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Coronavirus Pandemic

A survey of perceived risk and protective behaviours towards COVID-19 in 2020 in Iraqi Kurdistan

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Abstract

Introduction: Human perceptions and behavioural responses to the risk of epidemics have always been crucial factors in studying and containing disease spread. This study aims to assess and understand the risk perception and the behavioural response of a sample of the population in the Kurdistan Region toward COVID-19.

Methodology: A self-administered online survey (designed on Google Forms) was designed to get a rapid appraisal of the risk perception and behavioural response of people living in the Iraqi Kurdistan Region about COVID-19 from 17–25 November 2020.

Results: A total of 390 individuals responded to the survey. Many respondents (65.6%) recognized COVID-19 as a high or very high threat level. The most frequently applied protective behaviours included avoiding spitting on the ground (76.2%), avoiding contacting ill persons (75.9%) and wearing face masks (75.6%). The main source of information about COVID-19 was Internet news (46.2%), followed by social media (44.9%). Significantly higher perceptions of the threat of COVID-19 were found among females ($p = 0.004$) and those having family members with chronic diseases ($p < 0.001$).

Conclusions: Understanding the general public's risk perception toward the COVID-19 infection is essential for determining effective protective measures and can be used to guide proper preventive behaviour.

Key words: COVID-19; risk perception; protection; behaviour; Iraqi Kurdistan.

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Introduction

COVID-19 is a highly infectious virus, mainly transmitted among human beings through the respiratory tract [1]. Infected people usually develop mild to moderate respiratory symptoms and recover without requiring specific treatment. However, certain groups are at elevated risk of developing more serious symptoms and other complications, including older people, people with chronic medical problems like respiratory or heart diseases and diabetes, and people with cancer [2]. On March 11, 2020, WHO declared COVID-19 a global pandemic, as the WHO Director-General belatedly acknowledged that the spread of the virus outside China had increased thirteen-fold during the preceding fortnight. He also expressed the WHO's deep concern about the rapid spread of the disease and the severity of the infection and urged countries throughout the world to take urgent actions to contain the disease [3].

At the time of data collection for the current study, no specific vaccine was developed or confirmed against this virus. WHO and public health authorities stressed some personal protective measures to limit the spread of the infection. These included social distancing (typically keeping a distance of at least one meter from others), wearing facial masks, cleaning the hands regularly, covering sneezes and coughs, opening windows when possible, staying at home when sick, and seeking medical advice when feeling unwell and developing symptoms like breathing difficulties, fever, and severe cough [4]. Such guidelines are based on clinical evaluations of risk and political decision-making; the degree to which the public adheres to them depends on their own personal risk perception. Risk perception is the belief or awareness of harm or potential hazard, and it plays an important role in directing health-related behaviours during the spread of infectious diseases.

The relationship between risk perception and health behavioural changes can be used to measure the influence of an illness and susceptibility in a disease network [5]. Factors like the perception of the hazard,

social and cultural factors, or experiencing a prior similar hazard can affect the risk perception of a disease or an epidemic [6]. In general, information on people's perceptions and health-related behaviour is not collected or considered at the start of an epidemic, as more immediate and pressing concerns are prioritized in ad hoc approaches. For example, during the influenza A (H1N1) pandemic, there was a delay in relevant data collection [7]. However, data collection on people's perceptions and their health-related behavioural responses during the early stages of any epidemic can help health policymakers shape preventive measures and work towards limiting the spread of epidemics [8].

The rapidly developing situation of COVID-19 quickly affected Iran and then Iraq during early 2020 [9]. In Iraq, the number of COVID-19 cases increased slightly starting from 22 February 2020 with a case, reaching 684 cases on 7 April 2020, the highest peak registered in Iraq at that time. After 7 April 2020, the number of infected people slightly decreased but remained high compared to March 2020 [9,10]. In the Iraqi Kurdistan Region (IKR), the Ministry of Health and other departments in the Kurdistan Regional Government (KRG) coordinated local responsiveness to handle the situation and deal with its consequences [10]. Experience with previous epidemics or pandemics has provided important information for COVID-19 public health policies and risk management strategies in practical ways [11]. A wide range of measures were implemented by the KRG, including continuous observation, tracing of cases, preparing and equipping health facilities, and methods to mitigate the spread of the disease, such as periodic curfews and lockdown policies, suspending public transportation, limiting cross-border activities to essential cases, banning flights from all airports of the IKR, closing public and private schools, and suspending official work at all government offices [12]. The KRG also imposed quarantine measures for all reported contacts with infected people for a certain time set by the Health Ministry [13].

