Fear of a new pandemic; perception and prediction towards monkeypox among Middle East general population: A multi-country cross sectional study

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Abstract

Background

Monkeypox is a zoonotic disease caused by Monkeypox virus, an Orthopoxvirus. The 2022 Monkeypox outbreak has provoked a considerable amount of fear among the public. Awareness about this disease would modify the public attitudes in the fight against Monkeypox. We conducted this study aiming to assess the awareness and prediction of the middle east public about Monkeypox.

Methods

This cross-sectional study was conducted in August 2022. Data were collected from eight middle east countries using an online self-administered questionnaire distributed through educational and social media platforms. Statistical analysis was conducted using SPSS version 26.

Results

About 11,016 individuals have participated in this study. The majority of the participants have not seen a Monkeypox case, but will not travel to a country with the epidemic. Most of the participants knew the causative organism. Importantly, the majority were not aware of Monkeypox mode of transmission, symptoms, complications, and vaccination. A considerable proportion were aware of the disease protective measures. Participants' awareness was mostly gained from social media and it varied by age, gender, educational level, and country. The majority predicted acquiring Monkeypox when protective measures not taken, progression to a pandemic with economic consequences, and ability of ministry of health to control the epidemic. Participants' predictions varied by their country.

Conclusion

Middle east public knowledge about monkeypox is poor. Raising awareness about Monkeypox (especially mode of transmission, symptoms, and preventive measures) would be of benefit in controlling the epidemic. This study constitutes an evidence upon which health education programs could be designed.

Introduction

Human Monkeypox Virus (HMPV) is a zoonotic infection that belongs to the Poxviridae family of the genus Orthopoxvirus(1). Other viruses that infect humans and belong to this genus include Cowpox Virus, Variola Minor, and Variola major, with the latter being the cause of the eradicated Smallpox disease (2). The natural host of HMPV is unknown, nevertheless, it has a wide range of mammalian reservoirs including rats-being the largest group-, squirrels, dormice, and monkeys(2).

The first case of Monkeypox virus was identified in 1953 in Copenhagen, Denmark, among Asian monkeys imported from Singapore during poliovirus vaccine experiment (3). The Democratic Republic of the Congo reported the first human infection with HMPV in 1970(4). Since then, it has been endemic in the country, with wild spreading among the African continent, having numerous outbreaks throughout the years appearing in the Central African Republic, Liberia, Nigeria, Cameroon, and Sierra Leone(4). Nigeria reported the largest outbreak in 2017, with a case fatality of 6%(5,6). Endemicity of the virus has been established in Central and West Africa, and two genetic clades have emerged from the two areas (2). In 2003, the first outbreak in the Western world was reported in the United States (7), followed by cases reported in the United Kingdom (8) and Israel (9).

The clinical presentation of the HMPV is closely related to Smallpox, with the former being less severe and doesn't cause lymphadenopathy. The symptoms include a viral prodrome, followed by a maculopapular rash that evolves to form vesicles and pustules, which later form crusts (4). Comparing the case fatality rates of HMPV and Smallpox virus, the latter prominently exceeds, recording 30% among unvaccinated individuals (10). The Central African Clade exceeded the West African in regard to the case fatality, with the former reporting 10.6% and the latter 3.6% (11).

In May 2022, multiple cases were reported in Europe, US, and Australia among individuals who have no link to endemic areas (12–15). This new epidemic recorded around 300 notified cases in Western Europe, which was exponentially increasing to evolve into a pandemic, involving 33 countries and around 5949 cases worldwide (14).

In the light of this all, there is now an increasing fear among the public, that Monkeypox disease could be the next emerging pandemic. Especially since many cases of Monkeypox have recently been Identified in non-endemic countries, as well as the endemic countries. The majority of the proved cases had a travel history to non-endemic countries either in Europe or North America. All this has raised a concern that this concordance occurrence of Monkeypox disease might be a red flag of a world-wide health problem (17,18). This Monkeypox outbreak that started in May 2022, has provoked a considerable amount of fear among the population, particularly with the continuing COVID- pandemic (19). Human lives have been affected dramatically with the COVID-19 pandemic specifically on health and economic levels, therefore the declaration of a Monkeypox outbreak might have disturbing consequences on the population in terms of anxiety and apprehension (20).

A WHO report revealed that paucity of familiarity with Monkeypox among the population is a major challenge in limiting re-occurrence of Monkeypox (21). Raising awareness about Monkeypox can be regarded as the first approach to modify attitudes and behaviors. Moreover, when attitudes are established on top of good knowledge, they become great determinants of human behaviors (22,23). Unfortunately, there are very limited studies illustrating the perception

and level of awareness of the general population about Monkeypox. The aim of this study is to assess the perception and prediction of the general population of eight middle east countries towards Monkeypox.

Methodology

A cross-sectional multi-countery study was carried out in the period between 7/8/2022 to 15/8/ 2022 using a self-administered, online questionnaire which was distributed through online educational and social media platforms (e.g. Facebook, WhatsApp, Twitter and Instagram) including general population of eight countries within the middle east including (Egypt, Iraq, Palestine, Saudi Arabia, Sudan, Sultanate Oman, Syria, Yemen) to describe their knowledge , attitude and practice towards Monkeypox, and as secondary objective to link the descriptive factors along with population demographics.

