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RESEARCH ARTICLE

# Assessment of knowledge, attitude, and practice towards COVID-19 among undergraduate students and its psychological impact on their life: A cross-sectional study

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## Abstract

**Background:** The association between widespread outbreaks, such as COVID-19, and psychological distress and symptoms of mental illness is common. This study aimed to assess undergraduate students' knowledge, attitudes, and practices (KAP) toward COVID-19 and its psychological impact on their life. **Methods:** A cross-sectional study was done using a self-administered questionnaire. **Results:** The findings revealed that 11.9% of the participants had COVID-19, and 27.7% of their relatives contracted the disease. The overall rate of correct answers for the knowledge statements was 81.6%. Only 16.5% declared that COVID-19 had an extreme effect on their studies. However, 34% reported rarely or never having felt nervous or anxious during the pandemic. **Conclusion:** The findings revealed that undergraduate students have good knowledge and a positive attitude towards COVID-19, while their practice was poor. Also, the pandemic had a negative psychological impact on some students, thus the need for proactive psychological and social support for students.

## Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by a novel coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (WHO, 2019). The virus was first discovered in Wuhan city, Hubei Province, China, in December 2019 (Zhong *et al.,* 2020), from where it has spread widely and rapidly to other parts of the world, threatening the lives of millions of people. On 30 January 2020, the World Health Organisation (WHO) declared COVID-19 a pandemic and a public health emergency of international concern requiring collaborative efforts among all nations to prevent its rapid spread (WHO, 2020). Following the WHO declaration, countries around the globe, including Yemen, responded to global plans aiming at controlling the pandemic. The proactive measures applied were travel restrictions, curfews, limiting the number of employees at workplaces, lockdown measures, and closure of schools, universities, and mosques. As no specific antiviral treatment has been effective against COVID-19 till now (Cascella *et al.,* 2022), only appropriate symptomatic treatment and supportive care have been recommended in infected patients (Huang *et al.,* 2020; CDC, 2021). Nevertheless, the application of preventive measures to reduce the spread of disease is considered of prime importance. Some of these preventive measures, which have been adopted worldwide as the most effective methods of reducing the spread of the virus and limiting its morbidity and mortality, were airborne precautions, social distancing, regular handwashing with soap and wiping of surfaces, quarantining, and wearing of face masks (WHO, 2020; CDC, 2021; Pradhan *et al.,* 2021).

Since there is no specific antiviral treatment, the WHO and many governments directed their efforts towards educating people about preventive measures, including lockdowns, to decrease the disease spread

(Alrasheedy *et al.,* 2021). However, the management of non-communicable diseases, particularly mental health, which is affected by a lack of social interactions and support, has been negatively influenced by lockdowns (Kluge *et al.,* 2020; Palmer *et al.,* 2020). The main population affected psychologically were the students. Indeed, COVID-19 has been linked to psychological distress and symptoms of mental disease (Bao *et al.,* 2020; Palmer *et al.,* 2020; Son *et al.,* 2020; Ghazawy *et al.,* 2021; Villani *et al.,* 2021).

The situation in Yemen was further complicated by political instability, which hindered the implementation of robust preventive and precautionary measures. The COVID-19 scenario in Yemen was obscure, and the pandemic spread appeared relatively mild, which might have been accurate or attributable to the possible under-reporting of cases. However, between 3 January 2020 and 16 December 2021, the WHO reported 10,075 confirmed cases of COVID-19 and 1,972 deaths (WHO, 2021). The battle against COVID-19 is continuing in Yemen. Adherence of people to preventive measures, affected by knowledge, attitudes, and practices, is essential for controlling the spread of COVID-19. Indeed, evidence suggests the importance of public knowledge in tackling pandemics (Chirwa, 2019; Chirwa, 2020). Studying young adults should be prioritised since this age group has been reported to be less adherent to government health protocols (Nivette *et al.,* 2021). This age group commonly presents with mild symptoms or is asymptomatic for COVID-19. Due to its high social activity and mobility, it contributes to increased numbers of confirmed COVID-19 cases and mortalities (Nivette *et al.,* 2021). Hence, it was essential to assess KAP of young people toward COVID-19 and its impact on their mental health. The findings could serve to identify gaps and strengthen ongoing prevention efforts.

## Methods

### *Study design, setting, and participants*

A cross-sectional survey using a validated, self-administered questionnaire was employed in this study. The target population were undergraduate students in four selected colleges in the capital city of Yemen. The study period was one month as of October 1, 2021. All undergraduate students were eligible to participate in this study.

### *Sample size and sampling technique*

Using Raosoft software (Raosoft, 2004), a total sample of 435 was calculated based on the assumption that 50% of the study participants had a high level of knowledge of COVID-19, a 95% confidence interval, a 5% margin of error, and a 20% non-respondent rate. A total of 600 questionnaires were distributed to the students in selected colleges. Finally, 429 questionnaires were returned from students, yielding a response rate of 71.5%. Of the 429 questionnaires returned, 18 were excluded due to incomplete data, resulting in a final sample of 411 students.

### *Development and administration of the questionnaire*

The questionnaire was inspired by a previously published study (Alrasheedy *et al.,* 2021) and adapted with permission from the principal author. The Cronbach's alpha coefficient for the KAP questionnaire was 0.718, which was considered acceptable and consistent (Bland & Altman, 1997; Tavakol & Dennick, 2011). The preliminary draft was discussed with an academic expert in questionnaire design and was slightly modified. The minor linguistic modifications made the questionnaire suitable to the local context. To further ensure applicability, suitability, and clarity in the study setting and establish face and content validity, the draft questionnaire was given to two academicians for their review and comments. In addition, ten students were invited to review and give feedback and suggestions on the clarity and ease of understanding; there were no comments from the students. The responses of the pilot testing were not included in the study dataset.

Data collectors distributed the final questionnaire to the students. It contained 12 statements that examined respondents' knowledge about COVID-19. A correct answer was given a score of one, while an incorrect or a '*do not know'* response received a score of zero. The maximum knowledge score was 12. The questionnaire also included three attitude questions, three practice questions, and eight questions related to demographic data. The six questions related to attitude and practice were framed using three possible answers ('Yes', 'No', and 'Not sure'). A score of one was awarded for each positive response toward practice, while negative reactions were rated zero. 'Not sure' was recorded as a negative reaction. The maximum practice score was three. The last part of the questionnaire consisted of six questions evaluating the psychological effect of the pandemic on student lives and studies. A list of possible strategies adopted to improve mental health status during the lockdown period was provided to students in

the last multiple-response questions based on the literature.

Data collectors gave the participants a brief explanation of the objectives and benefits of the study while emphasising confidentiality, the voluntary aspect of participation, and the use of personal data for scientific purposes. The study was started after obtaining ethics approval from the Ethics Committee of the Scientific Issues in Al-Rowaad Medical College (Ref: AMC/131, September 26, 2021). Filling out the questionnaire was considered consent to take part in the study.

### *Data analysis*

The data were analysed using Statistical Package for Social Sciences software (SPSS, version 21, SPSS, Chicago, IL, U.S.A.). Descriptive statistics (i.e., frequencies, percentages, means, and standard deviation) were used to summarise responses to KAP statements. Inferential statistics were used to establish the association between demographics and KAP level. Pearson's Chi-square test was used to examine the association between categorical variables. The Kolmogorov-Smirnov (K-S test) test was used to assess the normal distribution of the continuous variables before performing inferential statistical tests. An independent t-test was used to examine the difference in means of the continuous variables between the targeted groups. A *p*-value of <0.05 was considered statistically significant.

## Results

### *Demographic characteristics*

A total of 411 students took part in the current study. The mean age of the students was 23.1±1.93, and the majority were females (59.9%). Most participants (283, n=68.9%) were medical students. More than half of the students (62.5%) were unmarried. About 11% reported having had COVID-19, and 27.7% claimed that one of their family members had COVID-19. Also, 10.5%(n=43) reported having co-morbidities, mainly asthma (n=6) and diabetes (n=5). The demographic characteristics of the students are shown in Table I.

**Table I: Demographic characteristics (n=411)**

| Characteristic | N (%) |
|---|---|
| **Gender** | |
| Male | 165 (40.1) |
| Female | 246 (59.9) |
| **Age groups** | |
| ≥23 | 245 (59.6) |
| <23 | 166 (40.4) |
| **Marital status** | |
| Non-married | 257 (62.5) |
| Married | 154 (37.5) |
| **Majors** | |
| Medical | 283 (68.9) |
| Non-medical | 128 (31.1) |
| **Had COVID-19** | |
| Yes | 49 (11.9) |
| No | 362 (88.1) |
| **Had family member with COVID-19** | |
| Yes | 114 (27.7) |
| No | 297 (72.3) |
| **Coexisting disease** | |
| Yes | 43 (10.5) |
| No | 368 (89.5) |

### *Knowledge about COVID-19*

The mean total knowledge score was 9.79 ± 1.84 out of the maximum attainable score of 12. The overall rate of correct answers for the knowledge statements was 81.6%. Table II shows responses to knowledge questions in detail.

**Table II: Responses to knowledge questions (n=411)**

| Item | Correct N (%) | Not correct N (%) | Don't know N (%) |
|---|---|---|---|
| K1. The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and muscle pain. | 358 (87.1) | 19 (4.6) | 34 (8.3) |
| K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus. | 259 (63.0) | 69 (16.8) | 83 (20.2) |
| K3. Currently there is no effective cure for COVID-19, but early symptomatic and supportive treatment can help most patients to recover from the infection. | 348 (84.7) | 16 (3.9) | 47 (11.4) |
| K4. Not all persons with COVID-19 will develop severe cases. Those who are elderly, have chronic illnesses, and are obese are more likely to be severe cases. | 364 (88.6) | 23 (5.6) | 24 (5.8) |
| K5. Eating or contacting wild animals would result in infection by the COVID-19 virus. | 193 (47.0) | 70 (17.0) | 148 (36.0) |

| Item | Correct N (%) | Not correct N (%) | Don't know N (%) |
|---|---|---|---|
| K6. Persons with COVID-19 cannot spread the virus to others when the symptoms of COVID-19 are not present. | 275 (66.9) | 73 (17.8) | 63 (15.3) |
| K7. The COVID-19 virus spreads via respiratory droplets of infected individuals. | 389 (94.6) | 5 (1.2) | 17 (4.1) |
| K8. Ordinary individuals can wear general medical masks to prevent the infection by the COVID-19 virus. | 366 (89.1) | 30 (7.3) | 15 (3.6) |
| K9. It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus. | 354 (86.1) | 35 (8.5) | 22 (5.4) |
| K10. To prevent the infection by COVID-19, individuals should avoid going to crowded places and avoid gatherings. | 388 (94.4) | 9 (2.2) | 14 (3.4) |
| K11. Test, Trace and Isolate (TTI) are the effective ways to reduce the spread of COVID-19. | 349 (84.9) | 13 (3.2) | 49 (11.9) |
| 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. | 382 (92.9) | 16 (3.9) | 13 (3.2) |

The t-test was performed to examine whether there were any statistically significant differences in the means of student knowledge scores in terms of demographic characteristics. The means of knowledge scores were significantly different ($p$<0.05) between genders, majors, those who had a family member with COVID-19, and those who had co-existing diseases (Table III).

**Table III: The difference in means of knowledge score among study participants (n=411)**

| Variables | N | Knowledge Mean (±SD) | *p*-value* |
|---|---|---|---|
| **Gender** | | | **0.009*** |
| Male | 165 | 9.50 (1.99) | |
| Female | 246 | 9.99 (1.70) | |
| **Age groups** | | | 0.64 |
| ≥23 | 245 | 9.83 (1.87) | |
| <23 | 166 | 9.74 (1.78) | |
| **Marital status** | | | 0.43 |
| Non-married | 257 | 9.85 (1.94) | |
| Married | 154 | 9.70 (1.65) | |
| **Majors** | | | **0.003*** |
| Medical | 283 | 9.97 (1.73) | |
| Non-medical | 128 | 9.40 (1.99) | |
| **Had COVID-19** | | | 0.18 |
| Yes | 49 | 10.12 (1.75) | |
| No | 362 | 9.75 (1.84) | |
| **Had family member with COVID-19** | | | **0.009*** |
| Yes | 114 | 10.18 (1.37) | |
| No | 297 | 9.65 (1.97) | |
| **Co-existing disease** | | | 0.27 |
| Yes | 43 | 9.19 (2.41) | |
| No | 368 | 9.54 (2.08) | |

Note: Independent-samples t-test was used; *Significant at $p < 0.05$

***Attitude towards COVID-19***

About 72% of students positively answered the attitude questions. More than half of the students (62.3%) agreed that COVID-19 would be finally successfully controlled. The majority (73.7%) believed that COVID-19 is a health threat to the community. Moreover, the vast majority of students (80.8%) thought that the lockdown would improve the situation in the country. Table IV summarises student responses to attitude questions.

**Table IV: Attitude towards COVID-19 among participants (n=411)**

| Questions | Yes N (%) | No N (%) | Don't know N (%) |
|---|---|---|---|
| A1. Do you agree that COVID-19 will finally be successfully controlled? | 256 (62.3) | 42 (10.2) | 113 (27.5) |
| A2. Do you think that COVID-19 is a threat for your community? | 303 (73.7) | 65 (15.8) | 43 (10.5) |
| A3. I think that the lockdown would improve the overall wellbeing of the society in terms of controlling COVID-19 pandemic situation. | 332 (80.8) | 40 (9.7) | 39 (9.5) |

The Chi-square analysis showed a statistically significant association between attitude in terms of thinking that COVID-19 is a threat to the community and majors of students ($p$<0.001) and those who had COVID-19 ($p$=0.011). The belief that lockdowns would improve the overall well-being of society was statistically significantly associated with gender ($p$=0.025), majors of students ($p$=0.039), and marital status ($p$=0.017). T-test showed a statistically significant association between attitude and knowledge ($p$<0.05) across all attitude questions (Table V).

Regarding individual question analysis, Chi-square showed that 70.3% and 65.5% of students who agreed that COVID-19 was a threat to society went to crowded places and did not wear masks, respectively. Similarly, Chi-square analysis showed that 70.4% and 66.7% of students who thought that the lockdown improved the well-being of society went to crowded places and did not wear masks, respectively.

**Table V: Association between attitude and knowledge (n=411)**

| Variables | n | Knowledge Mean (±SD) | *p*-value* |
|---|---|---|---|
| A1. Do you agree that COVID-19 will finally be successfully controlled? | | | 0.003* |
| Yes | 256 | 10.00 (1.62) | |
| No/Unsure | 155 | 9.45 (2.11) | |
| A2. Do you think that COVID-19 is a threat for your community? | | | <0.001* |
| Yes | 290 | 10.00 (1.62) | |
| No/Unsure | 121 | 9.31 (2.20) | |
| A3. I think that the lockdown would improve the overall wellbeing of the society in terms of controlling COVID-19 pandemic situation | | | <0.001* |
| Yes | 324 | 10.09 (1.47) | |
| No/Unsure | 87 | 8.68 (2.52) | |

Note: Independent-samples t-test was used; *Significant at $p$ < 0.05

***Practice towards COVID-19***

The total practice scores were three, while the mean score was 1.07±1.02. Study results showed that 275 (66.9%) students had poor practice. Only 98(23.8%) students did not go to any crowded places, and 122(29.7%) reported wearing masks when leaving home. Slightly more than half of the students (n=219; 53.3%) admitted following the recommendations of the authorities to prevent infection and the spread of COVID-19. The details of the replies to the practice questions are summarised in Table VI.

**Table VI: Practice towards COVID-19 among participants (n=411)**

| Questions | Yes N (%) | No N (%) | Don't know N (%) |
|---|---|---|---|
| P1. In recent days, have you gone to any crowded place? | 293 (71.3) | 98 (23.8) | 20 (4.9) |
| P2. In recent days, have you worn a mask when leaving home? | 122 (29.7) | 274 (66.7) | 15 (3.6) |
| P3. Are you following the strategies recommended by authorities (e.g. Ministry of Health) to prevent the infection and spread of COVID-19? | 219 (53.3) | 146 (35.5) | 46 (11.2) |

Chi-square analysis showed a statistically significant association between the practice of going out to crowded places during the pandemic and gender ($p$=0.021). Moreover, having a family member with COVID-19 was significantly associated with the practice of following the strategies recommended by authorities ($p$=0.05). T-test failed to show any statistically significant differences in the means of the student practice scores between all demographic variables. However, a statistically significant difference in the means of student knowledge scores was found among practice subgroups ($p$=0.029). With regards to the association between practice and attitude, the Chi-square analysis showed a statistically significant association between poor practice and attitude in terms of COVID-19 threat to society ($p$<0.001) and the importance of lockdown ($p$=0.002).

***Psychological Impact of COVID-19 on Participants:***

*Impact of COVID-19 on mental status of students*

More than one-quarter of students (28.5%) declared they always or frequently felt nervous or anxious during the pandemic. However, a lower proportion of participants reported feeling down (19.7%) and feeling little interest in doing things (16.5%) during the pandemic. Details of the impact of COVID-19 on the mental status of students are given in Table VII.

*Impact of COVID-19 on overall concentration*

With regard to what extent COVID-19 has caused trouble concentrating, the majority of students (73.9%) reported that the pandemic had no or limited impact on their overall concentration. However, about one-quarter of the participants (26.1%) were affected. Figure 1 summarises student responses.

**Table VII: Impact of COVID-19 on mental status of participants (n=411)**

| Descriptions | Always N (%) | Frequently N (%) | Occasionally N (%) | Rarely N (%) | Never N (%) |
|---|---|---|---|---|---|
| Feeling nervous/anxious | 41 (10.0) | 76 (18.5) | 154 (37.5) | 63 (15.3) | 77 (18.7) |
| Feeling hopeless/down | 21 (5.1) | 60 (14.6) | 112 (27.3) | 64 (15.6) | 154 (37.5) |
| Feeling little interest in doing things | 24 (5.8) | 44 (10.7) | 149 (36.3) | 77 (19.0) | 116 (28.2) |

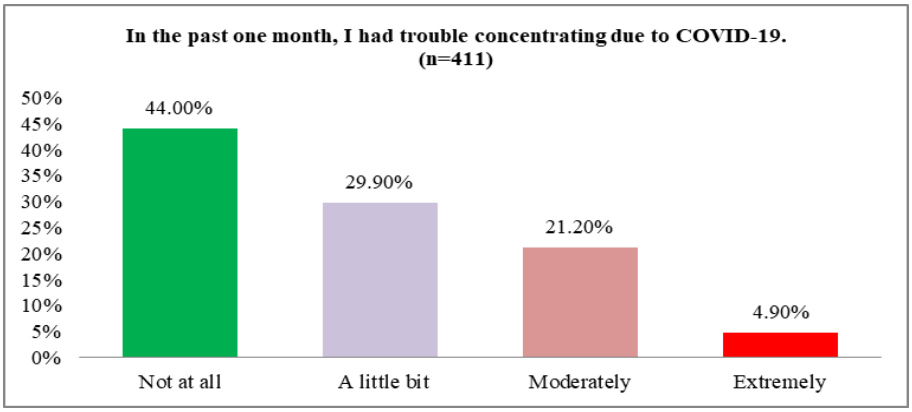


**Figure 1: Impact of COVID-19 on the overall concentration of students**

***Impact of COVID-19 on student studies***

Slightly more than half of the participants (51.6%) reported that the COVID-19 pandemic had either no or merely limited effects on their studies. However, about half (48.4%) of the participants were affected by this pandemic. Figure 2 summarises the details of the impact of COVID-19 on student studies.

Overall, a significant association was found between marital status and the statement related to the potential impact of COVID-19 on student concentration ($p$=0.035). Moreover, the potential impact of COVID-19 on student studies was significantly associated with majors ($p$=019) and marital status ($p$=0.05). Strategies used to improve mental health during the lockdown period are shown in Table VIII.

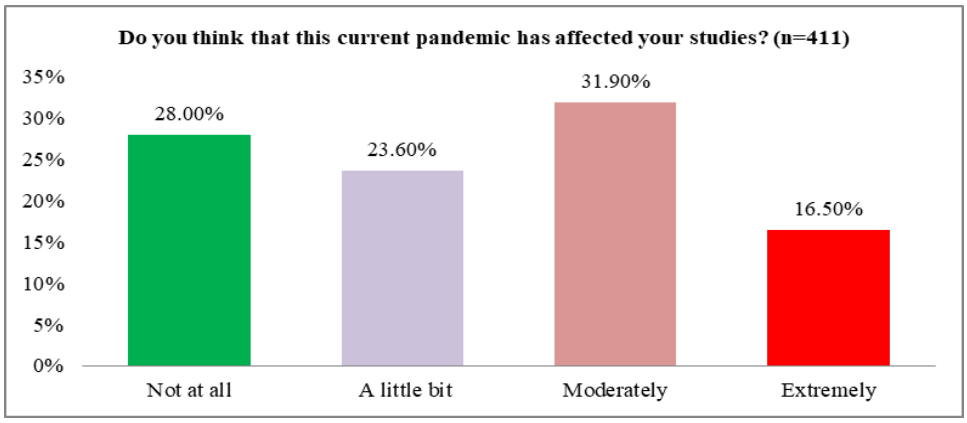


**Figure 2: Impact of COVID-19 on the students' study during the early stage of the pandemic**

**Table VIII: Strategies used to improve mental health during the lockdown period**

| Strategies | N (%) |
|---|---|
| Staying close to your normal life | 270 (65.69) |
| Eating healthy food and doing exercise | 153 (37.23) |
| Maintaining social connection and communication online | 206 (50.12) |
| Viewing the current situation as an opportunity to spend more time with family members | 151 (36.74) |
| Relying on authorities' information (eg Ministry of Health) to keep updated with the level of risk | 108 (26.28) |
| Avoiding too much exposure to news about COVID-19 | 171 (41.61) |
| Viewing the current situation as an opportunity to improve skills in independent learning | 128 (31.14) |

## Discussion

This study is the first of its kind in Yemen. It examined knowledge, attitude, and practice toward COVID-19 among 411 undergraduate students who appeared to have good knowledge about the COVID-19 pandemic, with an overall rate of 81.6%. The vast majority of students answered most knowledge statements correctly, ranging between 63.0% and 94.6%. These results are similar to previous findings in some countries, such as India (93.3%) (Maheshwari *et al.,* 2020), Jordan (90%) (Alzoubi *et al.,* 2020), Egypt (83.0%) (Hamza, Badary & Elmazar, 2021), Saudi Arabia (82.0%) (Alrasheedy *et al.,* 2021), China (82.3%) (Peng *et al.,* 2020), Iraq (75.8%) (Hussein *et al.,* 2020), Egypt (74.3%) (Elsayed Emara *et al.,* 2021), and Pakistan (71.7%) (Noreen *et al.,* 2021), but higher than those reported in other studies from Pakistan (68.0%) (Faisal, Khotib & Zairana, 2021), India (66.3%) (Joshi, Takhar & Jain, 2021), Saudi Arabia (60.4%) (Adam *et al.,* 2021), Syria (60%) (Al Ahdab, 2021), Sudan (59.0%) (Badi *et al.,* 2021), Bangladesh (52.1%) (Ferdousi *et al.,* 2020), and China (28.3%) (Zhang *et al.,* 2021). However, knowledge scores in this study were lower than those recorded in other countries such as Japan (100.0%) (Hatabu *et al.,* 2020) and Indonesia (99.5%) (Limbong, Kuswinarti & Sitorus, 2021).

Regarding the statement *"eating or contacting wild animals would result in the infection by the COVID-19 virus",* only 47.0% of participants answered correctly, while 36.0% were not sure. This result was consistent with previous findings from Saudi Arabia (Alrasheedy *et al.,* 2021). However, in this study, participants had better knowledge compared to those from Jordan (Khasawneh *et al.,* 2020), Malaysia (Azlan *et al.,* 2020), