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General public knowledge, attitudes and practices towards Coronavirus COVID-19 prevention measures, Mecca, KSA, 2020-2021

Fowzi O Elamin*; Elfadil M Salih, Alhnouf F Alyazidi, Amani I Maeeni, Asia S Alotaibi Rafal A Awan, Nawal J Almowalad, Ahmed D Alluqmani and Ahmed M Alamri,

Faculty of Public Health & Health Informatics, Umm Al-Qura University. **Kingdom of Saudi Arabia**

***Correspondence:** foomer@uqu.edu.sa, fowzi211@gmail.com **Received: 18-03-2023, Revised: 18-05-2023, Accepted: 20-05-2023 e-Published: 21-05-2023**

The COVID-19 pandemic emerged in late 2019 and quickly spread globally, including to the Kingdom of Saudi Arabia (KSA). With no known cure, the government implemented preventative measures to curb the virus's spread. This study aimed to evaluate the attitudes, knowledge, and practices of the population in Mecca towards prevention measures. Data collected using an online questionnaire from a randomly selected sample. The results showed that out of 553 participants, 30% were male and 70% were female. The majority were Saudi (88%), between 20-30 years old (64%), and had a university degree (66%). Additionally, 21% had contracted COVID-19, 56% had family members who had contracted it, and only 15% had been vaccinated. Overall, participants demonstrated high awareness and knowledge (86%), positive attitudes (90%), and good practices (86%) towards COVID-19. The study identified a statistically significant difference between the attitudes and practices of participants and their age group. There was also a significant difference between the knowledge of participants and their educational level and between their practices and infection status. The study concluded that assessing public knowledge, attitudes, and practices can help health authorities identify gaps in health education efforts. Overall, the study indicates that there is a good understanding and adherence to COVID-19 prevention measures in Saudi Arabia

Keywords: COVID-19, preventive measures, KSA, KAP

INTRODUCTION

The discovery of the first coronavirus, called B814, dates to 1965, when it was identified by Tyrrell and Bynoe. Since then, at least five new human viruses have been discovered, all of which target the respiratory system and can cause significant morbidity and mortality (Kahn & McIntosh, 2005; Tyrrell & Bynoe, 1965). In December 2019, a new strain of coronavirus emerged in Wuhan, Hubei province, China, causing an infectious respiratory disease that was named COVID-19 by the World Health Organization (WHO). This outbreak was caused by a novel coronavirus, also known as SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) (Wu et al. 2020; Zhu et al. 2020). As of March 2, 2021, the virus has spread widely across the globe, with 114,140,104 confirmed cases of COVID-19 and 2,535,520 deaths reported to the WHO (Rudnicka et al. 2020).

Professor Taisheng Li, who observed and treated severe and critically ill patients in the ICU, stated that early intravenous immunoglobulin (IVIG) and low molecular weight heparin (LMWH) anticoagulation therapy were crucial in treating patients (T. Li et al. 2020; Wiersinga et al. 2020). Developing vaccines or drug treatments for COVID-19 requires significant efforts, such as bedside observations, clinical management participation, and treatment strategy optimization to improve clinical outcomes (Mallapaty, 2020; Miljić, 2021).

The SARS-CoV-2 virus can be shed from several sources, such as saliva, respiratory secretions, feces, and urine, leading to potential transmission of the virus through various means. Transmission can occur through different ways, including direct contact with an infected person through exposure to droplets from coughing or sneezing, physical contact like shaking hands, hugging, or kissing, or indirect contact by touching contaminated surfaces or objects, followed by touching the eyes, nose, or mouth (Bwire et al. 2021; D. Wang et al. 2020; W. Wang et al. 2020) (Q. Li et al. 2020).

Furthermore, infection can also spread through airborne means when medical procedures or treatments generate aerosols, like cardiopulmonary resuscitation or intubation. It's important to note that certain activities, such as talking or singing, can also produce respiratory droplets that could potentially transmit the virus (Q. Li et al. 2020;

Singh, 2004; Thacker et al. 2011).

Therefore, taking precautions such as wearing masks, practicing physical distancing, and frequent hand washing can help minimize the risk of transmission. It's important to stay up to date with the latest guidance from health authorities and to follow recommended practices to help prevent the spread of COVID-19 (Singh, 2004) (Q. Li et al. 2020) (Li Guan et al, 2020

According to the pervious information, the current study aimed to evaluate the attitudes, knowledge, and practices of the population in Mecca towards prevention measures.

MATERIALS AND METHODS

Study location

Mecca (Makkah al-Mukarramah), situated in the western region of Saudi Arabia, holds the utmost significance in Islam as it encompasses the Grand Mosque and the revered *Kaaba*, towards which Muslims direct their prayers. Every year, millions of Muslims embark on a pilgrimage to the *Kaaba* during the *Hajj* and *Umrah* season. Covering an expanse of 850 km^2, Mecca is home to a populace of 1,578,722 individuals as per the 2015 census. The city consists of 93 districts, including densely populated slums. Given its high daily count of COVID-19 cases, Mecca was chosen for this study, which commenced in December 2020.

