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Knowledge, Attitudes, and Practices Toward COVID-19 Among Medical Sciences Students in Iraq: A Cross-Sectional Study with Age, Gender, and College Comparisons

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Abstract: COVID-19 has affected many countries around the world. Medical science students are the future public health staff who can provide the citizens with correct virological information. The study aimed to assess private medical sciences students' knowledge, attitude, and practice (KAP) regarding COVID-19 and to draw conclusions about their competence as community counselors regarding the pandemic. An online pre-tested questionnaire includes the study variables on: student demographics (5), COVID-19 information sources, student knowledge, attitudes, and practices. Descriptive and inferential statistics of students' KAPs and demographic characteristics were studied. A p-value of $p \leq 0.05$ was considered significant. Of the 383 participants, 53.5% were male, more than half were 20-25 years old, while a proportion of nursing students were over 25 years old. 66.8% of the students were not vaccinated. A total of 50.4% were infected. 51.7% got their information about the virus from a variety of sources, mostly the Internet, and rarely from scientific or official sources. Students from different faculties showed sufficient knowledge and good practices, although their attitudes were average and did not differ significantly among the groups ($p > 0.05$). The students' knowledge and practices were adequate and varied significantly with their demographic characteristics. Their attitudes were average and not statistically different. Older nursing students (25 years and over) were more knowledgeable and better practiced. Students should rely on scientific and official sources to improve their KAPs and become competent COVID-19 advisors. The low rates of positive attitudes could be attributed to students' beliefs and social habits.

Keywords: Attitude, COVID-19, knowledge, medical science students, Nasiriyah, Pandemic

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INTRODUCTION

The beginning of the spread of COVID-19 was first discovered in the Chinese urban area of Wuhan on December 31, 2019. Since the first report, the infectious virus has spread rapidly throughout the world as clusters of fatal respiratory symptoms **[1]**. The World Health Organization (WHO) has classified the virus as Coronavirus 2' (SARS-CoV-2) and infection as COVID-19 on February 11, 2020 [2].

On March 11, 2020, the World Health Organization declared the outbreak of COVID-19 a global pandemic **[3]**. During that time period, official statistics from 114 countries documented at least 118,000 cases of Covid-19 and up to 4,291 deaths **[4].**

Based on the latest WHO COVID-19 dashboard, global reporting indicates that covering the 28day period from 29December2025 through 25January2026, a total of 43,501 new confirmed COVID-19 cases have been reported byMember States in 63 countries and there were also reports of1461 new deaths from39countries. The numbers represent the ongoing SARS-CoV-2 transmission where testing and reporting may have decreased in some areas, potentiallyimpacting the completeness of the data. WHO emphasizes that these statistics reflect only reported data and may not represent the full global burden due to changes in surveillance practices and reporting frequency **[5]**? During the spread of the epidemic, the Iraqi Ministry of Health reported the first confirmed cases of coronavirus in the holy city of Najaf on February 24, 2020. Since then, the number of confirmed cases has increased across the country, including Baghdad, Erbil, Basra, Sulaymaniyah, Nasiriyah and Kirkuk, Diyala, Karbala, Babil, and Muthanna **[6].**

Symptoms of COVID-19 were similar to those of other coronaviruses, such as dry cough, fever, shortness of breath, and irregular bilateral consolidation on chest CT scan **[7]**. About two-thirds of infected cases had mild symptoms and recovered without medication; However, serious complications, including dyspnea, septic shock, and multiorgan failure, have been reported [3]. Older adults and people with respiratory diseases, circulatory problems, and diabetes are more likely to get severe COVID-19 infections **[3]**. Up to 80% of deaths related to COVID-19 have occurred among people over 65 years of age **[8]**.

The Iraqi Ministry of Health implemented security measures to limit the spread of the virus among the population. Lockdown measures include closing centers of social activity such as religious centers, schools, and universities, as well as other public gatherings. Furthermore, the authorities banned air travel between Iraq and other affected countries and restricted transit between Governorates **[9-11]**.

To prevent the spread of the virus, it is important to educate individuals with reliable information and relevant knowledge in ways that promote positive attitudes and good practices. The majority of people's lack of information, understanding, and perspectives on the pandemic may play an important role in public acceptance of preventive measures. This can be achieved by providing them with reliable information and advice so that they can obtain the necessary knowledge, change their mindset, and establish best practices to combat the growing threat of infection **[12]**.

Unfortunately, many sources of information, especially electronic and social media, may transmit false or illegal material, misleading the public and making them more vulnerable to infection. For instance, some limited laboratories and clinical studies have claimed that hydroxychloroquine, chloroquine, azithromycin, and redeliver have potential effects in reducing symptoms of COVID-19 infection **[12-15]**, yet, curative treatment for the virus has not yet been developed. So far, supportive medical intervention and vaccination are the only means available to control the infection. Fortunately, versions of the COVID-19 vaccine have been widely available and used as a preventative worldwide **[16, 17]**.

Medical science students are the future workforce who are willing to share responsibility for the Iraqi healthcare sector and are seen as a critical component in responding to COVID-19 concerns and advising their families and communities on the nature of the virus and how to prevent its prevalence **[18, 19]**. Previous research has suggested that the assessment of healthcare professionals and the general public's knowledge, attitudes, and practices about infection may help reduce the adverse effects of MERS and SARS **[20]**.

