Introduction

A novel coronavirus infection (now named as “COVID-19”) is an emerging infectious disease that was identified in December 2019 in Wuhan-city, China.[1] The infection has spread rapidly to enter all countries around the worldwide. Fever and dry cough are the most common clinical features of infection. Besides, patients may present with dyspnea, fatigue, and myalgia.[2] The infection might be highly contagious before the development of clinical symptoms and days after the patients become unwell.[3] According to clinical data in China, the case fatality rate of the infection was 2.3%. This is lower than that found in SARS (9.5%), MERS (34.5%), and H7N9 infection (39%).[4]

Assessment of knowledge, attitudes, and practices toward COVID-19 virus among university students in Kurdistan region, Iraq: Online cross-sectional study

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ABSTRACT

Background and Aim: The World Health Organization (WHO) declared the novel coronavirus infection COVID-19 as a pandemic on March 11, 2020. Adherence to infection control measures is potentially influenced by people’s knowledge, attitudes, and practices (KAP) about the infection. This project was performed to assess the KAP toward COVID-19 of university students in Kurdistan Region, Iraq. Materials and Methods: An online cross-sectional study was performed in April 2020 to evaluate KAP about coronavirus infection among university students in Kurdistan Region, Iraq. A total of 1959 students were recruited in this study and ages ranged from 18 to 55 years old. Results: Among the respondents, 55.03% were female, 93.8% were from Duhok province, and the majority of participants (93.4%) were undergraduate students. The overall correct answer rate of the knowledge questions toward COVID-19 was 75.8% with an average score of 9.1 ± 2.1 SD out of 12. Participants showed better knowledge of infection prevention with around 86.2% correct answers, while the lowermost subscale scores were (67.7%) for questions toward the mode of the transmission of the infection. We found a significant difference in knowledge scores across genders, marital status, program of study, and among different colleges/institutes (P < 0.001). The majority of participants agreed that the local authority will control the infection successfully (69.8%) and showed confidence that the battle against the virus will be won by Kurdistan Regional Government (86.7%). The majority of the recruited sample (93.0%) had not been in any area with crowd and 57.3% used facemasks when leaving out, recently. Conclusion: Students demonstrated good knowledge, appropriate practice, and positive attitude about the infection. These findings indicated that local health education plans to improve people’s knowledge about the infection are valuable in protecting the community. The results may be helpful in tailoring an educational program for better containment of the infection and halting the spread of the virus.

Keywords: Attitude, COVID-19, Iraq, knowledge, Kurdistan region, practice, university students
In Kurdistan Regional of Iraq, several unprecedented measures have adapted to control the COVID-19 transmission. These measures include the suspension of public transport; the closure of educational institutions; the prevention of public gatherings and events such as daily and Friday prayers, Church gathering, weddings, and funerals; the isolation of infected people; and the quarantine of suspected cases. Since March 15, 2020, the Kurdistan authorities have locked down the region, and people were required to stay home. Community health prevention program cannot be successful without health education programs which increase the commitment to control measures. Community-based education programs have shown a significant influence that can help to prevent the spread of infections among population.

To assist the management plan of COVID-19 outbreak in Kurdistan region, urgent measures were needed to evaluate the public’s knowledge about the infection at this difficult time. Therefore, the aims of this study were to assess the level of knowledge, attitudes, and practices (KAP) toward COVID19 among university students in Kurdistan region, Iraq during the COVID-19 outbreak and to evaluate the general satisfaction toward the governmental policies for the diseases conflict. The findings of this study are expected to help health authorities to organize the necessary educational programs, and better planning for awareness campaigns in order to provide up-to-date information and deliver the best practice to stop the spread of the virus.

Materials and Methods

Study design
This cross-sectional study was conducted in April 2020 at the University of Zakho, Kurdistan region, Iraq with a total number of 1959 undergraduate and postgraduate students recruited. Participants ages ranged from 18 to 55 years old (mean range: 22.2 ± 4.2 SD). An online questionnaire was sent to students via Facebook and Viber groups in all universities in Kurdistan, Iraq. Such groups were used as a platform for delivering notes and announcements to the students. Inclusion criteria of the study included university students, older than 18 years old, living in Kurdistan Region, Iraq, and agreement to be recruited in the study.

Assessments
A COVID-19 knowledge, attitude, and practice questionnaires were designed by Zhong et al following the original guidelines of the management of coronavirus infection by the National Health Commission of the People’s Republic of China. The survey questionnaire was composed of two parts: Sociodemographics and KAP. Sociodemographic variables included place of current residence (province), gender, age, marital status, university, college, and program of study (undergraduate and postgraduate). Students were recruited from Duhok, Sulaymaniyah, and Erbil provinces.