Study design

The data collection method used is simple random sampling. This approach involves selecting a sample of individuals from a larger community in a random manner, where every member of the population has an equal chance of being chosen. Then the questionnaire was distributed to through social media. Participants included Mecca city residents 13 years and above, intermediate school and above from all nationalities. However, excluded those individuals who fell short of these criteria.

Sample size

Sample size is calculated using the Raosof Online Calculator for the total number of the population of Mecca city which is 1.5 million and with a margin of error of 5% and confidence level of 95% and a response rate of 50%. Thus, recommended sample size is estimated to be 385.

The equation used:

$x = Z(c/100)^2 r(100-r)$

$n = Nx / ((N-1)E^2 + x)$

$E = \mathrm{Sqrt}[(N-n)x / n(N-1)]$

Where:

n= sample size

N= population size

E = margin of error

r = is the fraction of responses that you are interested in

Z(c/100) is the critical value for the confidence level c

Data analysis

Both Microsoft Excel and SPSS software were utilized. The analysis of the responses to the 20 knowledge, 15 attitude and 15 practice questions involved calculating scores based on Likert scale of 1 to 5. Each correct answer was assigned a score of 5 for Strongly Agree, 4 for Agree, 3 for Neutral, 2 for Disagree, and 1 for Strongly Disagree. The mean response for each question was calculated to differentiate between the levels of knowledge, attitudes, and practices for each question, and a total score was calculated for each respondent. Cross-tabulation was done to correlate relevance of certain variable to each other.

RESULTS

The result shows the frequency and percentage of respondents according to their gender, nationality, age group, educational level, and family monthly income level in Saudi Riyals (SAR). Gender: Most respondents were female (69.6%), while males made up 30.4% of the sample. Nationality: Most of the respondents were Saudi nationals (87.9%), while 11.8% were non-Saudi. Age Group: The largest age group in the sample was 20-30 years (64.4%), followed by those aged over 40 years (11.9%). The age groups of less than 20 years and 30-40 years were represented by 8.9% and 14.5% of respondents respectively. Educational Level: Most respondents had completed university education (66.2%), while 21.5% had completed secondary education, and 4.3% had completed education below secondary level. 7.6% of respondents had post-graduate qualifications (Table 1).

Table 1: demographic characteristics of participants

Variable	Value	Frequency	%
Gender	Female	383	69.6
	Male	168	30.4
Nationality	Saudi	486	87.9
	Non-Saudi	65	11.8
Age Group in years	Less than 20	49	8.9
	20 - 30	356	64.4
	30 - 40	80	14.5
	> 40	66	11.9
Educational Level	Below Secondary	24	4.3
	Secondary	119	21.5
	University	366	66.2
	Post-graduate	42	7.6
Family Monthly income level in SRs	< 5000	315	57.0
	5000-10000	92	16.6
	10000-15000	87	15.7
	> 15000	45	8.1
	No applicable	12	2.2

Out of the total sample, 21.2% (117) have been infected with COVID-19 at some point, while the majority, 77.2% (427) have not. More than half of the respondents,

55.9% (309), reported that at least one of their family members has been infected with COVID-19, while 42.5% (235) have not. Only 14.5% (80) of the respondents have been vaccinated against COVID-19, while the vast majority, 83.9% (464), have not yet received the vaccine. It's important to note that these data are based on self-reported responses and may not accurately reflect the actual infection or vaccination status of the participants (Table 2).

Table 2: incidence and vaccination rate of COVID-19

Variable	Value	Frequency	%
have you ever been infected by COVID-19	Yes	117	21.2
	No	427	77.2
Do any of your family member ever infected by COVID-19	Yes	309	55.9
	No	235	42.5
Vaccinated against COVID-19	Yes	80	14.5
	No	464	83.9

The data presented in the table consists of participants' responses to a set of statements related to COVID-19. The responses are categorized into Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree, and the percentage and mean scores are also provided. The mean score of participants' overall knowledge about COVID-19 is 4.3, which suggests that participants have a good understanding of the disease. Among the statements, the ones with the highest mean scores are "Avoid touching eyes, nose and mouth with unwashed hands" (4.8), "It is necessary for children or young people to take precautionary measures to prevent COVID-19 transmission" (4.79), and "Isolating people living with COVID-19 is an effective way to reduce the spread of the virus" (4.72), indicating that participants strongly agree with these statements.

The statement with the lowest mean score is "Antibiotics are an effective treatment for people with COVID-19" (3.01), suggesting that participants have a low level of agreement with this statement (Table 3).