Due to the paucity of information available about the knowledge and perceptions of Covid-19 for medical students of different specialization, it was decided to examine the validity of their sources of information as well as to assess their knowledge as well as their attitudes and practices in relation to the pandemic.

Our participants were students from the National University of Science and Technology (located in Nasiriyah city, Thi-Qar Governorate, southern Iraq) and majored in pharmacy, dentistry, and nursing. The results of the study could contribute to students' desire to increase trust in the community and provide advice on how to limit the spread of the virus.

MATERIALS AND METHODS

Study design and procedure

A prospective university in Nasiriyah based cross-sectional study was conducted using self-administered Google form questionnaires via student emails to assess medical science students' knowledge, attitudes, and practices (KAPs) during the increasing spread of COVID-19. The research was conducted from May 1 to July 5, 2021.

Study participants and sampling

Students of medical sciences (pharmacy, dentistry, and nursing) were enrolled from the National University of Science and Technology (NUST), “a private university in Nasiriyah, Thi-Qar Governorate, Southern Iraq”.

Study instrument and sampling

The survey questionnaire was developed using previously available materials with minor modifications [11]. Questionnaire validity was tested on 383 students, and their responses were analyzed using Cronbach’s alpha reliability [21], which indicated a value of 0.79. The items in the questionnaire were provided in both English and Arabic in five divided sections.

The first section (Table 1) examined the students' demographics (gender, age, college, Covid-19 infection, and vaccination). The second section (Table 2) dealt with information sources about the pandemic. The third section (Table 3) contains 18 three-point Likert scales of knowledge statements (K1-K18)**[22]**, with the following values: disagree = 1, not sure = 2, and agree = 3.

The fourth section (Table 4) addressed participants' attitudes toward the infection, which included seven items (A1-A7) with responses No = 1, Not Sure = 2, and Yes = 3.

The fifth section (Table 5) consists of eight practical affirmations (P1-P8) with the ranked answers No = 1, Sometimes = 2, and Yes = 3. The responses indicate positive and negative practices among the participants.

Ethical aspects

After obtaining the necessary ethical permission from the National University of Sciences and Technology Review Board, the survey was conducted online using a Google Form and sent to the students via email.

Data analysis

The survey data were collected in Microsoft Excel before being imported into SPSS version 26. Categorical variables were computed as frequency and percentages, and Continuous variables were expressed as mean ± standard deviation. A t-test and One-Way ANOVA were used to compute the interrelations of KAPs and students' demographics. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

Questionnaires were distributed to 383 participants, depending on the number of students registered for the academic year 2020-2021 (150 students from the faculties of pharmacy, dentistry, and nursing). A total of 383 people (85%) gave complete and valid responses.

Socio-demographic characteristics

Descriptive statistics of the study participants are presented in Table 1. The faculties of dentistry (39.7%) and nursing (38.1%) had the highest proportion of participants, followed by pharmacy (22.2%). More than half of the students (57.4%) were aged 20-25, compared to 17.8% of students aged 20 and younger. A large proportion of participants (24.8%) were between 25 and 30 years old, some of them older. 17.0% of participants and 11.5% from their families were vaccinated. The virus infected 30.8% of students and 49.6% of their families. Almost half of the respondents (49.6%) denied being infected. All variables were significantly different within the groups (P < 0.001).

TABLE(1)Student socio-demographic Characteristics (n = 383)

Characteristics	Variable	Number (%)	Sig (2-tailed)
Gender	**Female**	**178 (46.5)**	**< 0.001**
	Male	**205 (53.5)**	
Age	**< 20 years**	**68 (17.8)**	
	20-25 years	**220 (57.4)**	
	26-30 years	**45 (11.7)**	
	30 years	**50 (13.1)**	
College	**Pharmacy**	**85 (22.2)**	
	Dentistry	**152 (39.7)**	
	Nursing	**146 (38.1)**	
Infection with Covid-19	**Only me**	**118 (30.8)**	
	Relative	**75 (9.6)**	
	Both	**190 (49.6)**	
	Never	**0 (00.0)**	
Vaccination	**I'm vaccinated**	**65 (17)**	
	Close relative vaccinated	**44 (11.5)**	
	Both me and close relative	**18 (4.7)**	
	Never vaccinated	**256 (66.8)**	

Sources of Covid-19 information

Table 2 and Figure 1 revealed significant differences ($p < 0.001$) in the Covid-19 information sources. The majority of respondents (51.7%) got their information from more than one of the listed sources. Up to 32.1% use the Internet and electronic search engines. Only 8.6% received their information through television, newspapers and posters, 7.6% obtained their information through books, scientific seminars and workshops, or learned about the virus through their studies. Hardly any of the participants considered the Ministry of Health "MOH's" short mobile massage to be a reliable source of information (0.0%).

