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Knowledge, Attitudes, and Practices toward COVID-19 among University Students in Jeddah City, Saudi Arabia: Lessons Learned, and the Way Forward

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ABSTRACT

Introduction: The impact of the coronavirus disease-2019 (COVID-19) pandemic has become a major issue globally. The pandemic had impacted many places including factories, restaurants, transportation, schools, and universities.

Aim: The main aim of this work was to assess the awareness of undergraduate students toward COVID-19 and to identify their main sources of information.

Methods: an online google form was distributed among undergraduate university students with a total of 692 respondents obtained between February and March.

Results: We found that university students were aware of the main precautions taken to prevent COVID-Infection. However, more importantly there was confusion about the mode of transmission - including viral transmission through animals and undercooked meat. Conclusions: This study shows that for future outbreaks: 1- communicating through social media is an effective method to relay important information. 2-University students have excellent Knowledge, attitudes, and practices toward COVID-19. 3-authorities can improve public awareness about minor events such as rare symptoms and mode of transmission. This will help ease confusion and limit the spread of wrong information.

Key words: COVID-19, SARS-CoV-2, Applied sciences, Health sciences

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INTRODUCTION

In late 2019, a viral infection causing pneumonia appeared in Wuhan, China, causing an outbreak [1]. The responsible virus was named SARS-CoV-2, and this pneumonia was named by World Health Organization (WHO) as Coronavirus Disease 2019 (COVID-19). Soon after, there was an alarming level of spread and infection severity, which resulted in a devasted effect on the global economy. By March 2020, the WHO had declared the COVID-19 outbreak a global pandemic. Globally, as of June 2022, there had been 500 million confirmed cases of COVID-19 infection, including 6.3 million deaths, reported to WHO [2].

SARS-CoV-2 is a respiratory virus. Therefore, it transmits from one person to another through contact and droplet [3-5]. Following transmission, the virus incubation period can be up to 14 days before the symptoms appear [4,6]. Variation in the symptoms of infected people was reported to range from mild to severe form with acute respiratory distress syndrome, sepsis and septic shock [3,7,8]. However, most of the patients complained of fever, cough, dyspnea, and fatigue [3,8]. Some of the most common complications included pneumonia, bronchitis, difficulty breathing and multi-organ failure [4].

It is hypothesized that the spread of SARS-CoV-2 virus within and between communities was driven by human mobility both local and long-distance [9]. Unlike other respiratory diseases that caused pandemics (e.g. H1N1), there was no sufficient infrastructure to develop specific antiviral drugs or vaccines for COVID-19 [4,10,11]. For any new infection, vaccine development would take time. This makes public awareness a critical factor in limiting the spread of respiratory infection. Therefore, the management of the outbreak would depend on individuals' adherence to the recommended measures.

The assessment of community awareness about such pandemic help in having the correct plan for disease

prevention and control [12]. It may also give a clear guideline for further intervention and for setting up a proper response in case of future outbreaks [13]. Since COVID-19 has affected most of the world's countries, initiation of surveillance studies and investigations about awareness and attitude toward this highly contagious infection is extremely important. Therefore, the main aim of this research was to examine the knowledge, attitude, and practice levels among university Students. We thought it is important to measure the level of knowledge of this young and vibrant population because they might influence the health of their own families and friends. Moreover, university students are the most socially active, making them more vulnerable to contracting a community-acquired infection.

MATERIALS AND METHODS

Study population

Undergraduate university students were chosen to be the target samples of this work. An online google form was generated and distributed to students between February to March. During the period of study, a total number of 692 respondents were obtained. The sample size was calculated based on a confidence interval of 99%, and a margin of error of 5%, with a total population of 15,000 university students [14].

Questionnaire design

Questions were designed, sent to students and answers were collected after declaring their approval for participation in the study. The study questionnaire composed of three major parts. The first part contained demographic data of respondents including age, gender and field of study. The second part contained questions related to general and medical information about the novel coronavirus (SARS-CoV-2). The third part included questions related to students' attitude toward COVID-19.