The questionnaire was prepared, designed and distributed using Google forms in both Arabic and English language according to participant preference adjusting the goals of questions according to audience, formality, domain, tone, and intent. The audience and domain were selected as “general,” whereas the formality, tone, and intent were adjusted as “neutral,” “analytical,” and “describe,” respectively. An introduction page provides information regarding principal investigators identity, their official profiles links, their contact details and the objective of the study and its importance to the scientific community. The survey is expected to take between 3 to 5 minutes to be completed.
The form was then distributed among 30 participants, and their feedback was taken. This was to evaluate how each participant perceives the question. Their feedback, if any, was also taken into consideration to make any change to the questionnaire.

The questionnaire was developed based on existing facts from the United States Centers for Disease Control and Prevention (CDC) regarding the disease and the available literature (24)(25)(26)(27)(28), the questionnaires was divided into four sections:

Sociodemographic data including: country, age, sex, residence and educational level. Assessed by explanatory questions

Questions assessed Knowledge of Human Monkeypox: adopted from Harapan et al (6). The possible responses to each knowledge item were (yes vs. no vs. I do not know). Correct responses were scored as 1, incorrect responses were scored as −1, and “I do not know” was given a score of zero, which were used as a sum to represent the Monkeypox knowledge score (MPX K-score).

onset (old or new), causative organism, first time country appearance, presence in your country, source of outbreak in 2022, did you see previous case or not, source of information, mode of transmission

Symptoms of the disease, early symptoms of infection, late symptoms, common sites for rash, incubation period, Complications of the disease, mortality, management, passive and acquired immunity and prevention methods

Conspiracy beliefs regarding Monkeypox assessed by (Assessed by Yes vs. no): getting infection with the disease, declaration as a pandemic, traveling lockdown and restrictions, economic situation, and education process.

Statistical Analysis:

Data were analysed using R software. We presented continous variables as media (interquartile range), and categorical as percentage. We used chi square test, fisher exact test, Man whitney U test and Kruskal-Wallis test to find differences in variables.

Ethical consideration:

In the introduction page the participants were asked for their consent before starting with a sentence informing him that he could exit the questionnaire at any point, to ensure anonymity and confidentiality, participants IP addresses were not collected, and only the principal investigator had access to the survey account. The protocol of this study was approved (No: 25-22), on 23/7/2022 by the Institutional Review Board of the Faculty of Medicine, University of Gezira, Wad Medani, Sudan.

Results

A total of 11,016 individuals from eight middle east countries have participated in this study. Most of the participants were from Sudan (22.5%) and Saudi Arabia (18.6%), and females constituted the majority of the sample (59.4%). The predominant age group was 18 to 24 years (53.7%) followed by 25 to 34 years (25.8%), while elderly above 65 years were the least represented group (0.5%). Furthermore, the highest proportion of our participants were bachelor degree holders (65.9%) residing in urban areas (84.4%). Participants' demographic data are further described in ***table 1***.

In regards to participants' perception about Monkeypox, the greater majority have not seen a case of Monkeypox before (90.2%); yet, they were not willing to travel to a country that has declared a Monkeypox epidemic (83.5%). Social media was the widest source of information about Monkeypox, as reported by 61.8% of our participants. Around 26.5% of the subjects did not know whether Moneypox was present in their countries or not. ***Table 1***

Table 1: Participants' demographic factors.

Characteristic	Overall N = 11,016[1]
Age (years)	
< 18	577 (5.2%)
18-24	5,912 (53.7%)
25-34	2,844 (25.8%)
35-44	872 (7.9%)
45-54	566 (5.1%)
55-65	187 (1.7%)
> 65	58 (0.5%)
Country	
Egypt	1,056 (9.6%)
Palestine	1,077 (9.8%)
Qatar	1,045 (9.5%)
Saudi Arabia	2,054 (18.6%)
Sudan	2,478 (22.5%)
Sultanate Oman	898 (8.2%)
Syria	1,089 (9.9%)
Yemen	1,319 (12.0%)
Gender	
Female	6,544 (59.4%)
LGBT	33 (0.3%)
Male	4,439 (40.3%)
Residence	
Rural	1,715 (15.6%)
Urban	9,301 (84.4%)
Educational level	
Not educated	203 (1.8%)
Primary	292 (2.7%)
Secondary	1,993 (18.1%)
Bachelor	7,256 (65.9%)
Higher degree	1,272 (11.5%)
Are you willing to travel to a country that has declared itself as epidemic of Monkeypox? (Yes)	1,821 (16.5%)
Have you ever seen a case of Monkeypox before? (Yes)	1,084 (9.8%)
From where have you heared about this disease?	
Friends/ family members	734 (6.7%)
From medical staff	800 (7.3%)
Magazines and newspapers	289 (2.6%)
Official medical records	699 (6.3%)
Social media	6,806 (61.8%)
TV/Radio	1,319 (12.0%)
Other	369 (3.3%)
Is monkeypox present in your country?	

Yes	3,630 (33.0%)
No	4,463 (40.5%)
I don't know	2,923 (26.5%)

[1] n (%).

Less than half of the participants identified Monkeypox as a disease that existed before 2022 (43.3%), while higher number could identify the causative organism (66.7%). Only 22% of the participants knew where Monkeypox was initially discovered and where it was firstly reported in the 2022 outbreak. A similar proportion (27.6%) knew the incubation period of the disease. A small proportion of the subjects were aware of the disease modes of transmission; 48.1% identified contact with body fluids, 41.8% identified contact with infected animals, 34.4% identified transmission between homosexuals, whereas only 8.6% could exclude transplacental transmission. Around 39% of our participants did not know the symptoms of Monkeypox. However, fever was the most frequently known symptom (49.3%), followed by headache (37.9%), and less frequently severe fatigability (30.1%) and lymph nodes swelling (30%). Diarrhea was the least known symptom of Monkeypox (17.2%). Nearly half of the participants could identify the early and late signs of Monkeypox infection (46.9% and 44%, respectively). In addition, the participants were asked about the common sites for appearance of rash; 42.8% identified the face, 23.7% identified the legs, while a greater proportion (55.8%) did not know. ***Table 2***

The higher proportion of our participants was not aware about the complications of Monkeypox (53.7%), and a minor proportion could identify the correct ones. Disfigurement was the most frequently identified complication (27.7%), while brain infection was the least (12.5%). Moreover, the majority of the subjects had no idea about Monkeypox mortality (54.9%); yet, 34.3% stated that Monkeypox is less fatal than covid-19. Only 19.8% of our participants knew the correct treatment of Monkeypox. Moreover, about 27% knew that a Monkeypox infection is not protective against subsequent Monkeypox infection, and about 22% knew about Monkeypox specific vaccines. Generally, the participants' knowledge about protective measures against Monkeypox was better than their knowledge about the aforementioned disease aspects. Isolation of the infected individuals was the most frequently identified preventive measure (61.6%) followed by health education (52.5%), notification of health authorities (49.4%), Care of the environment (48.6%), and lastly, wearing personal protective equipment (44%). ***Table 2***

Table 2: Participants' knowledge about monkeybox.

Characteristic	Overall, N = 11,016[1]	Gender			p-value[2]
		Female, N = 6,544[1]	LGBT, N = 33[1]	Male, N = 4,439[1]	
Monkeypox is:					0.15
Correct	4,769 (43.3%)	2,878 (44.0%)	13 (39.4%)	1,878 (42.3%)	
Do not know	1,688 (15.3%)	993 (15.2%)	9 (27.3%)	686 (15.5%)	
Incorrect	4,559 (41.4%)	2,673 (40.8%)	11 (33.3%)	1,875 (42.2%)	
Causative organism					
Correct	7,348 (66.7%)	4,340 (66.3%)	14 (42.4%)	2,994 (67.4%)	0.005
Do not know	2,336 (21.2%)	1,382 (21.1%)	6 (18.2%)	948 (21.4%)	
Incorrect	1,332 (12.1%)	822 (12.6%)	13 (39.4%)	497 (11.2%)	
Monkey pox was first identified in?					**0.006**
Correct	2,433 (22.1%)	1,374 (21.0%)	11 (33.3%)	1,048 (23.6%)	
Do not know	5,108 (46.4%)	3,059 (46.7%)	11 (33.3%)	2,038 (45.9%)	
Incorrect	3,475 (31.5%)	2,111 (32.3%)	11 (33.3%)	1,353 (30.5%)	
The first reported Outbreak in 2022 was reported in					**<0.001**
Correct	2,483 (22.5%)	1,363 (20.8%)	12 (36.4%)	1,108 (25.0%)	
Do not know	3,937 (35.7%)	2,413 (36.9%)	8 (24.2%)	1,516 (34.2%)	
Incorrect	4,596 (41.7%)	2,768 (42.3%)	13 (39.4%)	1,815 (40.9%)	
Incubation period is less than two weeks?					**0.001**
Correct	3,037 (27.6%)	1,838 (28.1%)	9 (27.3%)	1,190 (26.8%)	
Do not know	6,150 (55.8%)	3,587 (54.8%)	12 (36.4%)	2,551 (57.5%)	
Incorrect	1,829 (16.6%)	1,119 (17.1%)	12 (36.4%)	698 (15.7%)	
Mode of transmission:					
I don't know	2,821 (25.6%)	1,632 (24.9%)	9 (27.3%)	1,180 (26.6%)	0.15
Contact with infected animals					**0.016**
Correct	4,608 (41.8%)	2,799 (42.8%)	9 (27.3%)	1,800 (40.5%)	
Do not know	6,408 (58.2%)	3,745 (57.2%)	24 (72.7%)	2,639 (59.5%)	
Contact with infected body fluids					0.1
Correct	5,298 (48.1%)	3,168 (48.4%)	10 (30.3%)	2,120 (47.8%)	
Do not know	5,718 (51.9%)	3,376 (51.6%)	23 (69.7%)	2,319 (52.2%)	
Homosexuals					**<0.001**
Correct	3,795 (34.4%)	2,044 (31.2%)	13 (39.4%)	1,738 (39.2%)	
Do not know	7,221 (65.6%)	4,500 (68.8%)	20 (60.6%)	2,701 (60.8%)	
During pregnancy through placenta					**0.007**
Do not know	10,070 (91.4%)	5,968 (91.2%)	25 (75.8%)	4,077 (91.8%)	
Incorrect	946 (8.6%)	576 (8.8%)	8 (24.2%)	362 (8.2%)	
Symptoms of this disease includes :					
I don't know	4,315 (39.2%)	2,486 (38.0%)	11 (33.3%)	1,818 (41.0%)	**0.006**
Fever					0.3
Correct	5,428 (49.3%)	3,210 (49.1%)	12 (36.4%)	2,206 (49.7%)	
Do not know	5,588 (50.7%)	3,334 (50.9%)	21 (63.6%)	2,233 (50.3%)	

Headache					**0.031**
Correct	4,170 (37.9%)	2,437 (37.2%)	7 (21.2%)	1,726 (38.9%)	
Do not know	6,846 (62.1%)	4,107 (62.8%)	26 (78.8%)	2,713 (61.1%)	
Back pain					>0.9
Correct	2,334 (21.2%)	1,394 (21.3%)	7 (21.2%)	933 (21.0%)	
Do not know	8,682 (78.8%)	5,150 (78.7%)	26 (78.8%)	3,506 (79.0%)	
Diarrhoea					**0.006**
Correct	1,902 (17.3%)	1,078 (16.5%)	10 (30.3%)	814 (18.3%)	
Do not know	9,114 (82.7%)	5,466 (83.5%)	23 (69.7%)	3,625 (81.7%)	
Lymph nodes swelling					0.5
Correct	3,308 (30.0%)	1,991 (30.4%)	9 (27.3%)	1,308 (29.5%)	
Do not know	7,708 (70.0%)	4,553 (69.6%)	24 (72.7%)	3,131 (70.5%)	
Severe fatigability					0.14
Correct	3,320 (30.1%)	2,013 (30.8%)	7 (21.2%)	1,300 (29.3%)	
Do not know	7,696 (69.9%)	4,531 (69.2%)	26 (78.8%)	3,139 (70.7%)	
Muscular pain					0.2
Correct	3,172 (28.8%)	1,845 (28.2%)	10 (30.3%)	1,317 (29.7%)	
Do not know	7,844 (71.2%)	4,699 (71.8%)	23 (69.7%)	3,122 (70.3%)	
The presence of these symptoms represents an early sign of infection					
Correct	5,163 (46.9%)	3,122 (47.7%)	14 (42.4%)	2,027 (45.7%)	
Do not know	4,757 (43.2%)	2,739 (41.9%)	11 (33.3%)	2,007 (45.2%)	
Incorrect	1,096 (9.9%)	683 (10.4%)	8 (24.2%)	405 (9.1%)	
The presence of rash is considered to be a late sign of infection					**<0.001**
Correct	4,848 (44.0%)	2,924 (44.7%)	8 (24.2%)	1,916 (43.2%)	
Do not know	4,393 (39.9%)	2,470 (37.7%)	12 (36.4%)	1,911 (43.1%)	
Incorrect	1,775 (16.1%)	1,150 (17.6%)	13 (39.4%)	612 (13.8%)	
What are the common sites for presence of rash?					
I don't know	4,871 (44.2%)	2,900 (44.3%)	8 (24.2%)	1,963 (44.2%)	0.068
Face					0.3
Correct	4,718 (42.8%)	2,764 (42.2%)	15 (45.5%)	1,939 (43.7%)	
Do not know	6,298 (57.2%)	3,780 (57.8%)	18 (54.5%)	2,500 (56.3%)	
Mucocutaneous (mouth and nose)					0.5
Do not know	8,925 (81.0%)	5,325 (81.4%)	27 (81.8%)	3,573 (80.5%)	
Incorrect	2,091 (19.0%)	1,219 (18.6%)	6 (18.2%)	866 (19.5%)	
Legs					0.079
Correct	2,612 (23.7%)	1,532 (23.4%)	13 (39.4%)	1,067 (24.0%)	
Do not know	8,404 (76.3%)	5,012 (76.6%)	20 (60.6%)	3,372 (76.0%)	
Groin area					0.071
Do not know	9,108 (82.7%)	5,436 (83.1%)	23 (69.7%)	3,649 (82.2%)	
Incorrect	1,908 (17.3%)	1,108 (16.9%)	10 (30.3%)	790 (17.8%)	
Perianal area					**<0.001**
Do not know	10,191 (92.5%)	6,100 (93.2%)	26 (78.8%)	4,065 (91.6%)	
Incorrect	825 (7.5%)	444 (6.8%)	7 (21.2%)	374 (8.4%)	
What are the complications of the disease?					

I don't know	5,941 (53.9%)	3,532 (54.0%)	12 (36.4%)	2,397 (54.0%)	0.13
Pneumonia					0.5
Correct	2,099 (19.1%)	1,272 (19.4%)	6 (18.2%)	821 (18.5%)	
Do not know	8,917 (80.9%)	5,272 (80.6%)	27 (81.8%)	3,618 (81.5%)	
Brain infection					**0.039**
Correct	1,380 (12.5%)	780 (11.9%)	6 (18.2%)	594 (13.4%)	
Do not know	9,636 (87.5%)	5,764 (88.1%)	27 (81.8%)	3,845 (86.6%)	
Sepsis					**<0.001**
Correct	1,573 (14.3%)	831 (12.7%)	6 (18.2%)	736 (16.6%)	
Do not know	9,443 (85.7%)	5,713 (87.3%)	27 (81.8%)	3,703 (83.4%)	
inflammation of the eyes					**0.001**
Correct	1,567 (14.2%)	888 (13.6%)	11 (33.3%)	668 (15.0%)	
Do not know	9,449 (85.8%)	5,656 (86.4%)	22 (66.7%)	3,771 (85.0%)	
Disfigurement					0.2
Correct	3,050 (27.7%)	1,785 (27.3%)	13 (39.4%)	1,252 (28.2%)	
Do not know	7,966 (72.3%)	4,759 (72.7%)	20 (60.6%)	3,187 (71.8%)	
The mortality rate of the disease?					
I don't know	6,049 (54.9%)	3,608 (55.1%)	14 (42.4%)	2,427 (54.7%)	0.3
Less than COVID-19					**0.021**
Correct	3,783 (34.3%)	2,184 (33.4%)	9 (27.3%)	1,590 (35.8%)	
Do not know	7,233 (65.7%)	4,360 (66.6%)	24 (72.7%)	2,849 (64.2%)	
Less than malaria					**<0.001**
Correct	1,107 (10.0%)	588 (9.0%)	5 (15.2%)	514 (11.6%)	
Do not know	9,909 (90.0%)	5,956 (91.0%)	28 (84.8%)	3,925 (88.4%)	
Less than flu					**<0.001**
Correct	1,010 (9.2%)	551 (8.4%)	7 (21.2%)	452 (10.2%)	
Do not know	10,006 (90.8%)	5,993 (91.6%)	26 (78.8%)	3,987 (89.8%)	
Less than tuberculosis					**<0.001**
Correct	857 (7.8%)	443 (6.8%)	3 (9.1%)	411 (9.3%)	
Do not know	10,159 (92.2%)	6,101 (93.2%)	30 (90.9%)	4,028 (90.7%)	
Less than chickenpox					**<0.001**
Correct	1,178 (10.7%)	662 (10.1%)	11 (33.3%)	505 (11.4%)	
Do not know	9,838 (89.3%)	5,882 (89.9%)	22 (66.7%)	3,934 (88.6%)	
Does getting infected with Monkeypox provide immunity against re-infection?					
Correct	1,660 (15.1%)	1,023 (15.6%)	12 (36.4%)	625 (14.1%)	
Do not know	6,352 (57.7%)	3,782 (57.8%)	12 (36.4%)	2,558 (57.6%)	
Incorrect	3,004 (27.3%)	1,739 (26.6%)	9 (27.3%)	1,256 (28.3%)	
The treatment of Monkeypox is through					**0.029**
Correct	2,179 (19.8%)	1,296 (19.8%)	5 (15.2%)	878 (19.8%)	
Do not know	4,547 (41.3%)	2,631 (40.2%)	12 (36.4%)	1,904 (42.9%)	
Incorrect	4,290 (38.9%)	2,617 (40.0%)	16 (48.5%)	1,657 (37.3%)	
Is there a specific vaccine for Monkeypox?					0.079
Correct	2,386 (21.7%)	1,445 (22.1%)	6 (18.2%)	935 (21.1%)	
Do not know	5,040 (45.8%)	2,921 (44.6%)	17 (51.5%)	2,102 (47.4%)	

Incorrect	3,590 (32.6%)	2,178 (33.3%)	10 (30.3%)	1,402 (31.6%)	
Methods for prevention and control should include					
I don't know	2,454 (22.3%)	1,352 (20.7%)	9 (27.3%)	1,093 (24.6%)	**<0.001**
Isolation of infected persons					**0.003**
Correct	6,786 (61.6%)	4,075 (62.3%)	12 (36.4%)	2,699 (60.8%)	
Do not know	4,230 (38.4%)	2,469 (37.7%)	21 (63.6%)	1,740 (39.2%)	
Notifying health authorities					0.079
Correct	5,444 (49.4%)	3,250 (49.7%)	10 (30.3%)	2,184 (49.2%)	
Do not know	5,572 (50.6%)	3,294 (50.3%)	23 (69.7%)	2,255 (50.8%)	
Wearing personal protective equipment					**0.002**
Correct	4,845 (44.0%)	2,929 (44.8%)	6 (18.2%)	1,910 (43.0%)	
Do not know	6,171 (56.0%)	3,615 (55.2%)	27 (81.8%)	2,529 (57.0%)	
Care of the environment					**0.003**
Correct	5,358 (48.6%)	3,267 (49.9%)	18 (54.5%)	2,073 (46.7%)	
Do not know	5,658 (51.4%)	3,277 (50.1%)	15 (45.5%)	2,366 (53.3%)	
Health education					0.087
Correct	5,782 (52.5%)	3,435 (52.5%)	11 (33.3%)	2,336 (52.6%)	
Do not know	5,234 (47.5%)	3,109 (47.5%)	22 (66.7%)	2,103 (47.4%)	

[1] n (%)

[2] Pearson's Chi-squared test; Fisher's exact test

The participants' overall knowledge score was 8.0 (3.0, 13.0), indicating poor knowledge about the Monkeypox. Level of knowledge was found to differ significantly by the participant's country (p<0.001); with participants from Sultanate Oman having the highest knowledge and those from Egypt having the lowest knowledge (12 vs. 5). Furthermore, participants' knowledge varied by their age (p<0.001); with participants aged 45 to 54 years having the highest knowledge, whereas those aged under 18 having the poorest knowledge (10 vs. 7). In addition, we found a significant variation in this knowledge by gender (p=0.037) and educational level (p<0.001); with females and higher degree holders being more knowledgeable. No significant difference in knowledge was detected between rural and urban residents (p=0.0064). Table 3

Table 3: Difference in overall knowledge score.