Knowledge about how people perceive the health risk of an outbreak and how they respond to it is always very limited [14]. Collection of knowledge in this regard, especially in the early stages of the outbreak, can provide policymakers with a solid evidence base to develop and inform key stakeholders about proper ways to combat incidental and future (unknown) outbreaks [15]. Examples of successful experiences with limiting the spread of infectious diseases by early response include limiting the cases of severe acute respiratory syndrome (SARS) [16]. Thus, this study aims to assess the risk perception and the behavioural response of a sample of the population in the IKR towards COVID-19.

Methodology

Design and setting

A self-administered online survey (designed on Google Forms) was conducted in IKR from 17–25 November 2020 after the COVID-19 lockdown was lifted. When the survey commenced (i.e., on 17th November 2020), 90,904 cases of COVID-19 were detected in the IKR, including 2,891 deaths. By 25th November 2020, when the survey was closed, 94,856 cases and 3,061 deaths were recorded in the region.

Study participants and data collection

All members of the general population of the IKR were eligible to participate in this virtual survey. The survey link was initially sent to a number of people to test the clarity of the content/questions and the practicality of completing and submitting the online questionnaire. Social networking sites like Facebook, Viber, and WhatsApp were used to share the survey link with a wide variety of people in IKR. The purpose of the survey and consent to participate was explained and obtained through the invitation message and the introduction part of the online survey. In addition, the participants' anonymity and confidentiality of the collected information were also explained.

Survey tool

The study adopted a questionnaire survey published previously, designed to obtain a prompt assessment of the risk perception and behavioural response of people living in IKR about COVID-19. The questionnaire was based on a previous study conducted by Shabu *et al.* [17] on risk perception and behavioural responses toward the COVID-19 pandemic among university academics and students at the start of the outbreak in early 2020.

The first part of the questionnaire was related to the participants' socio-demographic characteristics, such as age, gender, occupation, and area of residency. The second part comprised six main sections directly related to the perceived threat level of COVID-19 relative to other diseases; personal risk perception of COVID-19 concerning the risk of getting an infection, the risk of getting a severe illness, and the risk of dying; the number of contacts outside the house; applying protective measures against COVID-19; the impact of COVID-19 on sleeping and daily activity routine; and sources of obtaining information about COVID-19.

Data analysis

Data analysis was undertaken using SPSS v. 22.0 (IBM Corp., Chicago, Illinois, USA). Descriptive and inferential statistical analyses were applied depending on the nature of the variables.

Ethical consideration

This study was approved by the Research Ethics Committee at Hawler Medical University. The participants' informed consent was obtained before completing the survey. The survey results were automatically anonymized. The voluntary nature of participation and the anonymity and confidentiality of information were explained to potential participants on the introductory page of the online survey.

Results

A total of 390 individuals responded to the survey. The largest proportions of the respondents were female (69%), married (57.4%), governmental employees (53.1%), residents of main cities (88.2%), and stated that they were from medium (47.4%) and high (47.2%) socio-economic classes. Around 9% of the respondents had chronic diseases, and 41% had family members with chronic diseases. A large minority (40%) had a history of infection with COVID-19, and most (66.9%) reported that staying at home was their main health-seeking behaviour. Around 85% of respondents had family members infected with COVID-19 (Table 1).

Regarding perceiving the threat level of COVID-19 in comparison with different diseases, a large proportion of the respondents (65.6%) recognized COVID-19 to be of a "high" or "very high" threat level (Table 2).

Table 3 shows the respondents' risk perception of infection, severe disease, and death from COVID-19. The highest perceived risk level was for infection (11.8%), followed by severe disease (8%) and death (6.6%). The ability to prevent infection was perceived to be low (20.5%).