TABLE (2): Distribution of the studied sample with respect to Covid-19 information sources (n = 383)

Source of information	Number of Participants (n)	Percentages (%)	Sig (p)
Internet, social electronic search engines	**123**	**32.1**	**< 0.001**
Books and research articles	**11**	**2.9**	
Seminars and workshop	**15**	**3.9**	
Television, newspapers & posters	**33**	**8.6**	
As subject in my study courses	**3**	**0.8**	
More than one source	**198**	**51.7**	

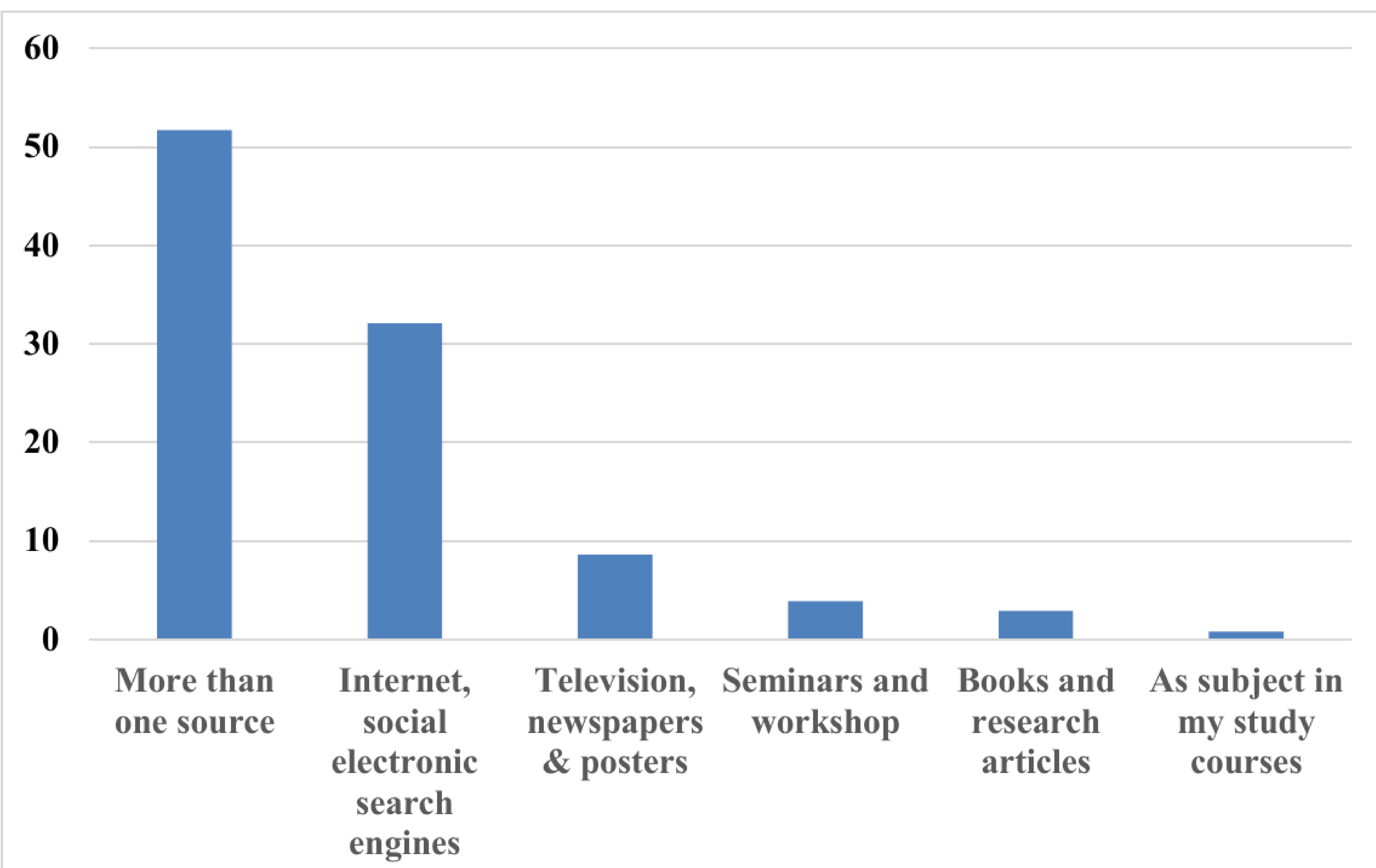

Figure 1. Percentage of students who got information from several sources

Knowledge responses

Table 3 shows the participants' responses to the knowledge statements. The mean score for each eligible item ranged from "2.30 ± 0.856" to "2.92 ± 0.300", with a mean score of "2.620 ± 0.217" for the total statements. The average adequate response rate was 299 (78.0%), and the average inadequate response rate was 84 (22.0%). The majority of students had substantial knowledge regarding infection و mortality, transmission, preventive measures, clinical manifestations, and complications. Older age, incubation period, WHO updates, and use of antibiotics to treat infections.

The most controversial epistemological data was "Covid-19 is a man-made pandemic virus", with only 19.1% opposed (adequate response), while the rest (81.0%) agreed or were unsure (inadequate response), "Covid-19 is caused by SARS CoV-2 virus, (only 31.6% agreed (appropriate answer) while a total of 68.4% were uncertain or disagreed (inappropriate answer), "Polymerase chain reaction (RT-PCR)" Covid-19 can be used to diagnose Covid-19, With 40.7% correct compared to 59.3% incorrect (wrong answer), "The spread of infection may be reached during any type of group activities," With 59.0% correct, Washing hands with soap and water is more effective than alcohol sanitizers for reducing the spread of Coved-19 in reducing the spread of Covid-9 with 55% correct.