The original questionnaire consists of 12 knowledge questions as shown in Table 1; 4 questions (K1-K4) about clinical manifestations, 3 questions (K5-K7) about the ways of transmission, and 5 questions (K8-K12) about preventive measures that help controlling the outbreak. All these questions were answered based on TRUE/FALSE with an additional option of “I do not know.” One point was assigned for a correct answer and zero point was assigned for an incorrect/I do not know answer. The total score of knowledge ranged from 0 to 12, with higher scores indicating a higher level of knowledge toward COVID-19 disease.

Attitudes of students about coronavirus infection were assessed by two questions (A1-A2) [Table 1]. The assessment of students’ practices comprised two questions (P1-P2) [Table 1].

Ethics approval
The study protocol, methods of taking consent, and format of informed consent were approved by the Ethics and Scientific Committee of the college of Medicine, University of Zakho. Consent was obtained from all participants 02.05.2020.

Statistical analysis
To study the significant differences between the different mean level of knowledge scores, attitudes, and practices of different subjects among students according to demographic characteristics, one-way analysis of variance (ANOVA), Independent samples t-test or Chi-square and Fisher exact test were used as appropriate. P value of 0.05 or less was considered statistically significant. The GraphPad Prism Version 8 software was used for statistical analysis.

Results
The average age of participants was 22.2 years [standard deviation (SD): 4.2, range: 18–55]. About 1078 (55.03%) were female and 1837 (93.8%) were from Duhok province [Table 2].

Among all participants, the correct answer rates of the 12 questions on the knowledge toward COVID-19 questionnaire were between 45.3% and 95% [Table 1]. Overall, the mean knowledge score of the participants about COVID-19 was 9.1 ± 2.1 (range of score: 2–12). Knowledge scores significantly differed across genders, marital status, program of study, and among different colleges/institutes (P < 0.001) [Table 2]. The overall percentage of COVID-19 knowledge among students was 75.8% [Table 3]. Students showed better knowledge toward infection prevention with 86.2% correct answers, while the lowermost subscale scores were for the mode of transmission of the infection (67.7%) [Table 3].

In terms of attitude, it was found that the majority of participants agreed that the authority will be successful in controlling the infection (69.8%) [Table 4]. The attitude of participants about the final success in controlling the infection was different significantly between genders (P < 0.001) [Table 5]. In addition, respondents stating “disagree” and “I don’t know” about
controlling the infection scored significantly lower knowledge scores than those stating “agree” ($P < 0.001$) [Table 5]. The majority of the respondents (86.7%) were confident the battle against the infection will be won by the government. The attitude toward confidence of winning significantly differed between genders ($P < 0.002$) and marital status ($P < 0.05$) [Table 5]. In addition, the COVID-19 knowledge scores were significantly lower in people without than those with the confidence of winning ($P < 0.001$) [Table 5].

Then, infection prevention practices were assessed. The majority of the participants (93.0%) did not visit any crowded area and around 57.3% of respondents wore masks when leaving home in recent days [Table 4]. The rates of these two practices among participants toward COVID-19 infection significantly differed across categories of gender, marital status, and college/institute of study ($P < 0.001$) [Table 6]. Furthermore, people who visited crowded place scored significantly lower knowledge score than those who did not visit ($P < 0.001$) [Table 6]. There were no

### Table 1: Questionnaire of knowledge, attitudes, and practice toward COVID-19 among students from universities

| Questions                                                | Option       |
|-----------------------------------------------------------|--------------|
| Knowledge toward COVID-19 (correct rate, % of total subjects) |              |
| K1. The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia (84.8%) | TRUE FALSE I don’t know |
| K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus (49.9%) | TRUE FALSE I don’t know |
| K3. There is currently no effective cure for COVID-19, but early symptomatic and supportive treatment can help most patients recover from the infection (78.9%) | TRUE FALSE I don’t know |
| K4. Not all persons with COVID-19 will develop to severe cases. Only those who are elderly, have chronic illnesses, and are obese are more likely to be severe cases (61.8%) | TRUE FALSE I don’t know |
| K5. Eating or contacting wild animals would result in the infection by the COVID-19 virus (45.3%) | TRUE FALSE I don’t know |
| K6. Persons with COVID-2019 cannot infect the virus to others when a fever is not present (78.6%) | TRUE FALSE I don’t know |
| K7. The COVID-19 virus spreads via respiratory droplets of infected individuals (78.6%) | TRUE FALSE I don’t know |
| K8. Ordinary residents can wear general medical masks to prevent the infection by the COVID-19 virus (66.9%) | TRUE FALSE I don’t know |
| K9. It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus (80.2%) | TRUE FALSE I don’t know |
| K10. To prevent the infection by COVID-19, individuals should avoid going to crowded places such as train stations and avoid taking public transportations (95.0%) | TRUE FALSE I don’t know |
| K11. Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus (94.2%) | TRUE FALSE I don’t know |
| K12. People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days (94.6%) | TRUE FALSE I don’t know |