The largest proportion of the respondents had no any contacts other than family members over the last 24 hours (47.2% with precautions and 34.4% without precautions).

Table 4 illustrates respondents' adherence to different protective behaviours. The most frequently applied protective behaviour included avoiding spitting on the ground (76.2%), avoiding contact with ill persons (75.9%) and wearing a mask (75.6%). The least frequently applied protective behaviours included wearing gloves (48.7%), followed by staying home from school/work (24.9%), and avoiding touching face, mouth, nose, and eyes (21.5%).

Table 1. Socio-demographic and clinical characteristics.

Variable	No. (%)
Gender	
Male	121 (31.0)
Female	269 (69.0)
Marital status	
Single	166 (42.6)
Married	224 (57.4)
Age group (years)	
≤20	55 (14.1)
21-30	128 (32.8)
31-40	145 (37.2)
≥41	62 (15.9)
Education	
Secondary school	35 (9.0)
Graduate	164 (42.1)
Postgraduate	191 (49.0)
Occupation	
Governmental employee	207 (53.1)
Student	79 (20.3)
Independent work	42 (10.8)
Unemployed	29 (7.4)
Retired	5 (1.3)
Others	28 (7.2)
Governorate	
Erbil	315 (80.8)
Sulaimaniyah	69 (17.7)
Duhok	6 (1.5)
Residence	
Inside city	344 (88.2)
Outside city	46 (11.8)
Economic level	
Very good	14 (3.6)
Good	184 (47.2)
Medium	185 (47.4)
Bad	7 (1.8)
Chronic disease	
No	339 (86.9)
Yes	36 (9.2)
Don't know	15 (3.8)
Family member with chronic disease	
No	223 (57.2)
Yes	160 (41.0)
Don't know	7 (1.8)
COVID-19 infection	
No	153 (39.2)
Yes	160 (41.0)
Don't know	77 (19.7)
Health seeking	
Private	59 (15.1)
Stay home	261 (66.9)
Other	69 (17.7)
Herbal	1 (0.3)
Family member with COVID-19	
No	45 (11.5)
Yes	331 (84.9)
Don't know	14 (3.6)

Table 2. Perceived threat level of COVID-19 compared to different diseases.

Disease	Perceived Threat Level					
	Very low/ Low		Medium		High/ Very high	
	No.	%	No.	%	No.	%
COVID-19	36	9.2	98	25.1	256	65.6
Diabetes mellitus	39	10	140	35.9	211	54.1
Road traffic accidents	69	17.7	148	37.9	173	44.4
Cardiovascular	38	9.7	88	22.6	264	67.7
Cancer	28	7.2	53	13.6	309	79.3
Influenza	192	49.2	129	33.1	69	17.7

Table 3. Perceived risk and prevention ability of COVID-19.

COVID-19 risk type	Risk level					
	Low		Medium		High	
	No.	%	No.	%	No.	%
Risk of infection	226	57.9	118	30.3	46	11.8
Risk of severe disease	247	63.4	112	28.8	31	8
Risk of death	286	73.3	78	20.1	26	6.6
Can prevent infection	182	46.7	128	32.9	80	20.5

Table 4. Protective behaviour by respondents.

Protective behaviour	None/rarely		Sometimes		Frequently	
	No.	%	No.	%	No.	%
Avoid people sneezing or coughing	41	10.5	75	19.2	274	70.3
Avoid large gatherings	44	11.2	107	27.4	239	61.3
Avoid touching face, mouth, nose, and eyes	84	21.5	114	29.2	192	49.2
Wash hands frequently	50	12.9	85	21.8	255	65.4
Avoid sick and infectious people	39	10	55	14.1	296	75.9
Avoid public places/ public transportation	65	16.7	119	30.5	206	52.8
Avoid travel to affected areas	50	12.8	70	17.9	270	69.2
Avoid or reduce going to hospitals and clinics	77	19.8	71	18.2	242	62.1
Avoid or reduce going to mosque	81	20.8	61	15.6	248	63.5
Avoid or reduce going to gym	60	15.4	57	14.6	273	70
Stay home from school/ work	97	24.9	96	24.6	197	50.5
Use alcohol-based disinfectant	72	18.5	85	21.8	233	59.7
Use a tissue when sneezing or coughing	38	9.7	72	18.5	280	71.8
Avoid spitting on the ground	42	10.8	51	13.1	297	76.2
Wear a mask	45	11.5	50	12.8	295	75.6
Wear gloves	190	48.7	85	21.8	115	29.5
Adhere to the above protective behaviours during lockdown	48	12.3	64	16.4	278	71.3
Adherence to lockdown	33	8.5	77	19.7	280	71.7

Table 5. Impact of COVID-19 pandemic on sleep and daily routine.

Impact	None/rarely		Sometimes		Frequently/always	
	No.	%	No.	%	No.	%
Sleep effect	122	31.3	147	37.7	121	31
Daily routine effect	53	13.5	131	33.6	206	52.9

Table 6. Sources of information about COVID-19.

Source of info	None/ rarely		Sometimes		Frequently/ always	
	No.	%	No.	%	No.	%
Internet news	113	29	97	24.9	180	46.2
Radio	341	87.4	31	7.9	18	4.6
TV	162	41.5	116	29.7	112	28.7
Health facilities	175	44.8	86	22.1	129	33.1
Publications	317	81.3	39	10	34	8.7
Friends	170	43.6	123	31.5	97	24.9
Social media	110	28.2	105	26.9	175	44.9
Work place	193	49.5	81	20.8	116	29.7
Family	137	35.2	97	24.9	156	40

Table 5 shows the impact of COVID-19 on sleep and daily routine. Sleep was frequently affected in almost a third (31%) of the respondents, while daily routine was frequently affected among more than half (52.9%).

The main source of information about COVID-19 was Internet news (46.2%), followed by social media (44.9%), family (40%), and health facilities (33.1%). However, 81.3% and 49.5% of the respondents reported that they never or rarely obtained information from publications or workplaces, respectively (Table 6).

Table 7 shows the association between respondents' characteristics and the risk perception of COVID-19. A significantly higher perception of a "high" threat level of COVID-19 was reported among females ($p = 0.004$), urban residents ("inside city") ($p = 0.017$), and those having family members with chronic disease ($p < 0.001$). The high risk of infection was not significantly associated with any respondents' characteristics. The high risk of severe illness was significantly higher among those infected with COVID-19 than among non-infected, or did not know ($p = 0.044$). The risk of death was significantly higher among the age group 31-40 years than among the other age groups ($p = 0.048$). The high anxiety was significantly higher among married participants than single participants ($p = 0.006$).

Table 8 shows the association between respondents' characteristics and protective behaviour. Females had significantly higher adherence to mask-wearing ($p <0.001$) and all protective measures during lockdown ($p = 0.013$). Adherence to all measures was also significantly higher among older people ($p = 0.028$) and those of a higher economic level ($p = 0.047$). Adherence to the lockdown was significantly higher among females ($p = 0.016$). Contact without precaution was significantly higher among males ($p = 0.004$), older age groups ($p = 0.037$), and those having a history of infection ($p = 0.009$).

Table 7. Association of respondents' characteristics with risk perception of COVID-19.