TABLE 3: Participants' responses to Covid-19 knowledge statements (n = 383)

Statement	Disagree (%)	Not sure n (%)	Agree (%)	Adequate answer n (%)	Inadequate answer n (%)	Mean ± SD
K1. COVID-19 is transmitted through respiratory droplets and contact with infected people	3 (0.8)	25(6.5)	355 (92.7)	355 (92.7)	28 (7.3)	2.92 (0.300)
K2. COVID-19 is a deadly disease	27 (7.0)	70(18.3)	286 (74.7)	286 (74.7)	97 (25.3)	2.68 (0.601)
K3. Symptoms of COVID-19 are similar to those of seasonal flu (Influenzas).	31 (8.1)	28 (7.3)	324 (84.6)	324 (84.6)	59 (15.4)	2.77 (0.585)
K4. WHO updates on Covid-19 have increased public awareness of the virus.	16 (4.2)	28 (7.3)	339 (88.5)	339 (88.5)	44 (11.5)	2.84 (0.465)
K5. No specific drug treatment available for COVID-19	40 (10.4)	69(18.0)	274 (71.6)	274 (71.6)	109 (28.5)	2.61 (0.669)

K6 Vaccine products for COVID-19 are available	21 (5.5)	70(18.3)	292 (76.2)	292 (76.2)	91(23.8)	2.71 (0.563)
K7. Washing hands with soap and water is more effective than alcohol sanitizers for reducing the spread of Coved-19	100 (26.1)	69(18.0)	214 (55.9)	214 (55.9)	169 (44.1)	2.30 (0.856)
K8. Headache, fever, cough, shortness of breath, sore throat, and flu are common symptoms of COVID-19	6 (1.6)	21(5.5)	356 (93.0)	356 (93.0)	27 (7.0)	2.91 (0.332)
K9. The virus can infect a person more than once	12 (3.1)	34 (8.9)	337 (88.0)	337 (88.0)	46 (12.0)	2.85 (0.438)
K10. Two weeks is the time required to recover from COVID-19 and able to mingle with others	79 (20.6)	72(18.8)	232 (60.6)	232 (60.6)	151 (39.4)	2.40 (0.809)
K11. The period between exposure to infection and appearance symptoms of the virus ranges from 2-14 days. .	15 (3.9)	35 (9.1)	333 (86.9)	333 (86.9)	50 (13.0)	2.83 (0.469)
K12. Older adults and people with chronic illnesses are more likely to get infected with COVID-19	21 (5.5)	26 (6.8)	336 (87.7)	336 (87.7)	47 (12.3)	2.82 (0.506)
K13. Antibiotics are not used as the first line treatment of Covid-19	28 (7.3)	49 (12.8)	306 (79.9)	306 (79.9)	77 (20.1)	2.73 (0.588)

K14. Covid-19 is caused by SARS CoV-2 virus	**80 (20.9)**	**182 (47.5)**	**121 (31.6)**	**121 (31.6)**	**262 (68.4)**	**2.11 (0.717)**
K15. Polymerase chain reaction (RT-PCR) is used to diagnose Covid-19	36 (9.4)	191 (49.9)	156 (40.7)	156 (40.7)	197 (59.3)	2.31 (0.636)
K16. Covid-19 vaccines are available in government hospitals	36 (9.4)	61 (15.9)	286 (74.7)	286 (74.7)	97 (25.3)	2.65 (0.645)
K17. Covid-19 is a man-made pandemic virus	73 (19.1)	129 (33.7)	181 (47.3)	73 (19.1)	310 (81.0)	2.28 (0.765)
K18. The spread of infection may be reached during any type of group activities,	53 (13.8)	104 (27.2)	226(59.0)	226(59.0)	157 (41.0)	2.45 (0.725)
Mean ± SD of total knowledge scores				= (2.620 ± 0.217)		
Average percentage of adequate answers				=276 (72.1)		
Average percentage of inadequate answers				= 107 (27.9)		

Attitude responses

Table 4 presents attitude scores with their means ± SD. The mean ± SD of overall attitude scores (2.251 ± 0.402), as well as the corresponding rates for positive and negative answers, are presented in the last row of the table. The means and standard deviations of the positive attitudes range from "2.56 ± 0.680" to "2.86 ± 0.437".

Participants reacted negatively to the question, "If you are diagnosed with COVID-19 infection, do you accept isolation in a health facility rather than home isolation?" at (1.870 ± 0.929), and "Do you think the health measures taken by the Iraqi Ministry of Health regarding the protection of COVID-19 are appropriate and effective? at (1.75 ± 0.898).

TABLE 4: Participants' attitudes toward COVID-19 (n = 383)

Statement	Not sure (%)	No (%)	Yes (%)	Positive n (%)	Negative n (%)	Mean ± SD
1. "do you think you are at risk of infection if you do not follow the preventive measures?"	**41 (10.7)**	**37 (9.7)**	**305 (79,6)**	**305 (79.6)**	**78 (20.4)**	**2.70 (0.636)**