Statistics analysis

Chi Squared goodness-of-fit was used to produce descriptive statistics of sample demographics and if the participants' responses deviated from an equal distribution across the possible answers. Chi Squared test for independence was used to evaluate the association between gender, age, and the field of study of the participants and their responses. Cramer's V was used to express the strength of the association. When significant, post hoc testing using the adjusted standardized residual with a Bonferroni-adjusted alpha was used to determine the source of significance. Spearman's correlation was used to test any correlation between the variables. An alpha threshold of 0.05 was set for significance.

RESULTS

Demographic characteristics and knowledge score of COVID-19 among participants

Among the participants, 272 (39.3%), 258 (37.3%), and 162 (23.4%) students were within the ages of ≤ 20, 21– 22, and ≥23 years, respectively (Table 1). More than three quarters (82.1%) of student participants in this study were female. The proportion of participants, when analyzed according to their majors, were as follows: 137 students (19.8%) were majoring in Applied Sciences, 86 students (12.4%) were majoring in arts and social sciences, 49 students (7.1%) were majoring in economy, business, and law and 347 students (50.1%) majoring in engineering and computing sciences and 73 students (10.5%) were majoring in health sciences.

We next asked the participant about their source of information when it comes to COVID-19 virus and infection. Predominantly participants reported that they learned of COVID-19 through social media (84.4%, P<0.001) and TV or radio (12.3%, P<0.001) (Figure 1). A very small percentage of the participants (2.7-0.3%) gathered their information from alternative sources such as university and workplace (Figure 1).

The awareness of university students toward COVID-19 infection

We first confirmed that the vast majority (99.0%, P<0.001) of the participants had heard about COVID-19. Next, we evaluated the participant's awareness of basic SARS-CoV-2 virus knowledge and viral transmission. Most participants knew that COVID-19 infection is caused by a virus (96.8, P<0.001), that it can be transmitted by infected individuals (96.0%, P<0.001), and that it is transmitted by air droplets after coughing or sneezing (91.2%, P<0.001). Interestingly however, over one fifth of the participants believed that COVID-19 can be transmitted by water (21.8%, P<0.001), nearly half of them believed that it will not be transmitted

Table 1: Demographic characteristics of the participating university students.

Variable		N	Percentage	X^2
Age	≤ 20	272	39.3	P<0.001
	21-22	258	37.3	
	≥ 23	162	23.4	
Gender	Male	124	17.9	P<0.001
	Female	568	82.1	
Field of study	Applied Sciences	137	19.8	P<0.001
	Arts and Social Sciences	86	12.4	
	Economy, Business & Law	49	7.1	
	Engineering & Computing Sciences	347	50.1	
	Health Sciences	73	10.5	

by water (45.1%, P<0.001), and a third were unsure (33.1%). Finally, most of the participants believed that the incubation period of the virus is between 1 and 14 days (84.0%, P<0.001) (Table 2).

Next, we evaluated the participants' awareness of COVID-19 symptoms. Most of the students were aware that the symptoms include fever (97.5%, P<0.001), cough (88.8%, P<0.001), dyspnea (94.0%, P<0.001), and fatigue (84.1%, P<0.001). However, only 56.6% of the participants believed that COVID-19 can cause myalgia (P<0.001) and a large percentage were unsure (32.0%) (Table 3).

Moreover, we evaluated the participants' awareness of COVID-19 risk of infection to different populations. Most students believed that travelers (95.4%, P<0.001), people in crowded areas (95.0%, P<0.001), and the elderly (87.3%, P<0.001) are at higher risk of COVID-19 infections. Nearly half of the participants believed that children are also at an increased risk of COVID-19 infection (46.8%, P<0.001), while a third of them did not believe so (32.9%). Surprisingly, more than half of the participants did not believe that healthcare workers are at an increased risk of COVID-19 infection (52.5%, P<0.001). Similarly, a little more than half of the participants believed that individuals with chronic diseases are at higher risk of COVID-19 infections (55.3%, P<0.001), while nearly a third were unsure (29.3%) (Table 4).

Finally, we evaluated participants' awareness about medical complications of COVID-19. The majority believed that pneumonia is a complication of COVID-19 infection (77.7%, P<0.001). Similarly, bronchitis (61.1%, P<0.001), and difficulty breathing (89.9%, P<0.001). However, only 35.5% of the participants believed that COVID-19 infections caused multi-organ failure, while nearly half of them did not know (45.5%, P<0.001) (Table 5).

The attitude of university students toward COVID-19 infection

When participants were asked about methods to prevent

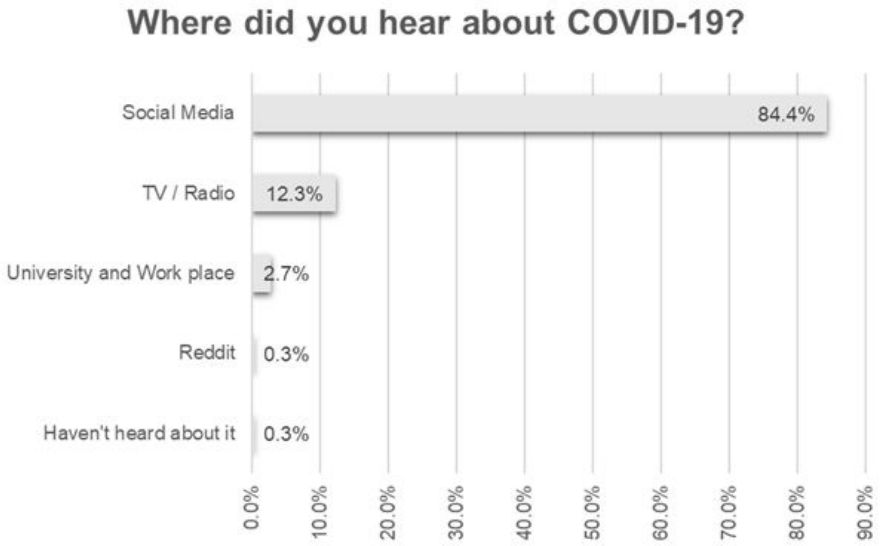

Figure 1: Source of knowledge where student obtained their COVID-19 related information.

Table 2: student awareness about COVID-19 infection.

Have you heard about COVID-19?	Yes	685 (99.0)	P<0 .001
	No	7 (1.0)	
COVID-19 is caused by a virus	Yes	670 (96.8)***	P<0 .001
	No	3 (0.4)***	
	Not sure	19 (2.8)***	
COVID-19 is transmitted by water	Yes	151 (21.8)***	P<0 .001
	No	312 (45.1)***	
	Not sure	229 (33.1)ns	
COVID-19 is transmitted by contacting infected individuals	Yes	664 (96.0)***	P<0 .001
	No	12 (1.7)***	
	Not sure	16 (2.3)***	
COVID-19 is transmitted by air droplet after coughing or sneezing	Yes	631 (91.2)***	P<0 .001
	No	34 (4.9)***	
	Not sure	27 (3.9)***	
The incubation period of COVID-19 is	1-14 days	581 (84.0)***	P<0 .001
	15-30 days	43 (6.2)***	
	Not sure	68 (9.8)***	

Table 3: Student awareness about the clinical symptoms of COVID-19.

Question	Choice	N (%)	χ2 GOF
Clinical symptoms of COVID-19 infection include			
Fever	Yes	675 (97.5) ***	P<0 .001
	No	6 (0.9) ***	
	Not sure	11 (1.6) ***	
Cough	Yes	614 (88.8) ***	P<0 .001
	No	39 (5.6) ***	
	Not sure	39 (5.6) ***	
Dyspnea	Yes	650 (94.0) ***	P<0 .001
	No	10 (1.4) ***	
	Not sure	32 (4.6) ***	
Fatigue	Yes	582 (84.1) ***	P<0 .001
	No	26 (3.8) ***	
	Not sure	84 (12.1) ***	
Myalgia	Yes	392 (56.6) ***	P<0 .001
	No	79 (11.4) ***	
	Not sure	221 (32.0) ns	

Table 4: Student awareness about population at increased risk of COVID-19 infection.