Variable	High threat level of COVID-19		High risk of COVID-19 infection		High risk of severe illness		High risk of death		High anxiety	
	No.	%	No.	%	No.	%	No.	%	No.	%
Gender										
Male	67	55.4	14	11.6	11	9.1	9	7.4	33	27.3
Female	189	70.3	32	11.9	20	7.4	17	6.3	85	31.6
p value	0.004		0.927		0.576		0.682		0.390	
Marital status										
Single	108	65.1	17	10.2	10	6.0	10	6.0	38	22.9
Married	148	66.1	29	12.9	21	9.4	16	7.1	80	35.7
p value	0.835		0.413		0.226		0.661		0.006	
Age group (years)										
≤ 20	34	61.8	9	16.4	3	5.5	3	5.5	11	20.0
21-30	82	64.1	12	9.4	10	7.8	6	4.7	30	23.4
31-40	98	67.6	19	13.1	14	9.7	16	11.0	48	33.1
≥ 41	42	67.7	6	9.7	4	6.5	1	1.6	29	46.8
p value	0.834		0.507		0.744		0.048		0.003	
Economic situation										
Good/ Very good	132	66.7	21	10.6	16	8.1	10	5.1	65	32.8
Moderate/ Bad	124	64.6	25	13.0	15	7.8	16	8.3	53	27.6
p value	0.665		0.460		0.922		0.194		0.262	
Residence										
Inside city	233	67.7	41	11.9	25	7.3	20	5.8	111	32.3
Outside city	23	50.0	5	10.9	6	13.0	6	13.0	7	15.2
p value	0.017		0.836		0.174		0.065		0.018	
Infection with COVID-19										
No/ DK*	154	67.0	22	9.6	13	5.7	15	6.5	63	27.4
Yes	102	63.8	24	15.0	18	11.3	11	6.9	55	34.4
p value	0.512		0.102		0.044		0.891		0.140	
Chronic diseases										
No/ DK*	235	66.4	43	12.1	27	7.6	24	6.8	112	31.6
Yes	21	58.3	3	8.3	4	11.1	2	5.6	6	16.7
p value	0.333		0.499		0.462		0.779		0.062	
Family member with chronic disease										
No/ DK*	134	58.3	27	11.7	19	8.3	13	5.7	71	30.9
Yes	122	76.3	19	11.9	12	7.5	13	8.1	47	29.4
p value	< 0.001		0.967		0.785		0.336		0.752	

*Don't know.

Discussion

The current study provides evidence of how the general public in IKR perceives their risk of infection with COVID-19 and identifies their behavioural responses toward it. Our analysis indicates that most respondents recognized COVID-19 as being at a "high" or "very high" threat level, and the highest risk level was for infection with the virus. However, a previous study by Shabu *et al.* [17] on risk perception and behavioural responses toward the COVID-19 pandemic among university academics and students earlier in 2020 reported that participants graded their perceived risk of getting the infection (26.9%), serious illness (29.7%), and death (41.7%) as "highly unlikely". This might be because the number of COVID-19 infected cases increased from 103 cases and two deaths on 26th March 2020 to 105,769 cases and 3,459 deaths eight months later (26th November 2020), when the data collection of the current study was completed [13].

Similarly, another study [18] in three Middle Eastern countries (Saudi Arabia, Jordan, and Egypt) found that the majority of participants perceived the COVID-19 pandemic to be "serious" or "very serious". Saudi participants had the highest total score of the perception of COVID-19 seriousness, followed by Egyptians and then Jordanians. The authors claimed that these disparities might have been related to the low numbers of confirmed COVID-19 cases and associated deaths reported in Jordan compared to the other countries. In contrast, another study reported a commonly low perceived threat of COVID-19 among the Ethiopian people [19].

At the beginning of general public awareness of the pandemic (March 2020), Schneider *et al.* reported that protective behaviours were lower than in January 2021 [20]. A study concluded that risk awareness and adherence to protective measures concerning COVID-19 are "contentious" matters among the general public

Table 8. Association of respondents' characteristics with protective behaviour against COVID-19.