2. Are you concerned if you or any of your close relatives have contracted COVID-19?	**14 (3.7)**	**100 (26.1)**	**269 (70.2)**	**269 (70.2)**	**114 (29.8)**	**2.44 (0.878)**
3. If you are diagnosed with Covid-19 infection, do you accept isolation in a health facility instead of home isolation?	**47 (12.3)**	**193 (50.4)**	**143 (37.3)**	**143 (37.3)**	**240 (62.7)**	**1.87 (0.929)**
4. Do you think you will not get an infection after taking the vaccine?	**72 (18.8)**	**79 (20.6)**	**232 (60.6)**	**232 (60.6)**	**151 (39.4)**	**2.40 (0.809)**
5. Do you expect that COVID-19 can be successfully controlled	**96 (25.1)**	**105 (27.4)**	**182 (47.5)**	**182 (47.5)**	**201 (52.5)**	**2.20 (0.843)**
6. Do you think the lockdown will improve the situation?	**60 (15.7)**	**85 (22.2)**	**238 (62.1)**	**238 (62.1)**	**145 (37.9)**	**2.40 (8.28)**
7. Are the preventive measures of the Iraqi Ministry of Health sufficient?	**51 (13.3)**	**214 (55.9)**	**118 (30.8)**	**118 (30.8)**	**265 (69.2)**	**1.75 (0.898)**
Average mean ± SD of total Attitude scores = 2.251 (0.402) % Positive attitude = 212 (55.4%) % Negative Attitude = 171 (44.6%)						

Practice responses

Table 5 shows the mean score for each item in the practice section, which ranged from "2.59 ± 0.68" to "2.86 ± 0.439", with a mean of "2.672 ± 0.406" for the total items. The table also presents the total number of participants who demonstrated good and poor practices, with rates of 290 (75.8%) and 93 (24.2%), respectively.

Table 5: Participants' practice response to COVID-19 (n = 383)

Statement	Sometimes (%)	No (%)	Yes (%)	Good n(%)	Poor n (%)	Mean ± SD
I avoid social and political protests through demonstrations and street camping since the outbreak of the pandemic.	**62 (16.2)**	**46 (12.8)**	**275 (71.8)**	**275 (71.8)**	**108 (29)**	**2.60 (0.694)**
I Keep myself at home during the lockdown	**58 (15.1)**	**41 (10.7)**	**284 (74.2)**	**284 (74.2)**	**99 (25.8)**	**2.63 (0.669)**
I use a face mask and alcohol sanitizer when I'm out and about.	**77 (20.1)**	**42 (11.0)**	**264 (68.9)**	**264 (68,9)**	**119 (31.1)**	**2.58 (0.681)**
I maintain social distancing between myself and others	**88 (23.0)**	**41 (10.7)**	**254 (66.3)**	**254 (66.3)**	**129 (33.7)**	**2.56 (0.680)**

I avoid touching my eyes and nose before sterilizing or washing my hands with soap and water.	**74 (19.3)**	**42 (11.0)**	**267 (69.7)**	**267 (69.7)**	**116 (30.3)**	**2.59 (0.680)**
Use disposable tissues to avoid spreading respiratory droplets when coughing or sneezing	**29 (7.6)**	**13 (3.4)**	**341 (89.0)**	**341 (89.0)**	**42 (21.0))**	**2.86 (0.437)**
I avoid touching flat surfaces and hospital objects when I am there	**41 (10.7)**	**14 (3.7)**	**328 (85.6)**	**328 (85.6)**	**55 (14.4)**	**2.82 (0.471)**
I wash my hands and face often with soap and water when exposed to people for a long time	**49 (12.8)**	**24 (6.3)**	**310 (80.9)**	**310 (80.9)**	**73 (19.1)**	**2.75 (0.561)**
Mean ± SD of total practice scores Percentage of good practice Percentage of poor practice	= 2.672 (0.406) = 290 (75.8) = 93 (24.2)					

Correlation between the socio-demographic characteristics and average means of knowledge, attitude, and practice.

The correlation of students' demographic characteristics and their mean knowledge, attitude, and practice are presented in Table 6. A significant difference in students' gender was observed showing that females were more knowledgeable (t = 3.54; P < 0.01) and had better practice (t = 3.509; P < 0.01) Compared to the male group, however, there was no statistical difference in their attitudes (t = 1.157; p = 0.248). On the other hand, there was no significant difference with respect to student age for both mean knowledge (F = 1.53; p = 0.205) and average attitude (F = 0.60; p = 0.615) but the result was significantly different with mean Average practice (F = 3.74; P < 0.01). Regarding college type, all KAPs were not significantly different among the three colleges at "F = 0.159; h = 0.853";" F = 0.750; h = 0.473"; and "F = 0.181; h = 0.835" respectively.

Table 6: Correlation between the students' socio-demographic characteristics and their average means of knowledge, attitude, and practice (n = 383)

Participants Characteristics	Frequency (%)	Average mean of Knowledge Mean ± SD	Average mean of Attitude Mean ± SD	Average mean of Practice Mean ± SD
GENDER: Male Female	 **205 (53.5)** **178 (46.5)**	 **2.584 ± 0.241** **2.662 ± 0.177**	 **2.229 ± 0.406** **2.277 ± 0.396**	 **2.605 ± 0.456** **2.749 ± 0.323**
Significance*		**t =3.54** **p < 0.001**	**t =1.157** **p = 0.248**	**t = 3.509** **p < 0.001**
AGE (Years): < 20	 **68 (17.8)**	 **2.596 ± 0.237**	 **2.288 ± 0.369**	 **2.645 ± 0.406**

