousands of homeless, demonstrated that the plans and measures on disaster management have not been effective enough (11, 12). The main reason is insufficient attention to disasters, as well as risk prevention programs and recommendations among policymakers, managers, and households (10). This situation, in turn, can result from an incorrect understanding of the risk of disasters.

Disaster risk perception means assessing and mentally understanding the likelihood of a particular

disaster and concerns about its consequences (13). This issue is important since, in almost all disaster management programs, the active participation and cooperation of the people are the main factors for the success of these programs; therefore, the approach dominant in this field today is people-centered disaster management (14). Environmental degradation and soil erosion, construction in the area of rivers and canals, ignoring warnings and recommendations during and after floods, such as the evacuation of areas at risk of floods, traffic limitations in flood routes, use of safe water resources after floods, are some examples of the public not taking the risk of floods seriously, which is due to low risk perception of the disaster (10).

Among the studies conducted in this field, we can refer to the research by Stewart et al. entitled "Rural Community Disaster Preparedness and Risk Perception in Trujillo, Peru." The findings of the stated study pinpointed that participants who had previous experience dealing with a disaster had a better understanding of the disaster. In general, the participants had the highest risk perception of earthquakes and epidemics (15). The findings of another study by Pan, aimed at understanding the risk of geological hazards in China's mountainous and hazardous areas, demonstrated that respondents considered landslides and massive mudflow to be the most likely hazards. While in terms of hazard consequences, the destruction of agricultural lands, forests, main roads, and damage to buildings were the most common (16).

Most natural hazards occur in developing countries and cause great human suffering, especially in rural areas (17). Villagers, who usually live in detached single-family homes, are more at risk of natural disasters, including floods, than residents of cities (18). However, studies on risk perception in rural areas are scarce, especially in Iran, a developing country that is more exposed to such risks (17). For those in charge of disaster risk management, it is important to be aware of people's understanding of disaster risk and its related factors.

2. Objectives

To fill the knowledge gap and help better disaster risk management, the present study aimed to determine the perception of flood risk and causes among residents of a flood-prone rural area in Iran.

3. Methods

3.1. Study Design and Participants

This research was conducted based on a descriptive-analytical cross-sectional design. The study population included the residents of three villages along the Hesar-Golestan River, including Jaghargh, Hesar, and Golestan, located in Khorasan Razavi, Iran. The study was conducted in February 2022. The inclusion criterion was the age range of 18- 70 years. On the other hand, the exclusion criterion was suffering from a mental disability. The sample size (93 people) was calculated using PASS software and taking into account 5% alpha, 20% accuracy, and 40% ratio. To report the results according to age groups and gender (four groups in total) with the mentioned accuracy rate, 372 cases were included in the study(Jaghargh (n=107), Hesar(n=122), and Golestan (n=143)) .

Multi-stage sampling method was applied in this study. In the first stage, each village was considered a class, and a number of households were randomly selected from each class according to the population covered by it, and then in the next stage, each household was randomly selected. One person entered the study using the Kish method. Household information was obtained from the health records available in the health houses of the studied villages. In cases where the individual or any of his /her family members did not visit the health center within three months from the beginning of data collection, they were asked via phone calls if they wished to participate in the study and invited to come over to the health house.

3.2. Measurement Tools

In this study, a researcher-made questionnaire was used to collect data. This questionnaire had three main sections. The first part assessed the demographic characteristics of the study participants. Demographic characteristics included age, gender, marital status, occupation, and education. The second part evaluated the participants' opinions about the causes of the flood. In the third part of the questionnaire, flood risk perception was assessed using 10 questions which were rated on a 5-point Likert scale (strongly disagree=1 and strongly agree= 5). Five questions in this part pertained to the probability of flood occurrence, and five of them were related to its severity and consequences from the participants' points of view. Risk perception was calculated at three levels: low (10-23), medium (24-37), and high (38-50). The validity of the questionnaire was measured and confirmed by obtaining the opinions of 10 experts in this field, using Content Validity Ratio (CVR) and Content Validity Index (CVI). Purposeful sampling was used to select the experts. The CVI and CVR values for all questionnaire items were in the acceptable range (>0.62 for CVR and >0.79 for CVI). The reliability of the questionnaire was evaluated by the test-retest method. A number of 20 residents of the studied villages participated in the two tests within a 2-week interval. According to ICC= 0.84, the reliability of the questionnaire was confirmed.

3.3. Ethical Considerations

In all stages of this study, ethical considerations

were observed, including obtaining informed consent from study participants and respecting the confidentiality of information.

3.4. Statistical Analysis

Data analysis was performed using Stata software. The ratio, mean, and Kruskal-Wallis, Mann-Whitney, and logistic regression tests were used for analysis. In data analysis, a p-value less than 0.05 was considered statistically significant.