Variable	Wear mask		Adherence to protective measures during lockdown		Lockdown adherence		Contact without precaution	
	No.	%	No.	%	No.	%	No.	%
Gender								
Male	77	63.6	76	62.8	77	63.6	92	76.0
Female	218	81.0	202	75.1	203	75.5	164	61.0
p value	< 0.001		0.013		0.016		0.004	
Marital status								
Single	122	73.5	112	67.5	124	74.7	111	66.9
Married	173	77.2	166	74.1	156	69.6	145	64.7
p value	0.395		0.152		0.273		0.661	
Age group (years)								
≤ 20	43	78.2	40	72.7	45	81.8	28	50.9
21-30	92	71.9	79	61.7	90	70.3	87	68.0
31-40	112	77.2	110	75.9	100	69.0	94	64.8
≥ 41	48	77.4	49	79.0	45	72.6	47	75.8
p value	0.686		0.028		0.326		0.037	
Economic situation								
Good/ Very good	159	80.3	150	75.8	148	74.7	136	68.7
Moderate/ Bad	136	70.8	128	66.7	132	68.8	120	62.5
p value	0.029		0.047		0.188		0.198	
Residence								
Inside city	260	75.6	245	71.2	251	73.0	224	65.1
Outside city	35	76.1	33	71.7	29	63.0	32	69.6
p value	0.940		0.942		0.160		0.551	
COVID-19 infection								
No/ DK*	175	76.1	162	70.4	171	74.3	139	60.4
Yes	120	75.0	116	72.5	109	68.1	117	73.1
p value	0.806		0.657		0.179		0.009	
Chronic diseases								
No/ DK*	266	75.1	251	70.9	254	71.8	233	65.8
Yes	29	80.6	27	75.0	26	72.2	23	63.9
p value	0.471		0.605		0.952		0.816	
Family member with chronic disease								
No/ DK*	171	74.3	163	70.9	160	69.6	154	67.0
Yes	124	77.5	115	71.9	120	75.0	102	63.8
p value	0.476		0.829		0.241		0.512	

*Don't know.

in IKR [12]. During any pandemic, risk perception and adopting protective behaviours vary over time [21], indicating the dynamic process of risk perception [20].

Studies have shown that gender is an influencing factor in risk perception in the context of COVID-19. A study [22] documented that males had a lower level of risk perception than females, and the current study affirmed significantly higher risk perception among females. Studies in various countries have reached the same conclusions [20,23,24].

Our findings indicate that respondents adhered to various protective behaviours, and wearing a facemask and avoiding contact with ill individuals were among the most commonly reported measures applied. However, our respondents were relatively well-educated, which might be one reason for this high adoption of protective behaviours. Studies have shown that there is an association between education level and applying protective behaviours, with a higher chance of adopting protective behaviour being linked with education (i.e., the higher the educational level, the higher the adoption of protective behaviours) [25,26]. Specifically, participants with higher educational levels have been demonstrated to have more positive attitudes toward wearing facemasks [27].

However, other factors, such as culture, play an important role in applying protective measures, especially concerning facemasks. Numerous studies have shown that culture and ethnicity are important indicators of applying these protective behaviours [28]. For instance, in Saudi Arabia, a qualitative study on risk perceptions and precautionary behaviour in response to COVID-19 reported that wearing facemasks is linked to culture since women are accustomed to covering their faces for cultural and religious purposes [29]. Additionally, a study [30] reported that since the Polish respondents did not like to wear facemasks, fewer wore facemasks than Chinese respondents.

Our findings displayed that other socio-demographic characteristics such as age (older age) and gender (female) had a significant association with applying protective measures (wearing facemasks). Similar findings were noticed in Saudi Arabia, where a study [27] examined the community knowledge and compliance with wearing facemasks for COVID-19 prevention and found that older people had more positive attitudes towards wearing facemasks, along with women, as explained above.

A previous investigation in IKR found that wearing facemasks was among the least applied protective behaviours among the academics and students studied [17]. In contrast, the current study found that using facemasks was among the top applied measures. This indicates that people's behaviour can be changed steadily (over a few months in this case) [31]. This behaviour change may be associated with the diffusion of more knowledge and awareness of COVID-19 and preventive measures among the general public. When people became more knowledgeable about the disease, they became more aware of the benefits of wearing facemasks and recognized that wearing a facemask is one of the effective ways of preventing the virus from spreading. Thus, they tended to use this protective measure more frequently and consistently.

The current study revealed that adherence to all protective measures during lockdown was significantly higher among older age groups and people with more economic resources. This is congruent with another study findings' that socio-demographic factors such as being older and having a higher monthly family income (more than BDT 30,000) were associated with adherence to protective measures [32].

The respondents in the current study had varied sources of information regarding COVID-19. The most frequently used source of information among the respondents was Internet news, which was also reported in numerous countries worldwide [33], including China and Ethiopia, where over 90% of participants reported this as their chief information source about the pandemic [19,28]. Social media was the second most frequently used source of information. Internet news and social media play important roles in rapidly providing people with the information they need . However, people should be aware of unreliable information that spreads more quickly through such channels. Social media allows healthcare professionals to communicate accurate information about COVID-19 rapidly, but it commensurately allows others to spread misinformation [34].