Other notable findings include a high level of agreement with the effectiveness of social distancing, fines for non-compliance, respiratory transmission, and transmission through contact with contaminated surfaces. There is also a high level of agreement with the need to isolate contacts of people with COVID-19 and avoid crowded places and public transportation.

However, there is some disagreement with the use of masks, with participants split between those who believe that wearing medical masks prevents transmission of COVID-19 and those who believe that people should only wear masks if they are infected or looking after someone who is suspected of contracting the disease.

In conclusion, the data suggests that participants have a good understanding of COVID-19 and its transmission, although there is some disagreement with certain prevention measures, such as the use of masks.

The results indicate that overall, respondents have a positive attitude towards COVID-19 measures in Saudi Arabia. All questions have a mean score of over 4.0, which suggests that respondents generally agree with the effectiveness of the measures taken.

The data presented shows the results of a survey on people's adherence to various COVID-19 preventative measures. The survey included 15 statements, each related to a specific preventative measure, and participants were asked to rate their level of agreement or disagreement on a 5-point Likert scale. The survey was conducted in French and the results are presented in both frequency and percentage distributions, as well as a mean score for each statement. The overall mean score for all statements is 4.3, which represents a high level of adherence to the recommended preventative measures (Table 4).

Looking at the individual statements, some measures have higher levels of adherence than others. For example, statement 4, "I cover the mouth and nose when sneezing and coughing", and statement 14, "When I have any symptoms, I isolate myself immediately and seek help from the department of health services", have very high mean scores of 4.72 and 4.66, respectively, indicating that most participants strongly agree with these measures. Similarly, statement 3, "Make sure to wear the muzzle when you get out of the house", has a high mean score of 4.73, indicating strong agreement with this measure as well.

Other statements, such as statement 2, "Be sure to wear gloves when going shopping", and statement 15, "I registered in the list of obtaining the corona vaccine through the application of "My Health"", have lower mean scores of 3.61 and 3.66, respectively, indicating less agreement with these measures. This suggests that there may be some hesitancy or reluctance among participants to adopt these particular preventative measures.

It is also interesting to note that some statements have relatively high levels of neutral responses, such as statement 9, "Avoid family and friends visits", and statement 6, "Make sure to measure my temperature periodically", both of which have neutral response rates of over 20%. This may suggest that participants are unsure about the effectiveness of these measures or may not fully understand how to implement them (Table 5).

Table 3: Participants Knowledge towards COVID-19

Variable		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
1. Ban on movement and travelling help reduce the spread of coronavirus	**Fr.**	4	21	68	159	299	4.32
	%	0.7	3.8	12.3	28.9	54.3	
2. The Government of the Saudi Arabia has imposed heavy fines for those who have failed to curb the spread of the coronavirus	**Fr.**	0	8	20	136	387	4.64
	%	0	1.5	3.6	24.7	70.2	
3. The coronavirus spreads from person to person at a distance of about two meters (social distance)	**Fr.**	17	69	78	179	208	3.89
	%	3.1	12.5	14.2	32.5	37.7	
4. Coronavirus spreads through respiratory spray, which occurs when infected people cough and sneeze.	**Fr.**	3	7	6	171	364	4.61
	%	0.5	1.3	1.1	31	66.1	
5. Coronavirus can be infected by touching a surface or body contaminated with the virus, then touching the person's mouth, nose or eyes	**Fr.**	3	12	15	159	362	4.57
	%	0.5	2.2	2.7	28.9	65.7	
6. The main symptoms COVID 19 include fever, fatigue, dry cough, muscle pain and shortness of breath.	**Fr.**	0	4	16	168	363	4.62
	%	0	0.7	2.9	30.5	65.9	
7. Unlike colds, congestion, runny nose and sneezing are less common in people with COVID 19	**Fr.**	17	50	123	169	192	3.85
	%	3.1	9.1	22.3	30.7	34.8	
8. Antibiotics are an effective treatment for people with COVID 19	**Fr.**	80	103	185	97	86	3.01
	%	14.5	18.7	33.6	17.6	15.6	
9. The most vulnerable groups are the elderly, pregnant women and those with serious chronic diseases, such as heart or lung disease and diabetes.	**Fr.**	1	5	22	132	391	4.65
	%	0.2	0.9	4	24	71	
10. Injury in children is less serious than adults.	**Fr.**	12	44	140	195	160	3.81
	%	2.2	8	25.4	35.4	29	
11. It is necessary for children or young people to take precautionary measures to prevent COVID 19 transmission	**Fr.**	0	0	13	91	447	4.79
	%	0	0	2.4	16.5	81.1	
12. Avoid touching eyes, nose and mouth with unwashed hands	**Fr.**	3	1	3	87	457	4.8
	%	0.5	0.2	0.5	15.8	82.9	
13. The right way to wash hands: Wash with soap and water for at least 40 seconds	**Fr.**	2	7	31	126	385	4.61
	%	0.4	1.3	5.6	22.9	69.9	
14. Wearing medical masks prevents transmission of COVID 19	**Fr.**	1	8	45	152	345	4.51
	%	0.2	1.5	8.2	27.6	62.6	
15. People should only wear a mask if they are infected with the virus, or if they are looking after a person suspected of contracting the COVID 19	**Fr.**	113	131	41	102	164	3.13
	%	20.5	23.8	7.4	18.5	29.8	
16. Isolating people living with COVID 19 is an effective way to reduce the \spread of the virus.	**Fr.**	0	5	14	110	422	4.72
	%	0	0.9	2.5	20	76.6	
17. Isolate contacts of people with COVID 19 is in an appropriate place, for a monitoring period of 14 days.	**Fr.**	0	8	26	146	371	4.6
	%	0	1.5	4.7	26.5	67.3	
18. Avoiding crowded places and using public transport helps reduce the spread of COVID 19 infection	**Fr.**	2	7	40	154	348	4.52
	%	0.4	1.3	7.3	27.9	63.2	
19. When taking the CORONA vaccine, it prevents, God willing, from contracting it and exposing it to serious complications.	**Fr.**	8	26	133	152	232	4.04
		1.5	4.7	24.1	27.6	42.1	