Attitudes toward COVID-19

A1. Do you agree that COVID-19 will finally be successfully controlled? | Agree Disagree I don’t know |
| A2. Do you have confidence that Kurdistan can win the battle against the COVID-19 virus? | YES NO |

Practices toward COVID-19

P1. Have you visited any crowded place in recent days? | YES NO |
| P2. Have you worn a mask when leaving home in recent days? | YES NO |

### Table 2: Participants demographic characteristics and knowledge score of COVID-19 by demographic variable

| Variables            | No. of participants (%) | Knowledge score (mean±SD) | $P$  |
|----------------------|-------------------------|---------------------------|------|
| Gender               |                         |                           |      |
| Male                 | 881 (44.97)             | 8.93±2.2                  | $<0.001$ |
| Female               | 1078 (55.03)            | 9.2±2.0                   |      |
| Province             |                         |                           |      |
| Duhok                | 1837 (93.8)             | 9.09±2.1                  | $<0.001$ |
| Sulaymaniyah         | 82 (4.2)                | 9.1±2.1                   |      |
| Erbil                | 40 (2.0)                | 9.03±2.7                  |      |
| Marital Status       |                         |                           |      |
| Single               | 1775 (90.6)             | 9.1±2.1                   | $<0.001$ |
| Married              | 184 (9.4)               | 8.7±2.5                   |      |
| Program of Study     |                         |                           |      |
| Undergraduate        | 1829 (93.4)             | 9.1±2.1                   | $<0.001$ |
| Postgraduate         | 130 (6.6)               | 9.3±2.4                   |      |
| College/Institute    |                         |                           |      |
| Medical              | 474 (24.2)              | 10.01±1.4                 | $<0.001$ |
| Sciences             | 618 (31.6)              | 9.2±2.1                   |      |
| Humanities           | 504 (25.7)              | 8.5±2.3                   |      |
| Engineering          | 128 (6.5)               | 9.1±2.2                   |      |
| Social Sciences      | 235 (12)                | 8.3±2.3                   |      |
significant differences in the knowledge score between people who were wearing a mask outside than those who were not [Table 6].

**Discussion**

To the best of our knowledge, this is the first survey conducted in Iraq investigating the KAP toward COVID-19 among university students. This study found an overall correct rate of 75.8% of the knowledge questions among university students indicating that most students in Kurdistan Region, Iraq were knowledgeable about COVID-19 disease. This study showed that the knowledge scores of females, not married, and medical students and those who had higher education were significantly higher than others. In a study carried out in Iran during the epidemic of COVID-19, where 8591 people participated, an overall correct rate of 90% on the knowledge questions among Iranian population was recorded.[13] Our findings are in agreement with the results obtained from the study on COVID-19 in China which showed that the majority of participants had good knowledge about the main clinical symptoms, treatment and vaccine unavailability, and methods of prevention and control of COVID-19.[11,14,15]

In addition, our findings regarding the differences in responses according to age, gender, marital status, and program of study related to KAP concerning COVID-19 were greatly similar to previous KAP studies conducted in China.[13]

The present study showed that the overall knowledge score about the clinical manifestation and transmission routes of diseases was 68.8% and 67.7%, respectively. Around, 86% of participants had better knowledge about the prevention and control measures of COVID-19 virus. The high knowledge of recruited samples could be explained by various factors such as the seriousness of the disease and the effectiveness of different education programs in the region. In addition, good knowledge reflects a good relationship between their deep understanding and the information available about COVID-19 virus in the literature and social media.

It is important to notice that higher knowledge scores toward COVID-19 were associated significantly with a higher likelihood of positive attitude. These results clearly suggest the importance of students’ knowledge improvement that may lead to improving
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Our findings

119 (6.5)
P2: Wearing a mask

P570 (92.2)
479 (54.4)
57 (69.5)

[16,17]

124 (6.8)
P

66 (80.5)

[5]

<0.68
9 (22.5)
69 (53.1)
402 (45.6)

In addition, the present study found

167 (90.8)
783 (88.9)
P

294 (62.0)
P

<0.001
<0.009
180 (38)
1054 (57.6)
<0.87
759 (42.8)
77 (41.8)
13 (5.5)
357 (33.1)
1016 (57.2)
2 (5)
1032 (56.3)
9.0 (2.1)
P

<0.22
9 (7.0)
Male

31 (77.5)

[11]

Single

775 (42.4)
117 (90)
P

60 (46.9)
232 (46.0)
25 (30.5)
119 (93.0)
248 (40.1)
<P<0.001
<P<0.001

in agreement
with these
data as

We would like to thank all the respondents recruited in this

their attitudes and practice toward COVID-19. Furthermore, it
is worthy of note that there was no significant difference among
Duhok, Sulaymaniyah, and Erbil provinces in terms of knowledge
and attitude among students. This is expected because the infection
outbreak is widely covered by local and international media.