Our analysis indicates that most respondents did not have contact over the last 24 hours (with and without precautions). This result aligns with another study [35] that found that 79% of their respondents reduced their social contacts due to the pandemic. The current study indicated that those with family members with chronic disease had significantly higher perceptions of the risk of COVID-19. This relates to risk perception being affected by concern for others in addition to oneself. Ding *et al.* [22] reported that 85.1% of their respondents (college students) worried about their family members getting infected with COVID-19. This suggests that our respondents take precautions in encountering other people as they have concerns about the well-being of their family members with chronic diseases.

Our analysis also indicates a significantly greater perception of a high risk of severe illness among those infected with COVID-19 than among non-infected or did not know whether they had contracted the virus. Similar findings have been documented elsewhere. Dryhurst *et al.* [23] surveyed ten countries around the world, including Australia, Europe (Germany, Italy, Spain, Sweden, and the UK), Mexico, the US, South Korea and Japan, to assess public risk perception about COVID-19. They found that individuals with direct personal experience with the COVID-19 virus perceived more risk than those who did not have direct personal experience. This was corroborated more recently by Schneider *et al.* [20].

It has been documented that the COVID-19 pandemic is linked with mental health consequences such as anxiety and depression [28,36]. Our analysis indicates that high anxiety was significantly more prevalent among married individuals than singles. This is in accordance with a study's findings in Kuwait [37]. However, their findings showed no significant effect of COVID-19 on anxiety levels in married individuals. The COVID-19 pandemic had a greater psychological impact (such as depression) on married persons. In contrast, a study [38] revealed that "single status" was significantly associated with greater psychological impacts of the COVID-19 pandemic.

This study found that the COVID-19 pandemic had a negative impact on sleep health, which was reciprocally linked with several factors of daily routine. These included reduced physical activity, imposing mitigation policies like social distancing that caused stress for most people, limiting conventional sources of social support and altering people's daily routines and activity levels due to quarantine measures. Such immediate impacts were subsequently compounded by economic stress and reduced access to resources due to the economic crisis and stagnation associated with lockdown and global supply issues. During the IKR lockdown, most people could not work, exacerbating the general poverty that is endemic in the region after decades of conflict and neglect [39,40]. Although the current study was conducted just after the lockdown was lifted, it was evident that the lockdown effects remained manifest and profoundly affected participants.

The current study was conducted at a time when no vaccines had been developed. Identifying people's risk perception and behavioural response toward COVID-19 after the vaccine had been developed, distributed, and taken might be of particular interest to see if people's perceptions have changed. Thus, further research exploring this issue might be considered important. Although this study provided an important insight into the general public's risk perception and behavioural response toward COVID-19 several months after its emergence in the IKR, it has some limitations. Most respondents were residents of main cities, were employed, and were highly educated (to postgraduate level) because the potential participants were recruited from university-based social media groups and the author's personal social media accounts. Thus, the results of the current study could not be generalized to people with poor education and those who did not have Internet access.

Conclusions

Understanding the general public's risk perception toward infection is essential for determining effective protective measures and can guide proper preventive behaviour concerning COVID-19 and other (unknown) future risks. This study identified that risk perception was linked to socio-demographic variables and direct experience with the virus. In addition, respondents' characteristics were also associated with protective behaviour against COVID-19. Health policymakers should focus on reducing anxiety and explaining the effectiveness of preventive measures to help citizens evaluate risks appropriately and adopt commensurate personal protective measures.

Authors' contributions

Karwan M-Amen: Conceptualization, Methodology, Funding acquisition, Supervision, Project administration. Sherzad Shabu: Conceptualization, Methodology, Writing - Original Draft. Kazhan Mahmood: Conceptualization, Methodology, Writing - Original Draft. Nazar Shabila: Conceptualization, Methodology, Formal analysis, Visualization, Supervision.

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