20-25	**220 (57.4)**	**2.619 ± 0.202**	**2.236 ± 0.406**	**2.672 ± 0.389**
25-30	**45 (11.7)**	**2.601 ± 0.236**	**2.219 ± 0.425**	**2.550 ± 0.534**
➢ 30	**50 (13.1)**	**2.676 ± 0.231**	**2.297 ± 0.408**	**2.820 ± 0.294**
Significance**		**F = 1.53** **p = 0.205**	**F = 0.60** **p = 0.615**	**F = 3.74** **p < 0.011**
COLLEGE:				**3**
Pharmacy	**85 (22.2)**	**2.632 ± 0.214**	**2.279 ± 0.367**	**2.685 ± 0.391**
Dentistry	**152 (39.7)**	**2.618 ± 0.193**	**2.220 ± 0.398**	**2.657 ± 0.403**
Nursing	**146 (38.1)**	**2.616 ± 0.242**	**2.267 ± 0.424**	**2.680 ± 0.419**
Significance**		**F = 0.159** **P = 0.853**	**F = 0.750** **P = 0.473**	**F = 0.181** **P = 0.835**
*Independent sample t-test				
**One-way ANOVA				

Figure 2 represents a presentation of the KAP scores among students, indicating that the majority of participants were more knowledgeable (68.82%) and had good practices (75.80%), but their positive attitude rate was not satisfactory (53.02%).

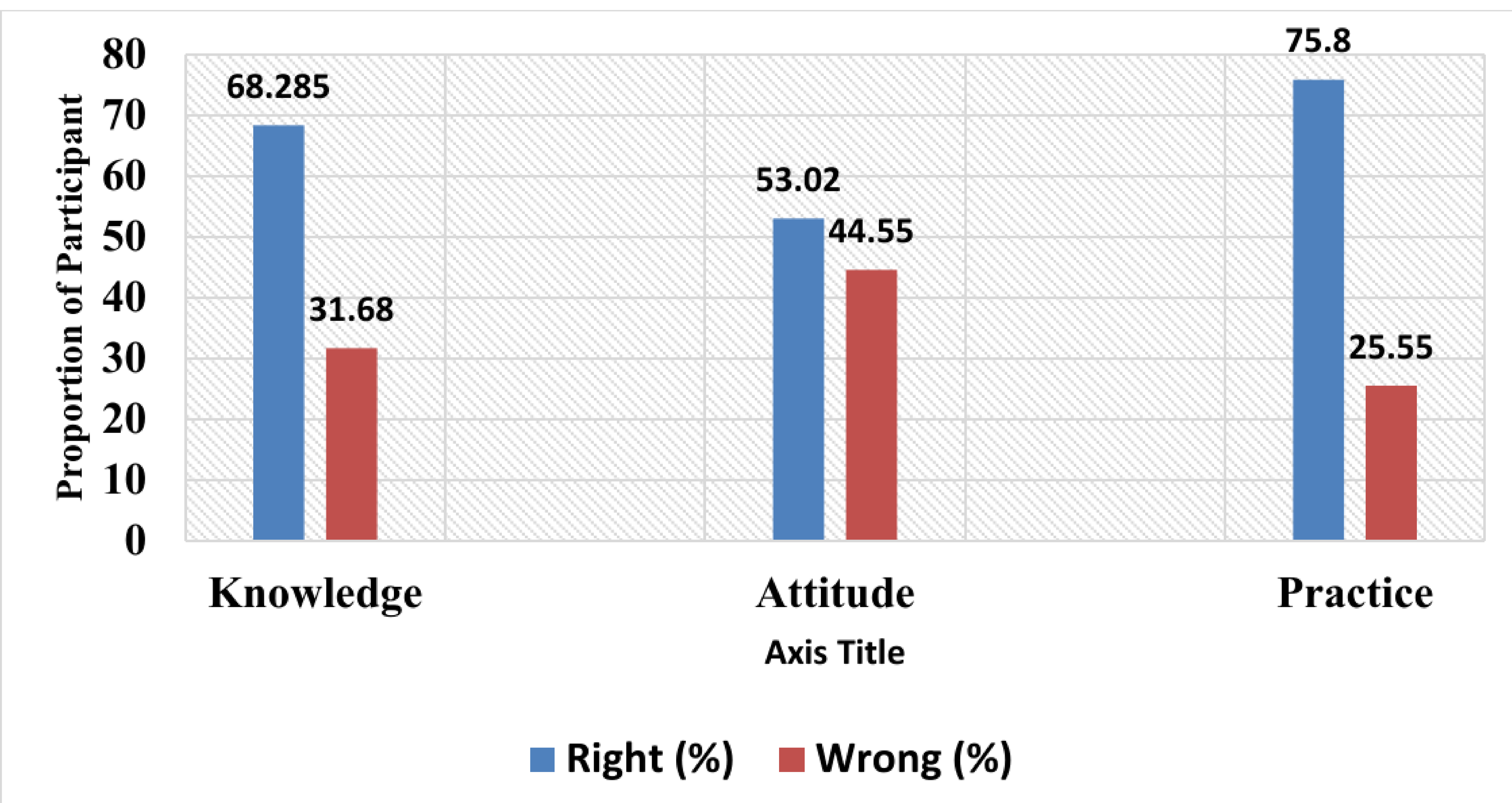

Figure 2 Medical science students' knowledge, attitude, and practice responses and Proportion of Participants (%)

Table 7 shows Pearson's correlations between demographic characteristics, means of knowledge, and practices. The association between KAP, for both age and colleges were very small and not statistically different ($p > 0.05$). Gender had statistically significant associations with knowledge and practice ($p = < 0.01$), but not with attitude ($p = 0.248$)

TABLE 7: Pearson's correlations between students' socio-demographic characteristics and their average means of KAP.