Characteristic		Countries								p-value[2]	Age (years)							p-value[2]	G
	Overall, N = 11,016[1]	**Egypt**, N = 1,056[1]	**Palastine**, N = 1,077[1]	**Qatar**, N = 1,045[1]	**Saudi Arabia**, N = 2,054[1]	**Sudan**, N = 2,478[1]	**Sultanate Oman**, N = 898[1]	**Syria**, N = 1,089[1]	**Yemen**, N = 1,319[1]		**18-24**, N = 5,912[1]	**25-34**, N = 2,844[1]	**35-44**, N = 872[1]	**45-54**, N = 566[1]	**55-65**, N = 187[1]	**< 18**, N = 577[1]	**> 65**, N = 58[1]		**Female**, N = 6,544[1]
Overall knowledge score	8.0 (3.0, 13.0)	5.0 (1.0, 12.0)	7.0 (1.0, 13.0)	9.0 (4.0, 14.0)	8.0 (3.0, 13.0)	8.0 (3.0, 14.0)	12.0 (6.0, 16.0)	8.0 (3.0, 14.0)	6.0 (2.0, 11.0)	**<0.001**	7.0 (2.0, 12.0)	9.0 (3.0, 15.0)	8.5 (3.0, 14.0)	10.0 (4.0, 13.0)	8.0 (3.0, 13.0)	7.0 (1.0, 12.0)	9.0 (5.0, 13.8)	**<0.001**	8.0 (3.0, 13.0)

[1] Median (IQR)

[2] Man whitney U test; Kruskal-Wallis rank sum test

Finally, the participants were asked about their predictions about Monkeypox. The majority of the participants thought they would contract Monkeypox if they did not take the appropriate preventive measures (72.7%). Although over half the participants thought their ministry of health can control Monkeypox (51.5%), a similar proportion predicted that Monkeypox can become a worldwide pandemic and it will affect their economy (50.8% and 52%, respectively). A fewer proportion of our participants thought Monkeypox can affect their education (47.9%), while a much fewer proportion predicted a lockdown and sanction (38.9%). Table 4

Table 4: Participants' predictions about monkeypox.

Characteristic		Gender			p-value[2]
	Overall, N = 11,016[1]	Female, N = 6,544[1]	LGBT, N = 33[1]	Male, N = 4,439[1]	
Do you think that you will contract monkey pox in the coming year if you did not take any preventive measures? (Yes)	8,008 (72.7%)	4,873 (74.5%)	20 (60.6%)	3,115 (70.2%)	<0.001
Do you think the ministry of health in your country is able to control this pandemic? (Yes)	5,678 (51.5%)	3,299 (50.4%)	12 (36.4%)	2,367 (53.3%)	0.002
Do you think that monkey pox can become a worldwide pandemic? (Yes)	5,597 (50.8%)	3,505 (53.6%)	15 (45.5%)	2,077 (46.8%)	<0.001
Do you predict there is going be a lockdown and sanction? (Yes)	4,285 (38.9%)	2,851 (43.6%)	11 (33.3%)	1,423 (32.1%)	<0.001
Do you predict that the pandemic will affect your country/family's economy? (Yes)	5,728 (52.0%)	3,676 (56.2%)	14 (42.4%)	2,038 (45.9%)	<0.001
Do you think this disease will affect you/or your family's education? (Yes)	5,280 (47.9%)	3,375 (51.6%)	15 (45.5%)	1,890 (42.6%)	<0.001

[1] n (%)

[2] Pearson's Chi-squared test; Fisher's exact test

The participants' prediction about Monkeypox differed significantly by their countries (p<0.001 for all the questions). Participants from Qatar were more confident that their ministry of health can control Monkeypox pandemic (86.8%), in contrast to those from Yemen (17.5%). Without adopting the appropriate preventive measures, more participants from Sultanate Oman predicted acquiring the disease (85.7%). More participants from Sudan predicted that Monkeypox will spread and become a worldwide pandemic (61.1%), whereas more participants from Sultanate Oman predicted a lockdown and sanction (55.3%). Participants from Sudan more frequently predicted that Monkeypox will affect their economy and education (64.4% and 61.4% respectively). Table 5

Table 5: Difference in prediction according to countries.