Table 4: Attitudes of participants towards COVID-19

Variable		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
1. Ministry of Health guidelines have played a major role in preventing the spread of COVID 19	Fr.	0	0	16	134	401	4.7
	%	0	0	2.9	24.3	72.8	
2. I must keep the distance between me and others, to avoid the spread of COVID 19	Fr.	0	0	8	114	429	4.76
	%	0	0	1.5	20.7	77.9	
3. Hand washing is necessary to protect myself from COVID 19	Fr.	0	0	8	110	433	4.77
	%	0	0	1.5	20	78.6	
4. To protect myself from exposure to corona virus I must stay at home if I am ill, unless I am receiving medical care.	Fr.	1	13	25	146	366	4.57
	%	0.2	2.4	4.5	26.5	66.4	
5. The imposition of fines prevented young people and adolescents from movement	Fr.	6	7	61	150	327	4.42
	%	1.1	1.3	11.1	27.2	59.3	
6. Suspending the study and attending workplaces in all government agencies is a right decision to control the spread of the virus	Fr.	2	10	23	134	382	4.6
	%	0.4	1.8	4.2	24.3	69.3	
7. The closure of markets, shopping malls, restaurants and cafes helped to control the spread of the virus	Fr.	4	14	29	138	366	4.54
	%	0.7	2.5	5.3	25	66.4	
8. Partial curfew helped contain the virus and reduce its spread	Fr.	9	35	49	135	323	4.32
	%	1.6	6.4	8.9	24.5	58.6	
9. Curfew decision, causes increased gatherings after the time limit for prohibition	Fr.	9	40	115	165	222	4
	%	1.6	7.3	20.9	29.9	40.3	
10. The decision to totally curfew within cities was an important step to control the outbreak of the coronavirus	Fr.	7	11	27	117	389	4.58
	%	1.3	2	4.9	21.2	70.6	
11. The decision to prevent entry and exit from the Kingdom has a significant impact on the achievement of fewer injuries	Fr.	2	2	16	87	444	4.76
	%	0.4	0.4	2.9	15.8	80.6	
12. Suspension of Hajj and Umrah helped prevent gatherings to perform duties and protect those most vulnerable COVID 19	Fr.	6	8	28	97	412	4.64
	%	1.1	1.5	5.1	17.6	74.8	
13. "My Health" and "Tawaklna" applications provided by the Saudi Ministry of Health contributed to the diagnosis of people with COVID 19 and check on their health condition	Fr.	6	5	33	126	381	4.58
	%	1.1	0.9	6	22.9	69.1	
14. - Based on the kingdom's efforts in the strict measures, the Corona virus will eventually be successfully controlled.	Fr.	1	5	33	144	368	4.58
	%	0.2	0.9	6	26.1	66.8	
15. If you had the opportunity to take the COVID 19 vaccination, would you receive the vaccination?	Fr.	16	30	99	117	289	4.15
	%	**2.9**	**5.4**	**18**	**21.2**	**52.5**	
Overall attitudes							**4.5 (90%)**