4. Results

In this study, the response rate was 54% (n=201). The mean age of participants was 39±9 years. More than half of the participants were female (55%; n=110). In terms of marital status, 94% (n=189) of cases were married. Most participants had a high school diploma (n=45%), and a few had a bachelor's degree or higher (16%; n= 8%). Regarding careers, most participants were housewives (52%; n= 102) or worked in non-administrative jobs (37%; n = 72%). Table 1 presents the demographic characteristics of the study participants and the distribution of flood risk perception scores by demographic characteristics. (Table 1)

According to Table 1, the mean score of flood risk perception was higher in the age group of 45-70 (P-value= 0.894), men (P = 0.035), the married (P= 0.161), those having secondary education (P=0.429) and farmers (P=0.267) than other groups. Moreover, 81% (n= 162), 10% (n=20), and 9% (n=19) of study participants had a moderate, low, and high risk perception, respectively. In addition, the mean risk perception score was 30±5, which indicates a moderate risk perception. The frequency distribution of the causes of floods according to the study participants is illustrated in Table 2.

As displayed in this table, the three main causes of floods in the participants' view included environmental degradation and soil erosion, unplanned development and construction in flood-prone areas, and seasonal heavy rains. The findings demonstrate no significant relationship between participants' opinions about the causes of floods and their level of risk perception. (Table 2)

In the univariate analysis, perception of flood risk showed no statistically significant correlation with age, gender, level of education, and occupation (Table 3). Table 3 presents the results of the logistic regression test, which examines the relationship between demographic variables (as independent variables) and participants' opinions about the causes of floods (dependent variables). As depicted in this table, women were 2.43 times more likely than men to choose God's punishment and punishment for sins as the causes of the flood. Moreover, single people were 3.25 times more likely to choose unplanned development and construction in flood-prone areas as the reasons. In addition, the chance of choosing inappropriate irrigation in agriculture was 1.76 times more from one age group to the older one.

Table 1. Demographic characteristics of the study participants and the distribution of flood risk perception scores by demographic characteristics

Variable	Categories	Frequency (Percentage)	Mean ± SD	P-value*
Age	19-32	48 (23.88)	30.02 ± 3.98	0.894
	33-37	52 (25.87)	30.07 ± 5.09	
	38-44	49 (24.38)	29.85 ± 5.56	
	45-70	52 (25.87)	30.5 ± 5.44	
Sex	Male	91 (45.27)	30.96 ± 5.58	0.035
	Female	110 (54.73)	29.46 ± 4.45	
Marriage Status	Married	189 (94.03)	30.26 ± 4.95	0.161
	Single	12 (5.97)	28.16 ± 6.11	
Education	Primary school	31 (15.50)	31.03 ± 4.86	0.429
	Secondary school	63 (31.50)	30.58 ± 5.59	
	High school diploma	90 (45)	29.67 ± 4.64	
	Bachelor and higher	16 (8)	29.18 ± 5.40	
Job	Farmer	2 (1.02)	32 ± 1.41	0.267
	Non-administrative	72 (36.73)	30.26 ± 5.31	
	Housewife	102 (52.04)	29.52 ± 4.45	
	Others	20 (10.20)	31.8 ± 6.53	

* Independent sample t-test & One-way analysis of variance (ANOVA)

Table 2. Frequency distribution of the causes of the flood from the participants' point of view and the relationship between the participant's opinion and the level of risk perception

Cause of Flood	Frequency (Percentage)	P-value*
Environmental degradation and soil erosion	101 (51.74)	0.515
Unplanned development and construction in flood-prone areas	74 (36.82)	0.557
Seasonal heavy rains	68 (33.83)	0.628
Lack of dams	59 (29.36)	0.390
God's punishment and the punishment for sins	54 (26.86)	0.615
Climate change	30 (14.93)	0.863
Inappropriate irrigation in agriculture	26 (12.94)	0.379

* Ordered Logistic Regression

Table 3. Relationship between flood causes and research variables

Study Variables / Causes of Flood	Age		Gender (Reference: Male)		Education (Reference: Primary)		Job (Reference: Farmer)		Marriage Status (Reference: Married)	
	OR	P-value*	OR	P-value*	OR	P-value*	OR	P-value*	OR	P-value*
Environmental degradation and soil erosion	1.25	0.172	0.51	0.070	0.70	0.105	0.57	0.062	0.38	0.349
Seasonal heavy rains	1.09	0.642	0.64	0.306	1.28	0.325	1.19	0.586	0.58	0.577
Climate changes	1.07	0.773	0.38	0.089	1.38	0.331	0.75	0.505	5.28	0.992
God's punishment and the punishment for sins	0.79	0.161	2.43	0.028	0.80	0.307	1.42	0.216	5.25	0.995
Unplanned development and construction in flood-prone areas	0.73	0.070	1.43	0.334	0.90	0.649	1.08	0.785	3.25	0.032
Inappropriate irrigation in agriculture	1.76	0.034	0.37	0.087	1.00	0.992	1.20	0.659	5.28	0.992
Lack of dams	1.27	0.164	1.04	0.910	1.43	0.130	0.96	0.917	2.06	0.146