Characteristic		Countries								p-value[2]
	Overall, N = 11,016[1]	Egypt, N = 1,056[1]	Palastine, N = 1,077[1]	Qatar, N = 1,045[1]	Saudi Arabia, N = 2,054[1]	Sudan, N = 2,478[1]	Sultanate Oman, N = 898[1]	Syria, N = 1,089[1]	Yemen, N = 1,319[1]	
Do you think that you will contract monkey pox in the coming year if you did not take any preventive measures? (Yes)	8,008 (72.7%)	749 (70.9%)	718 (66.7%)	663 (63.4%)	1,361 (66.3%)	2,019 (81.5%)	770 (85.7%)	831 (76.3%)	897 (68.0%)	<0.001
Do you think the ministry of health in your country is able to control this pandemic? (Yes)	5,678 (51.5%)	533 (50.5%)	417 (38.7%)	907 (86.8%)	1,775 (86.4%)	593 (23.9%)	719 (80.1%)	503 (46.2%)	231 (17.5%)	<0.001
Do you think that monkey pox can become a worldwide pandemic? (Yes)	5,597 (50.8%)	528 (50.0%)	510 (47.4%)	553 (52.9%)	893 (43.5%)	1,513 (61.1%)	520 (57.9%)	487 (44.7%)	593 (45.0%)	<0.001
Do you predict there is going be a lockdown and sanction? (Yes)	4,285 (38.9%)	451 (42.7%)	371 (34.4%)	364 (34.8%)	616 (30.0%)	1,143 (46.1%)	497 (55.3%)	386 (35.4%)	457 (34.6%)	<0.001
Do you predict that the pandemic will affect your country/family's economy? (Yes)	5,728 (52.0%)	614 (58.1%)	536 (49.8%)	559 (53.5%)	683 (33.3%)	1,597 (64.4%)	508 (56.6%)	558 (51.2%)	673 (51.0%)	<0.001
Do you think this disease will affect you/or your family's education? (Yes)	5,280 (47.9%)	535 (50.7%)	453 (42.1%)	481 (46.0%)	670 (32.6%)	1,521 (61.4%)	503 (56.0%)	414 (38.0%)	703 (53.3%)	<0.001

Discussion

In the section of the study, we provide a comparative analysis of the results assessing the objectives of the study, which are to assess the perception and prediction of the general population of eight Middle East countries towards Monkeypox.

In total, 11,016 people from eight Arab nations took part in this study. The majority of participants (59.4%) were female, with the majority from Sudan (22.5%), and Saudi Arabia (18.6%) respectively. The most common age range was 18 to 24 years (53.7%), followed by 25 to 34 years (25.8%), and the least represented group was elderly over 65 years (0.5%). Additionally, the majority of our participants (84.4%) lived in urban areas and had bachelor's degrees (65.9%) (Table 1

provides more information about the participant's demographics). Comparing the demographics of participants in studies similar to our study, they had much lower number of participants. In a study conducted on the general population of Saudi Arabia, participants were mostly females, with a mean age of 30 years, single, urban residents, had bachelors degrees, and a little more than half unemployed (30). Another study done in Bangladesh had the majority of its participants as men between 18 and 35, living in urban areas, and had graduate degrees (31).

The majority of participants had never seen a case with Monkeypox (90.2%), yet they were unwilling to travel to a nation where an outbreak of the disease had been declared (83.5%). According to 61.8% of our participants, the most common source of knowledge regarding Monkeypox was social media. About 26.5% of the participants were unaware of the presence or absence of Moneypox in their nations (more information in Table 1). The other comparable studies stated that social media and the internet were the most common sources of knowledge, The respondents' knowledge of any cases of Monkeypox in Bangladesh was insufficient (31). Overall, social media was the most common source of knowledge for the population studied in Saudi Arabia (30).

Less than half of the participants (43.3%) correctly identified Monkeypox as a disease that existed prior to 2022, whereas a larger percentage (66.7%) correctly identified the causing organism. Only 22% of the participants knew the locations of the initial discovery and the first reports of the 2022 outbreak of Monkeypox. Only (27.6%) were aware of the incubation period. Regarding transmission, only (8.6%) of the participants were able to rule out transplacental transmission, while (48.1%) could identify contact with body fluids, (41.8%) could identify interaction with infected animals, and (34.4%) could identify transmission between homosexuals. In Bangladesh, Monkeypox was correctly classified as a viral disease although respondents are mainly unclear about its specific causative organism. Most respondents were generally unaware of the signs and symptoms of Monkeypox, As for paths of transmission, knowledge was graded on an overall score and participants did very poorly. The majority of the respondents knew that overseas travelers are a source of imported cases of Monkeypox (31), In Saudi Arabia, the great majority of participants were aware that no instances had been recorded in Saudi Arabia. They also understood Monkeypox to be an infectious sickness. As for transmission, they truthfully knew that it transmits from human to human or by infected animal scratches and the majority know that it can spread through body fluids. They also thought that Monkeypox was not sexually transmissible, knew that chickenpox and Monkeypox were two different diseases, and most knew that Monkeypox was uncommon outside of Middle Eastern countries, and its typical geographic distribution (30).

As for the symptoms of the disease, (39%) of the participants in our study were unaware of the symptoms of Monkeypox. The most frequent known symptoms were fever (49.3%), headache (37.9%), severe fatigability (30.1%), and swollen lymph nodes (30%) in order. The least recognized sign of Monkeypox (17.2%) was diarrhea. The early and late signs of Monkeypox infection could be distinguished by nearly half of the participants (46.9% and 44%, respectively). In addition, when asked where the rash typically appears, the participants responded with (42.8%) the face and (23.7%) the legs, while a higher percentage (55.8%) did not know (details in Table 2). In Saudi Arabia, (80%) named skin rash as a symptom, however fewer (53.8%) correctly identified that it also had symptoms like the flu (30). The majority of our participants (53.7%) were unaware of the consequences of Monkeypox, and only a small percentage were able to name the proper ones. The most frequently reported complication was disfigurement (27.7%), while the least common was brain infection (12.5%). In addition, the majority of the individuals (54.9%) were unaware of the fatality rate for Monkeypox, although 34.3% believed that it was less lethal than covid-19. Only 19.8% of our participants were aware of the proper Monkeypox.