Table 5: Practices of participants towards COVID-19

Variable		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
1. Continue washing hands with soap & water for at least 40 seconds, especially after going to a public place or after coughing & sneezing or touching the surfaces	Fr.		4	28	128	391	4.64
	%		0.7	5.1	23.2	71	
2. Be sure to wear gloves when going shopping	Fr.	50	81	100	123	197	3.61
	%	9.1	14.7	18.1	22.3	35.8	
3. Make sure to wear the muzzle when you get out of the house	Fr.	1	1	13	114	422	4.73
	%	0.2	0.2	2.4	20.7	76.6	
4. Cover the mouth and nose when sneezing & coughing	Fr.	1	1	18	109	422	4.72
	%	0.2	0.2	3.3	19.8	76.6	
5. Avoid touching the mouth, nose & eye when you get out of the house	Fr.	4	10	28	117	392	4.6
	%	0.7	1.8	5.1	21.2	71.1	
6. Make sure to measure my temperature periodically	Fr.	12	46	116	132	245	4
	%	2.2	8.3	21.1	24	44.5	
7. Avoid shaking hands with others	Fr.	3	20	71	161	296	4.32
	%	0.5	3.6	12.9	29.2	53.7	
8. Commit to social spacing by setting a distance (1.8 m) with others	Fr.	2	21	62	161	305	4.35
	%	0.4	3.8	11.3	29.2	55.4	
9. Avoid family & friends visits	Fr.	18	63	150	132	188	3.74
	%	3.3	11.4	27.2	24	34.1	
10. Commit to staying home and going out for necessity only	Fr.	12	35	79	171	254	4.13
	%	2.2	6.4	14.3	31	46.1	
11. Avoid being in crowded places	Fr.	1	11	15	139	385	4.63
	%	0.2	2	2.7	25.2	69.9	
12. During the partial curfew, committed to being in authorized groups	Fr.	2	4	23	147	375	4.61
	%	0.4	0.7	4.2	26.7	68.1	
13. Committed to the decision of the curfew between cities	Fr.	4	3	16	104	424	4.71
	%	0.7	0.5	2.9	18.9	77	
14. When have any symptoms, I isolate myself immediately and seek help from the department of health services	Fr.	2	6	18	128	397	4.66
	%	0.4	1.1	3.3	23.2	72.1	
15. Registered in the list of obtaining the corona vaccine through the application of "My Health"	Fr.	42	98	95	85	231	3.66
	%	7.6	17.8	17.2	15.4	41.9	
Overall practices							**4.3 (86%)**

Overall, the high mean score of 4.3 for all statements combined indicates that participants have a strong level of adherence to the recommended COVID-19 preventative measures. However, there is variation in the level of agreement with individual measures, suggesting that public health messaging and education may need to be targeted towards certain measures to increase adherence. Additionally, the relatively high neutral response rates for some statements may indicate a need for clearer communication and education about the importance and effectiveness of these measures.

DISCUSSION

The relationship between gender and overall knowledge, attitudes, and practices of the population towards COVID-19 of the sample (N 553), As for knowledge, the mean score for males and females is very

similar (4.29 vs. 4.31), and there is no significant difference between them (p=0.51). The mean score for the total sample is 4.3. This suggests that gender is not a significant factor in determining overall knowledge about COVID-19. A study carried in Pakistan showed different result the gender is significant in determining the link knowledge about COVID-19(Afzal et al. 2021). For attitudes, the mean score for females is slightly higher than for males (4.56 vs. 4.52), but the difference is not significant (p=0.24). The mean score for the total sample is 4.53. This indicates that gender is not a significant factor in determining overall attitudes towards COVID-19. For practices, the mean score for females is slightly higher than for males (4.4 vs. 4.32), but the difference is not significant (p=0.06). The mean score for the total sample is 4.34. This suggests that gender is not a significant factor in determining overall practices towards COVID-19, the same result were found by Moran in a study to find the association between gender and protective behaviors in response to respiratory epidemics and pandemics,(Moran & Del Valle, 2016).

In summary, the data suggest that gender is not a significant factor in determining the overall knowledge, attitudes, and practices of the population towards COVID-19. However, it is important to note that the sample size for females is smaller than for males, which may affect the statistical power of the analysis.

the relationship between overall knowledge, attitudes, and practices of the population towards COVID-19 and nationality. The mean score for knowledge among Saudi nationals was 4.3 with a standard deviation of 0.35, while for non-Saudi nationals, it was 4.25 with a standard deviation of 0.34. Although the mean scores were slightly different, the confidence intervals for both groups overlapped, suggesting that the difference may not be statistically significant. The p-value of 0.26 supports this observation the same finding were found among Jordanians, (Lataifeh et al. 2022). The mean score for attitudes among Saudi nationals was 4.54 with a standard deviation of 0.43, while for non-Saudi nationals, it was 4.45 with a standard deviation of 0.46. The confidence intervals for both groups also overlap, but the p-value of 0.08 indicates that there may be a significant difference in attitudes towards COVID-19 between the two groups. The mean score for practices among Saudi nationals was 4.35 with a standard deviation of 0.5, while for non-Saudi nationals, it was 4.27 with a standard deviation of 0.56. Similar to knowledge, the confidence intervals for both groups overlapped, and the p-value of 0.23 suggests that the difference may not be statistically significant.