About 69.6% of participants had the belief that the outbreak
will eventually be successfully controlled, and 86.7% were
certain that Kurdistan Region can win the battle against
the COVID-19 virus and this significantly differed according to
gender and marital status. The optimistic attitude of students in
Kurdistan region attributed to the unprecedented COVID-19
control measures to stop the spread of infection by the regional
government in Kurdistan. Such measures included the
shutdown of cities, closure of educational institutions, shopping
mall, workplaces, and roads. In addition, the present study found
that higher knowledge score about the infection was significantly
associated with a higher likelihood of positive attitude and
good practice during the period of COVID-19 outbreak. The
practices of university students toward the virus were extremely
cautious as the majority of the recruited sample (93%) avoided
crowded places and more than a half of participants (57.3%)
wore masks when going out the home during the period of the
outbreak. This could be due to the result of the good knowledge
and practice among participants. A similar study carried out in
China and showed that 96.4% of the recruited sample avoided
crowded places and 98.0% wore masks upon departing their
homes during the outbreak of COVID-19. Several studies
suggested that age and gender may influence the pattern of risky
behaviors. Our findings are in agreement with these data as
we showed a significant association between male gender and
potentially unhealthy practices towards the infection prevention
is much better.

The strengths of the present study were the relatively large and
diverse sample, and the early stage of the COVID-19 outbreak.

Conclusion

The overall correct answer rate of the knowledge questions
toward COVID-19 was 75.8%. Students showed better
knowledge of infection prevention rather than the mode of
the transmission. This study showed that the knowledge scores
of females, not married, and medical students and those who
had higher education were significantly higher than others. The
majority of participants were confident that the local authority
will control the infection successfully and will win the battle,
eventually. The majority of the recruited sample avoided attitudes
that increase the risk of infection such as avoiding crowded
area. Furthermore, a good COVID-19 knowledge score was
associated with positive attitudes and appropriate practices about
COVID-19. The results of this study may be utilized as a baseline
for planning awareness campaigns in the future.

Acknowledgments

We would like to thank all the respondents recruited in this

Table 6: Practices toward COVID‑19 by demographic variables among students from universities

| Variable | Practice toward COVID‑19 by demographic variables among students from universities |
|----------|-------------------------------------------------------------------------------------|
|          | P1: Visiting to a crowded place | P2: Wearing a mask |
|          | Yes | No | P | Yes | No | P |
| Gender   | Male | 98 (11.1) | 783 (88.9) | 402 (45.6) | 479 (54.4) | P<0.001 |
|          | Female | 39 (3.6) | 1039 (96.4) | 721 (66.9) | 357 (33.1) | P<0.001 |
| Province | Duhok | 119 (6.5) | 1718 (93.5) | 1032 (56.3) | 802 (43.7) | P<0.001 |
|          | Sulaymaniyah | 16 (19.5) | 66 (80.5) | 57 (69.5) | 25 (30.5) | P<0.001 |
|          | Erbil | 2 (5) | 38 (95) | 31 (77.5) | 9 (22.5) | P<0.001 |
| Marital Status | Single | 120 (6.8) | 1655 (93.2) | 1016 (57.2) | 759 (42.8) | P<0.087 |
|          | Married | 17 (9.2) | 167 (90.8) | 107 (58.2) | 77 (41.8) | P<0.31 |
| Program of Study | Undergraduate | 124 (6.8) | 1705 (93.2) | 1054 (57.6) | 775 (42.4) | P<0.009 |
|          | Postgraduate | 13 (10) | 117 (90) | 69 (53.1) | 61 (46.9) | P<0.001 |
| College/Institute | Medical | 32 (6.8) | 442 (93.2) | 294 (62.0) | 180 (38) | P<0.001 |
|          | Sciences | 48 (7.8) | 570 (92.2) | 370 (59.9) | 248 (40.1) | P<0.001 |
|          | Humanity | 35 (6.9) | 469 (93.1) | 272 (54.0) | 232 (46.0) | P<0.001 |
|          | Engineering | 9 (7.0) | 119 (93.0) | 68 (53.1) | 60 (46.9) | P<0.001 |
|          | Social Sciences | 13 (5.5) | 222 (94.5) | 119 (50.6) | 116 (49.4) | P<0.001 |
| COVID-19 Knowledge score | 8.7 (2.2) | 9.1 (2.1) | P<0.001 | 9.1 (2.1) | 9.0 (2.1) | P<0.001 |
project for their voluntary cooperation and support and for providing essential information.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.

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