* Ordered Logistic regression

5. Discussion

The present study aimed to determine the perception of flood risk among residents of a flood-prone area. The obtained results pointed out that 81% of participants had a moderate perception of flood risk, and only 9% showed a high understanding of flood risks. Kraus and Slovic argued that higher levels of fear results in greater perceived risk (19). Based on this statement, it can be concluded that since our study was conducted in a flood-prone area, the residents' fear of floods and perceived risks were not high.

Despite the fact that the World Health Organization recognizes gender as one of the social determinants of health (20), in the present study, no statistically significant relationship was found between gender and the perception of flood risk. This finding is consistent with the results of the study by Kellens et al. entitled "an analysis of the general perception of flood risk off the Coast of Belgium" (21) and the study by Bustillos Ardaya et al. aimed at assessing the disaster risk perception in Brazil (22). Based on related studies, women tend to have a higher risk perception of floods than men. This difference can be attributed to cultural differences between the present research environment and the mentioned studies.

The findings of our study did not show any statistically significant relationship between the perception of flood risks and the age of participants. This finding is in agreement with the study by Qasim in Pakistan (23), aimed at determining the risk perception in flood-prone provinces, and the study by Miceli in Italy, which evaluated disasters preparedness and flood risk perception among people living in a mountainous area in northern Italy (24). In both studies, no association was observed between age and the perceptions of flood risks. Moreover, the results of the present study did not demonstrate any significant relationship between education level and perception of flood risks. This finding is in line with the study by Armas conducted to determine the perception of flood risk among people living along the Danube River in Romania (25).

In addition, consistent with the results of the present research, the findings of a study conducted by Shabanikiya et al. entitled "Behavior of crossing flood on foot, associated risk factors and estimating a predictive model" in 2012 indicated that education level and high-risk flood behavior were not significantly correlated with an understanding of flood risks (26). Nonetheless, a study conducted by Dzialek et al. in the flood-hit areas of southern Poland found that those with little knowledge of the causes of floods had a lower perception of flood risks (27). In agreement with the findings of the study by Wang et al. aimed at determining the risk perception in a flood-prone city in China in 2017, the results of our study also did not show a significant relationship between people's carrier and their perception of flood risks (28).

According to the participants, the three main causes of floods were environmental degradation and soil erosion, unplanned development and construction in flood-prone areas, and heavy seasonal rainfall, respectively. In a study by Fuchs et al. conducted in two regions of Greece to assess the understanding of flood risks and the capacity of people to adapt to flood risks, the most common cause of floods included deforestation, unplanned construction in high-risk areas, and interventions in the riverbed, which are not consistent with the results of our study (29).

The study pointed to a significant relationship between gender and one of the causes, namely God's punishment and punishment for sins. Women selected this cause more than men (OR = 2.43); It can be attributed to stronger spiritual and religious beliefs among women. In a study aimed at examining the differences in personality traits between men and women based on four categories: religious only, spiritual only, both spiritual and religious, and neither spiritual nor religious, it was shown that more women than men were in both religious and spiritual category (30). Furthermore, in the study by

Schmuck et al., which was conducted to examine religious views and explanations for the flood in Bangladesh, it was concluded that religious beliefs affected danger perception in the Muslim community. Moreover, the occurrence of a flood is considered a coercive action from God (31). The single cases were 2.53 times more likely to choose unplanned development and construction in flood-prone areas as the cause of floods than married subjects.

In addition, in the present study, a significant relationship was observed between age and choosing inappropriate irrigation in agriculture as the reason for floods, which was reported by people aged 45-70 (OR = 1.76). This difference can be ascribed to having more information about agriculture and irrigation. Low access to samples in remote rural areas was the main limitation of the study. Furthermore, their participation in the study was low. To overcome this obstacle, researchers explained the aim of the study to target groups to encourage their cooperation.

6. Conclusion

Since this study was performed on the population living in flood-prone areas, average risk perception indicates inadequate attention or insufficient measures to reduce the risk and increase the preparedness to respond to a flood. Taking measures, such as education to increase the knowledge and awareness of people living in flood-prone areas about the causes and consequences of floods, can help better manage natural disasters. (1)

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Footnotes

Conflicts of Interest: The authors have no conflict of interest to disclose.

Author Contribution: All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by FN, HHM, and HRS. The first draft of the manuscript was written by FKS, and all authors commented on it. All authors read and approved the final manuscript.

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