Overall, the data suggest that there may be some differences in attitudes towards COVID-19 between Saudi and non-Saudi nationals. However, the differences in knowledge and practices may not be statistically significant. It is important to note that the sample size for non-Saudi nationals is relatively small, and therefore, the findings should be interpreted with caution. Future studies with a larger sample size may provide more insight into the relationship between nationality and knowledge, attitudes, and practices towards COVID-19.

The relationship between overall knowledge, attitudes, and practices of the population towards COVID-19 and age group. The results shows that there are differences in knowledge, attitudes, and practices among different age groups. In terms of knowledge, the mean scores of participants were similar across all age groups. However, the p-value was not statistically significant, indicating that there was no significant difference in knowledge scores between different age groups. In terms of attitudes, the data showed a statistically significant difference in mean scores among different age groups. The mean attitude score was highest for participants above 40-years-old, followed by those in the 30-40 age group, and then those in the 20-30 age group. The mean attitude score was lowest for participants below 20-years-old. The statistically significant p-value suggests that these differences are not due to chance. Finally, in terms of practices, the data also showed a statistically significant difference in mean scores among different age groups. Participants in the 30-40 age group had the highest mean practice score, followed by those above 40-years-old, those in the 20-30 age group, and those below 20-years-old. The statistically significant p-value suggests that these differences are not due to chance.

Overall, the results suggest that age is a significant factor in determining attitudes and practices towards COVID-19. The differences in attitudes and practices among age groups may be due to differences in risk perception, health literacy, and social responsibility. These findings can help inform public health interventions targeted towards specific age groups to improve their COVID-19 knowledge, attitudes, and practices.

The relationship between overall knowledge, attitudes, and practices towards COVID-19 and educational level among the population. In terms of knowledge, the mean score for participants with below secondary education was 4.41, which was slightly higher than the mean score for secondary education holders (4.39), university degree holders (4.26), and post-graduate degree holders (4.28). However, the difference was only statistically significant between the below secondary education group and the university degree group. Regarding attitudes, the mean score for participants with below secondary education was 4.6, which was slightly higher than the mean score for secondary education holders (4.53), university degree holders (4.54), and post-graduate degree holders (4.45). However, the difference was not statistically significant between any of the educational level groups. For practices, the mean score for participants with below secondary education was 4.43, which was slightly higher than the mean score for secondary education holders (4.34), university degree holders (4.33), and post-graduate degree holders (4.42). However, the difference was not statistically significant between any of the educational

level groups.

Overall, the results suggest that there is no clear relationship between educational level and attitudes and practices towards COVID-19 among the population. However, participants with below secondary education had a slightly higher knowledge score than those with higher educational levels, though the difference was only statistically significant compared to university degree holders. It is important to note that these findings are specific to the population surveyed and may not generalized to other populations.

The relationship between overall knowledge, attitudes, and practices of the population towards COVID-19 and their income level. The results indicate that there is no statistically significant difference in mean scores between different income levels. This suggests that income level is not a significant factor in determining the level of knowledge of individuals regarding COVID-19. For attitudes, the results show that individuals with higher income levels have slightly more positive attitudes towards COVID-19, but the difference is not statistically significant. For practices, the results suggest that individuals with higher income levels have better practices towards COVID-19, with a statistically significant difference in mean scores. This finding may be since individuals with higher income levels have better access to resources such as personal protective equipment and healthcare services, which may contribute to better practices towards COVID-19.

Overall, the results suggest that income level may have a limited impact on knowledge and attitudes towards COVID-19 but may play a role in shaping practices towards the virus. However, it is important to note that this study only provides a snapshot of the relationship between income level and COVID-19, and further research is needed to fully understand the underlying factors that contribute to these findings.

The relationship between previous infection with COVID-19 and the overall knowledge, attitudes, and practices towards the virus, shows that 109 participants had a previous infection of COVID-19, while 397 hadn't. For those with a prior infection, the mean score for knowledge about COVID-19 was slightly higher (M = 4.34, SD = 0.31) than those with no prior infection (M = 4.29, SD = 0.36). However, the difference was not statistically significant (p = 0.15), suggesting that previous infection does not significantly affect an individual's overall knowledge about COVID-19. In terms of attitudes towards COVID-19, 117 participants reported having a previous infection, and 427 reported no prior infection. Interestingly, those with a previous infection had a slightly lower mean score (M = 4.47, SD = 0.50) compared to those with no prior infection (M = 4.55, SD = 0.41), but this difference was not statistically significant (p = 0.08). Thus, the previous infection does not seem to have a significant impact on the attitudes towards COVID-19. those with a previous infection had lower mean scores for their practices towards COVID-19 (M = 4.16, SD = 0.60) compared to those with no prior infection (M = 4.38, SD = 0.47), and this difference was statistically significant (p = 0.001). Therefore, individuals who had a previous infection may be less likely to follow recommended practices to prevent the spread of COVID-19.