Question	Choice	N (%)	χ2 GOF
Children is at increased risk of COVID-19 infection	Yes	324 (46.8) ***	P<0 .001
	No	228 (33.0) ns	
	Not sure	140 (20.2) ***	
Healthcare workers are at increased risk of COVID-19 infection	Yes	174 (25.1) ***	P<0 .001
	No	363 (52.5) ***	
	Not sure	155 (22.4) ***	
Elder people are at increased risk of COVID-19 infection	Yes	604 (87.3) ***	P<0 .001
	No	9 (1.3) ***	
	Not sure	23 (3.4) ***	
Travelers to affected areas are at increased risk of COVID-19 infection	Yes	660 (95.4) ***	P<0 .001
	No	9 (1.3) ***	
	Not sure	23 (3.3) ***	
People in crowded places are at increased risk of COVID-19 infection	Yes	657 (95.0) ***	P<0 .001
	No	10 (1.4) ***	
	Not sure	25 (3.6) ***	
Patients with chronic diseases are at increased risk of COVID-19 infection	Yes	383 (55.4) ***	P<0 .001
	No	106 (15.3) ***	
	Not sure	203 (29.3) ns	

Table 5: Student awareness about COV0D-19 related complication.

Question	Choice	N (%)	χ2 GOF
One of the complications of COVID-19			
pneumonia	Yes	538 (77.7) ***	P<0 .001
	No	19 (2.8) ***	
	Not sure	135 (19.5) ***	
bronchitis	Yes	423 (61.1) ***	P<0 .001
	No	42 (6.1) ***	
	Not sure	227 (32.8) ns	
difficulty in breathing	Yes	622 (89.9) ***	P<0 .001
	No	10 (1.4) ***	
	Not sure	60 (8.7) ***	
multi-organ failure	Yes	246 (35.6) ns	P<0 .001
	No	131 (18.9) ***	
	Not sure	315 (45.5) ***	

COVID-19 infections, nearly all believed that avoiding crowds is a method to prevent infections (99.1%, P<0.001), washing hands with soap and water or with sanitizers (09.7%, P<0.001), isolation of suspected cases of infections (98.4%, P<0.001), and using respiratory hygiene etiquette (98.0%, P<0.001). Interestingly, most participants believed that avoiding direct contact with live animals would prevent COVID-19 infections (57.8%, P<0.001), as well as avoiding the consumption of raw or undercooked animal products (69.1%, P<0.001).

Table 6: Student attitude toward COVID-19 infection.

Question	Choice	N (%)	χ^2 GOF
Avoid crowded area and close contact with people to prevent COVID-19 infection	Agree	686 (99.1)***	P<0 .001
	Disagree	2 (0.3)***	
	Not sure	4 (0.6)***	
Avoid direct contact with live animals to prevent COVID-19 infection	Agree	400 (57.8)***	P<0 .001
	Disagree	122 (17.6)***	
	Not sure	170 (24.6)***	
Avoid the consumption of raw or undercooked animal products to prevent COVID-19 infection	Agree	478 (69.1)***	P<0 .001
	Disagree	96 (13.9)***	
	Not sure	118 (17.0)***	
Suspected cases should be isolated immediately to prevent spread of COVID-19 infection	Agree	681 (98.4)***	P<0 .001
	Disagree	3 (0.4)***	
	Not sure	8 (1.2)***	
Washing hands with soap and water or with sanitizers is important to prevent COVID-19 infection	Agree	683 (98.7)***	P<0 .001
	Disagree	3 (0.4)***	
	Not sure	6 (0.9)***	
Respiratory hygiene etiquette is important to avoid infection	Agree	678 (98.0)***	P<0 .001
	Disagree	4 (0.6)***	
	Not sure	10 (1.4)***	
No effective treatment available for the infection	Agree	620 (89.6)***	P<0 .001
	Disagree	21 (3.0)***	
	Not sure	51 (7.4)***	

Lastly, 89.6% of the participants believed that there is no effective treatment available to treat COVID-19 infections (89.6% P<0.001) (Table 6).

DISCUSSION

Herein we evaluated the knowledge, awareness and attitude of undergraduate students in Jeddah city toward the 21st century pandemic, COVID-19. Our results indicated that young Saudi adults: 1- Utilized social media as their main source of information.

Had a high level of awareness about the transmission of the SARS-CoV-2 virus, the nature of the COVID-19 infection and the most common symptoms.