In general, the participants' understanding of defenses against Monkeypox was superior to their understanding of the aforementioned illness features. The most often mentioned preventive approach was isolating affected people (61.6%), followed by health education (52.5%), alerting the appropriate authorities (49.4%), taking care of the environment (48.6%), and wearing personal protective equipment (44%) (Table 2). Roughly 27% were aware that a Monkeypox infection does not protect against a subsequent Monkeypox infection, and about 22% were aware that there are vaccinations specifically for Monkeypox. In the study conducted on Bangladesh population, the poor awareness of the population with the disease's transmission routes subsequently lead to poor awareness with preventive methods. Added to that, most did know of a vaccine for Monkeypox or any cures for it (31). In Saudi Arabia, the most common mentioned preventive measures were face masks and hand sanitizers. Only a few knew about the availability of their vaccine in their country, the overlap between it and the smallpox vaccines, and that smallpox offers no protective immunity (30).

Monkeypox ignorance was shown by the participants' average knowledge score of 8.0 (3.0, 13.0), which was low. It was discovered that participant knowledge levels varied considerably by nation (p0.001), with participants from Sultanate Oman having the highest level of knowledge and those from Egypt having the lowest level (12 vs. 5). Additionally, participants' knowledge differed by their ages (p0.001), with those under 18 having the least knowledge and those aged 45 to 54 having the most (10 vs. 7). Additionally, we discovered a significant difference in this knowledge according to gender (p=0.037) and educational attainment (p0.001), with females and those with higher degrees having more knowledge. Between people of rural and urban areas, there was no discernible difference in knowledge (p=0.0064) (Table 3).

In the study conducted on the general population of Bangladesh, the mean knowledge score of respondents corresponded significantly with the level of education, with postgraduate degree holders scoring the best and respondents without formal education scoring the lowest. The mean knowledge score as also strongly influenced by occupational and educational characteristics (p 0.001). Healthcare workers got the highest mean knowledge score of all the professions (13.38 4.43). In Saudi Arabia, the knowledge of the general population about Monkeypox according to the score designed in the paper was low. Age and knowledge score had a favorable relationship that grew as participants aged. High knowledge scores were more prevalent among respondents who were married, from the middle area, had postgraduate degrees, were employed, worked in healthcare, made less than 16,000 SAR per month, and were smokers. Both urban and rural residences were typically associated with low knowledge scores, although urban residency was relatively correlated with higher scores.

Last but not least, the participants were questioned regarding their Monkeypox forecasts. The majority of participants (72.7%) believed that if they did not take the proper precautions, they would get Monkeypox. “Monkeypox can become a global epidemic and have an impact on their economy”, according to a comparable percentage of participants (50.8% and 52%, respectively), even though more than half of them believed their ministry of health can contain it

(51.5%). Less than half of our participants (47.9%) believed that Monkeypox could hinder their ability to learn, whereas much less (38.9%) predicted a lockdown. In other literature, the projected impact of Monkeypox on social and economic lives and knowledge scores were significantly correlated, with poor scores being more common among those who anticipated it to have the same impact as COVID-19 than among those who did not (30).

By country, the participants' predictions regarding Monkeypox varied significantly (p 0.001 for each question). Participants from Qatar (86.8%), as opposed to those from Yemen (17.5%), were more optimistic about the ability of their health ministry to contain the Monkeypox outbreak. A higher percentage of participants from Sultanate of Oman projected the possibility of contracting the disease (85.7%) if the proper preventive measures weren't taken. While more respondents from Sultanate of Oman expected a shutdown and sanction (55.3%), more respondents from Sudan said that Monkeypox will spread and become a global epidemic (61.1%). Participants from Sudan made this prediction more frequently than other participants (64.4% and 61.4%, respectively). To our knowledge, no other comparable study was conducted across the Middle East with this same objective.

Conclusion

Most of the participants of this study were female, with an age range between 18 to 24 years, living in urban areas and had higher education. The majority had never seen a case with Monkeypox before and would avoid countries with declared cases. Social media formed the primary source of information. Most respondents were unaware of the presence or absence of Monkeypox in their nations. The majority correctly identified the causing organism but not its location of discovery. They did not know its incubation period but could identify that the disease transmits through body fluids and interaction with infected animals. The participants were unaware of the symptoms for the larger part: less than half of the participants could identify the early and late signs of the disease. They were largely ignorant to the complications and fatality rates of the disease. All this translated into low scores on the knowledge scale. There were significant associations between knowledge scores and age, gender, educational environment, and residence. Participants demonstrated belief that Monkeypox can become an epidemic. Opinions around the ability to control the disease largely varied between countries.

Strengths and Limitations:

The strength of this study is that it is the first study with this sample size on the subject, as previous studies had much smaller sample sizes. Hence, it can reflect more faithfully the knowledge and understanding of Monkeypox among the general population, especially in the Middle East. Additionally, it is the first study to offer regional coverage of the topic. The study also assessed the general population’s knowledge of Monkey pox complications and their predictions about the disease; two areas which haven’t been assessed frequently throughout studies that targeted the general population. The limitation of this study might come from unequal representation across demographics in the sample size, since most participants lived in urban areas and had higher education. It is natural to expect that this unequal representation had its consequences on the findings.

Recommendations:

This study’s conclusions point out that future research on this topic should consider better demographic representation, for better coverage and understanding of the general population’s perceptions around the topic as the results might show to be sensitive for changes in participants’ backgrounds.

Declarations

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