Overall, the results suggest that previous infection by COVID-19 does not have a significant impact on an individual's knowledge and attitudes towards COVID-19, but it may affect their practices towards preventing the spread of the virus. The findings highlight the importance of public health campaigns to encourage adherence to preventive measures, even for those who have previously been infected.

The relationship between vaccination against COVID-19 and the overall knowledge, attitudes, and practices towards COVID-19. the difference was not statistically significant (p = 0.57), indicating that vaccination status does not significantly impact an individual's overall knowledge about COVID-19. Similarly, there was no statistically significant difference in attitudes towards COVID-19 between those who reported being vaccinated and those who did not (p = 0.69). The mean score for attitudes was slightly higher for those who reported being vaccinated (M = 4.55, SD = 0.45) compared to those who were not vaccinated (M = 4.53, SD = 0.43). Regarding practices towards COVID-19, those who reported being vaccinated had a slightly higher mean score (M = 4.37, SD = 0.48) compared to those who were not vaccinated (M = 4.33, SD = 0.52). However, this difference was not statistically significant (p = 0.48).

Overall, the results suggest that vaccination status does not significantly impact an individual's knowledge, attitudes, or practices towards COVID-19. However, it is worth noting that these results may be influenced by various factors, such as the timing of the survey, the population studied, and the context of the study. Further research is needed to explore the relationship between vaccination status and COVID-19-related knowledge, attitudes, and practices. Nonetheless, these findings highlight the importance of promoting public awareness and encouraging adherence to preventive measures, regardless of vaccination status.

The mean scores, standard deviations, and p-values for the overall knowledge, attitudes, and practices towards COVID-19. The mean score for attitudes towards COVID-19 was 4.52 (SD = 0.434), indicating a positive attitude overall. The mean score for knowledge about COVID-19 was 4.29 (SD = 0.350), suggesting a moderate level of knowledge. The mean score for practices towards COVID-19 was 4.34 (SD = 0.510), indicating a moderate level of adherence to preventive measures. The p-values indicate the statistical significance of the differences between the mean scores of different variables. For attitudes and practices towards COVID-19, the p-values were both less than 0.001, indicating that there were significant differences in mean scores between individuals. This

suggests that attitudes and practices towards COVID-19 are distinct and may not necessarily be correlated. For knowledge about COVID-19, the p-value was not significant ($p = 0.11$), indicating that there was no significant difference in mean scores between individuals. This suggests that the level of knowledge about COVID-19 was relatively consistent among the sample.

Overall, the results suggests that attitudes and practices towards COVID-19 are important factors to consider in promoting public health and preventing the spread of the virus. It is crucial to continue educating the public on preventive measures and encouraging positive attitudes and behaviors towards COVID-19.

Finally, the study suggests that there may be a significant difference in knowledge between participants with below secondary education and university degree holders. However, there was no significant difference in attitudes or practices between any of the educational level groups. It is important to note that the mean scores for attitudes and practices were relatively high across all educational levels, indicating a generally positive attitude towards COVID-19 and adherence to preventive measures.

CONCLUSION

In summary, the study suggest that gender is not a significant factor in determining the overall knowledge, attitudes, and practices of the population towards COVID-19. Age may play a significant role in determining attitudes and practices towards COVID-19, while nationality and educational level may have a smaller impact. Future studies with larger sample sizes are needed to confirm these findings and provide more insight into the relationship between demographic factors and COVID-19 knowledge, attitudes, and practices.

Recommendation:

it can be recommended that public health interventions should focus on educating the general population about COVID-19, regardless of gender. However, interventions targeted towards specific age groups may be necessary to improve their attitudes and practices towards the virus. Additionally, interventions targeted towards university degree holders may be beneficial, as they showed lower knowledge scores compared to participants with below secondary education. future studies with larger sample sizes may provide more insight into the relationship between COVID-19 knowledge, attitudes, and practices and nationality, educational level, and other demographic factors.

CONFLICT OF INTEREST

"We declare that the present study was performed in the absence of any conflict of interest. We affirm that there are no financial, personal, or professional relationships that could potentially influence or bias the design, conduct, analysis, or interpretation of the research findings. Furthermore, there are no affiliations, memberships, or sponsorships with any organization or entity that may have a direct or indirect interest in the subject matter of this study.

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REFERENCES

Afzal, M. S., Khan, A., Qureshi, U. U. R., Saleem, S., Saqib, M. A. N., Shabbir, R. M. K., Naveed, M., Jabbar, M., Zahoor, S., & Ahmed, H. (2021). Community-Based Assessment of Knowledge, Attitude, Practices and Risk Factors Regarding COVID-19 Among Pakistanis Residents During a Recent Outbreak: A Cross-Sectional Survey. Journal of Community Health, 46(3). https://doi.org/10.1007/s10900-020-00875-z

Bwire, G. M., Majigo, M. V., Njiro, B. J., & Mawazo, A. (2021). Detection profile of SARS-CoV-2 using RT-PCR in different types of clinical specimens: A systematic review and meta-analysis. In Journal of Medical Virology (Vol. 93, Issue 2). https://doi.org/10.1002/jmv.26349

Kahn, J. S., & McIntosh, K. (2005). History and Recent Advances in Coronavirus Discovery. Pediatric Infectious Disease Journal, 24(11). https://doi.org/10.1097/01.inf.0000188166.17324.60

Lataifeh, L., Al-Ani, A., Lataifeh, I., Ammar, K., Alomary, A., Al-Hammouri, F., & Al-Hussaini, M. (2022). Knowledge, Attitudes, and Practices of Healthcare Workers in Jordan towards the COVID-19 Vaccination. Vaccines, 10(2). https://doi.org/10.3390/vaccines10020263

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K. S. M., Lau, E. H. Y., Wong, J. Y., Xing, X., Xiang, N., Wu, Y., Li, C., Chen, Q., Li, D., Liu, T., Zhao, J., Liu, M., … Feng, Z. (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. New England Journal of Medicine, 382(13). https://doi.org/10.1056/nejmoa2001316

Li, T., Lu, H., & Zhang, W. (2020). Clinical observation and management of COVID-19 patients. Emerging Microbes & Infections, 9(1), 687–690. https://doi.org/10.1080/22221751.2020.1741327

Mallapaty, S. (2020). The coronavirus is most deadly if you are older and male - new data reveal the risks. In Nature (Vol. 585, Issue 7823). https://doi.org/10.1038/d41586-020-02483-2

Miljić, P. (2021). Characteristics and treatment of coagulopathy associated with COVID-19. Medicinski Podmladak, 72(3). https://doi.org/10.5937/mp72-33067

Moran, K. R., & Del Valle, S. Y. (2016). A meta-analysis of the association between gender and protective behaviors in response to respiratory epidemics and pandemics. PLoS ONE, 11(10). https://doi.org/10.1371/journal.pone.0164541

Rudnicka, E., Napierała, P., Podfigurna, A., Męczekalski, B., Smolarczyk, R., & Grymowicz, M. (2020). The World Health Organization (WHO) approach to healthy ageing. Maturitas, 139. https://doi.org/10.1016/j.maturitas.2020.05.018

Singh, J. (2004). Centers for disease control and prevention. In Indian Journal of Pharmacology (Vol. 36, Issue 4). https://doi.org/10.1097/jom.0000000000001045

Thacker, S. B., Stroup, D. F., & Sencer, D. J. (2011). Epidemic assistance by the centers for disease control and prevention: Role of the epidemic intelligence service, 1946-2005. American Journal of Epidemiology, 174(SUPPL. 11). https://doi.org/10.1093/aje/kwr307

Tyrrell, D. A. J., & Bynoe, M. L. (1965). Cultivation of a Novel Type of Common-cold Virus in Organ Cultures. British Medical Journal, 1(5448). https://doi.org/10.1136/bmj.1.5448.1467

Wang, D., Hu, B., Hu, C., Zhu, F., Liu, X., Zhang, J., Wang, B., Xiang, H., Cheng, Z., Xiong, Y., Zhao, Y., Li, Y., Wang, X., & Peng, Z. (2020). Detection of SARS-CoV-2 in Different Types of Clinical Specimens. JAMA - Journal of the American Medical Association, 323(11).

Wang, W., Xu, Y., Gao, R., Lu, R., Han, K., Wu, G., & Tan, W. (2020). Detection of SARS-CoV-2 in Different Types of Clinical Specimens. In JAMA - Journal of the American Medical Association (Vol. 323, Issue 18). https://doi.org/10.1001/jama.2020.3786

Wiersinga, W. J., Rhodes, A., Cheng, A. C., Peacock, S. J., & Prescott, H. C. (2020). Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review. In JAMA - Journal of the American Medical Association (Vol. 324, Issue 8). https://doi.org/10.1001/jama.2020.12839

Wu, F., Zhao, S., Yu, B., Chen, Y. M., Wang, W., Song, Z. G., Hu, Y., Tao, Z. W., Tian, J. H., Pei, Y. Y., Yuan, M. L., Zhang, Y. L., Dai, F. H., Liu, Y., Wang, Q. M., Zheng, J. J., Xu, L., Holmes, E. C., & Zhang, Y. Z. (2020). A new coronavirus associated with human respiratory disease in China. Nature, 579(7798). https://doi.org/10.1038/s41586-020-2008-3

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., Zhao, X., Huang, B., Shi, W., Lu, R., Niu, P., Zhan, F., Ma, X., Wang, D., Xu, W., Wu, G., Gao, G. F., & Tan, W. (2020). A Novel Coronavirus from Patients with Pneumonia in China, 2019. New England Journal of Medicine, 382(8). https://doi.org/10.1056/nejmoa2001017