Identified most but not all the groups at high risk and the complications of COVID-19 infection.

Knew most methods that can be used to stop transmission of the SARS-CoV-2 virus.

To the researchers' knowledge, this is the only study that focuses on college student knowledge, attitude, and practices (KAP) toward COVID-19, in Makkah region. We choose to focus on this age group because it accounts for 17% of the Saudi population [15]. Data collection took place in February and March 2020. In February 2020, Saudi Arabia started implementing precautionary measures to prevent the SARS-CoV-2 virus spread and to mitigate its impact. Moreover, in March 2020, the first case of COVID-19 infection in KSA was confirmed. Therefore, our findings may assist health authorities to develop preventive strategies for events in the future.

Social media is important for communicating with others locally and worldwide. Herein, we provided evidence for the usage of social media as a source of information during COVID-19 pandemic. Therefore, social media can influence young adults' behaviors and attitudes. The Saudi ministry of health's (MOH) communication strategy during the COVID-19 pandemic involved utilizing social media. At the beginning of 2020, MOH used 1293 tweets to inform the public about COVID-19 [9]. Other studies which focused on university students were from two Jordanian universities; the studies also showed the importance of social media during the COVID-19 pandemic [16,17]. Based on these evidences, we recommend that health and educational authorities should utilize social media to relay important messages during a health crisis.

The main method to control a pandemic is through a high level of vaccination [18,19]. However, vaccine development and distribution would require time [11,19]. In KSA, vaccine distribution began in December 2020, 8 months following the first COVID-19 case in KSA [20]. By March 2021, KSA announced that 70% of its population was vaccinated with 2 doses of the vaccine [20]. Individuals who were worried about picking up the COVID-19 virus were more prone to accept the COVID-19 vaccine in comparison with those who were not worried about catching the infection [21-23]. Therefore, people might reject vaccination if they don't believe they are at risk of infection. Notably, our participants failed to identify some of the populations with a high risk of COVID-19 infection (children, healthcare workers and patients with chronic illness). Therefore, we recommend enhancing awareness about people with a high risk of COVID-19 infection and its complication.

Most of the students correctly answered the questions in the general knowledge of COVID-19. Our results are similar to studies conducted in Qassim Region, Japan and Jordan [16,17,24,25]. Lower knowledge scores were related to less common symptoms, risks

and complications. For example, a low percentage of students recognized myalgia as a symptom and multi-organ failure as a complication. Notably, in Saudi patients with COVID-19, only 29% of the patients had myalgia. Several studies did not report multi-organ failure as a complication of COVID-19 [26-28]. A low percentage of Jordanian students also recognized multiorgan failure as a complication of COVID-19 [17]. Therefore, to enhance knowledge of the population during a pandemic, authorities can also focus on deeper knowledge awareness.

We found that college students were aware of the main precautions taken to prevent COVID-Infection. These were the precaution WHO firstly recommended, such as avoiding contact with people [5,6,29]. Notably, there was confusion about viral transmission through animal and undercooked meat. This might be due to the fact that most of the early cases of COVID-19 reported from the Wuhan district were either workers or had a link to a Huanan market, where wild animals are sold [30,31]. Moreover, in early 2020 Chinese authorities announced the Huanan market to be a potential source of a COVID-19 outbreak. Notably, WHO has provided recommendations to reduce the risk of transmission from animals to humans [29]. The public should be aware that even though, methods of transmission will not be fully understood, and precautions should be taken. Authorities should actively seek out misinformation and responded to rumors.

LIMITATIONS

Further studies are needed to determine the actual adherence of students to COVID-19 precautions. Nevertheless, this study shows that for future outbreaks:

1. Communicating through social media is an effective method to relay important information.

2. University students have excellent knowledge, attitudes, and practices toward COVID-19.

3. Authorities can improve public awareness about minor events such as rare symptoms and mode of transmission. This will help ease confusion and limit the spread of wrong information.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest related to this study.

LIST OF ABBREVIATIONS

COVID-19: Coronavirus Disease 2019

KAPs: Knowledge, Attitude, and Practices

WHO: World Health Organization

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