** Correlation is significant at the 0.01 level (2-tailed)

Variants		GENDER	AGE	College
Mean Knowledge	Pearson Correlation	-.178**	.088	-.026
	Sig. (2-tailed)	.000	.085	.617
	N	383	383	383
Mean Attitude	Pearson Correlation	-.059	.005	.000
	Sig. (2-tailed)	.248	.926	.993
	N	383	383	383
Mean Practice	Pearson Correlation	-.177**	.081	.001
	Sig. (2-tailed)	.001	.113	.985
	N	383	383	383

DISCUSSION

The outbreak of COVID-19 as an epidemic threat coincided with frequent demonstrations and public gatherings in the city of Nasiriyah. The high rate of infection and deaths associated with COVID-19 may be attributed to misinformation and a lack of knowledge about the nature of the virus. The lack of knowledge in participants may have negative effects on their adequate attitudes and practices, both of which are required to limit the spread of the virus **[23]**.

Medical science students can be suitable candidates to provide their relatives with enough information on how to control the virus rather than relying on questionable sources of information [23]**.** On this basis, it was found appropriate to give insight into the knowledge, attitude, and practice of COVID-19 among a diverse group of students of medical sciences (pharmacy, dentistry, nursing) in order to assess their competence as a reliable guide and source of information within their community.

Based on our findings, dental and nursing students were more motivated to participate in the study than pharmacy students. This may be due to the nature of their education and access to people, especially during training periods and hospital rotations, which pharmacy students do not really have.

Low vaccination rates among students and their families indicate a lack of confidence in the vaccine due to incorrect information about its dangerous side effects. Lack of confidence in the benefits of the vaccine is one of the most important obstacles to the use of vaccination **[24-27]**. **There** are three variables that affect vaccine acceptance: confidence, suitability, and complacency **[28].**

Regarding COVID-19 infection, the data revealed that the percentages of students who are infected versus not infected are almost equal, which may be attributed to poor vaccination rates or a lack of protection measures.

Turning to the sources of information about the pandemic, the data obtained showed a large discrepancy in the sources of information. The majority of students received their information from a variety of sources. The Internet and electronic search engines came in second place as the most reliable resources. The least proportion relied on television, newspapers, and posters, with only a few reliant on scientific sources, but none on Ministry of Health information or mobile short message service statements (SMS).

The Internet was undoubtedly the most popular source of access to information for students who did not have time to watch television, which focused mainly on the dismal news about the increasing number of infections worldwide. There has been a lack of reliable scientific seminars and workshops that might provide accurate information about the virus. Students do not seem interested in reading books other than those prescribed to them for their courses.

A Pakistani study showed that medical students relied more on mobile SMS and TV **[28],** which is consistent with a Turkish study that showed that social media was a source of knowledge about the influenza pandemic, in contrast to the Zika virus information collected from the news. Outlets **[29].**

Our participants seem to rely on untrustworthy sources of information, and therefore, a proposal to use validated official information generated by digital SMS and sent to all people via their mobiles would be more helpful in controlling the transmission of the virus. Our findings also point to the need to strengthen reliable information sources, even within a small group of people who should be more familiar with reliable medical sites than the general population.

The KAP scores among students indicated that the majority of participants were knowledgeable (68.82%) and had good practices (75.80%), however, their positive attitude was not satisfactory (53.02%). In terms of knowledge of COVID-19, the majority of students demonstrated a good understanding of the pandemic, including its mode of transmission, incubation period, clinical manifestations, preventive measures, availability of vaccine or effective drugs, and serious complications at high-risk. More than 72% of students were knowledgeable in such different aspects. These results are consistent with previous studies, although our rates were lower **[31]**.

The most controversial knowledge statements, among our participants, were “Covid-19 is a man-made pandemic virus”, “Covid-19 is caused by SARS CoV-2”, and “Polymerase chain reaction (RT-PCR) used to diagnose Covid-19, “infection may spread during any sort of group activity,” and “hand washing with soap and water is more effective than alcohol sanitizers in avoiding infection.” These unfavorable findings were comparable to those reported from Bangladesh **[32].**

Respondents' attitudes were average. Students reacted positively to four of the seven questions related to the attitudes, including "Do you think you are at risk of infection if you do not follow the preventive measures?" “Are you concerned if you or any of your close relatives have contracted COVID-19?” “Do you think you will not get an infection after taking the vaccine?” and “Do you think lockdown will improve the situation?”

Conversely, three negative responses were given to the attitude questions, " If you are diagnosed with COVID-19 infection, do you accept isolation in a health facility instead of home isolation?”, Do you expect that COVID-19 can be successfully controlled? and "Are the preventive measures of the Iraqi Ministry of Health sufficient?" All the questions require sufficient information on how to improve participants' attitudes. Our results did not agree with previous studies on medical students' perceptions of COVID-19, which found participants to have very positive attitudes [31-32]; however, this difference may be due to differences in our participants' social beliefs and habits.

In terms of preventive measures, the majority of participants had significantly higher levels of good practice. Students were able to put in place effective preventive measures, such as “avoiding social and political protests through demonstrations and street camping.” “Stay home during lockdown”, “Use a face mask and use an alcohol-based sanitizer,” “Keep a social distance between you and others,” “Avoid touching eyes and nose before sanitizing,” “Avoid touching smooth surfaces and objects”, and “Wash my hands and face with water and soap regularly. This data is consistent with some previous studies **[33].**

Levels of knowledge, attitudes, and practices (KAP) varied widely across participants' demographics. Older nursing students (≥ 30 years of age) had more relevant knowledge and best practices. This can be explained by the fact that the older students were graduates of intermediate nursing institutes and had previous nursing experience in hospitals and health care centers before entering the College of Nursing for a higher undergraduate degree.

Differences in attitude score were marginal across all demographic characteristics, indicating lower levels of positive attitude in our study, in contrast to other reports that showed somewhat significant positive attitudes among medical students [**11, 31–32**].

Participants answered negatively to the questions, “Would you rather be isolated in a healthcare facility than at home if you were diagnosed with the infection?” and "Do you feel that the protection measures taken by the Iraqi government are reasonable and effective?" These disparities may be attributed to uncertainty in some community services.

The majority of students had good practices such as using face masks and alcohol-based sanitizers, staying at home during the lockdown, keeping social distance, using disposable tissues when coughing and/or sneezing, washing hands often with soap and water, and avoiding touching the nose and face. These results were in agreement with those previously reported **[11, 32-33].**

An independent samples t-test showed that female students had significantly higher knowledge and practice scores than male students, but there was no significant difference in attitude. However, our results contradict similar Iraqi and Iranian research, which did not find significant gender differences in knowledge, but agreed that they were significantly different in practice **[11, 33].**

In contrast to gender, one-way ANOVA revealed no significant differences in age group responses to knowledge and attitudes, but responses to practice were significant. There were also no significant differences regarding the responses of KAPs with the colleges.

Pearson’s product correlations of gender with both knowledge and practice were respectively found to be negative and very low and statistically significant ($r = -0.178$, $p = 0.000$ and $r = -0.177$, $p = 0.001$). This shows that females are more enthusiastic about their protection than males. On the other hand, there was a markedly low and negligible correlation between age groups and colleges' KAPs.

Despite the fact that our study was limited to 383 participants from one university, additional medical science students from other public and private colleges are expected to provide a broader scope. However, the study results may indicate that students with such a representative sample size have enough experience to act as vital public counselors in an effort to help local health authorities control the ongoing spread of COVID-19 infection, at least within the city of Nasiriyah.

CONCLUSION

According to the study, medical students had a satisfactory level of knowledge and practice with COVID-19, but their attitude towards the infection was not satisfactory. Students must rely on legitimate sources of information about the virus to provide specific guidance to their community. There was a significant difference in knowledge and practice, but not in attitudes, with socio-demographics. Medical students can guide their community on COVID-19 infection; however, their beliefs and social habits can be factors in moderating their attitudes towards the pandemic. The public should be advised to avoid demonstrations and gatherings related to social claims in order to contain the spread of the virus.

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المعرفة والمواقف والممارسات تجاه كوفيد-19 بين طلاب علوم الطب في العراق: دراسة مقطعية مع مقارنات حسب العمر والجنس والكلية

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الملخص: لقد أثّر كوفيد-19 على العديد من الدول حول العالم. طلاب العلوم الطبية هم كوادر الصحة العامة المستقبلية القادرون على تزويد المواطنين بالمعلومات الفيروسية الصحيحة. هدفت الدراسة إلى تقييم معرفة ومواقف وممارسات طلاب (KAP) العلوم الطبية الخاصة فيما يتعلق بكوفيد-19، واستخلاص الاستنتاجات بشأن كفاءتهم كمستشارين مجتمعيين خلال الجائحة. يتضمن استبيان إلكتروني تم اختباره مسبقًا متغيرات الدراسة حول: البيانات الديموغرافية للطلاب، مصادر معلومات كوفيد-19، معرفة الطلاب، مواقفهم، وممارساتهم. تمت دراسة الإحصاءات الوصفية والاستنتاجية لمعارف ومواقف وممارسات الطلاب وخصائصهم الديموغرافية. اعتُبر أن القيمة الاحتمالية ≤ 0.05 ذات دلالة إحصائية. من بين 383 مشاركًا، كان 53.5% منهم ذكورًا، وأكثر من نصفهم تتراوح أعمارهم بين 20-25 عامًا، بينما كانت نسبة من طلاب التمريض فوق سن 25 عامًا. 66.8% من الطلاب لم يتلقوا اللقاح. وأُصيب ما مجموعه 50.4%. حصل 51.7% من الطلاب على معلوماتهم عن الفيروس من مصادر متنوعة، أغلبها الإنترنت، ونادرًا من مصادر علمية أو رسمية. أظهر طلاب الكليات المختلفة معرفة كافية كانت معرفة ($p > 0.05$). وممارسات جيدة، رغم أن مواقفهم كانت متوسطة ولم تختلف بشكل كبير بين المجموعات وممارسات الطلاب كافية وتباينت بشكل ملحوظ وفقًا لخصائصهم الديموغرافية. كانت مواقفهم متوسطة ولم يكن هناك فرق ذو دلالة إحصائية. كان طلاب التمريض الأكبر سنًا (25 عامًا فأكثر) أكثر معرفة وأفضل في الممارسات. يجب على الطلاب الاعتماد على المصادر العلمية والرسمية لتحسين معارفهم ومواقفهم وممارساتهم ليصبحوا مستشارين أكفاء بشأن كوفيد-19. .وقد تعزى معدلات المواقف الإيجابية المنخفضة إلى معتقدات الطلاب وعاداتهم الاجتماعية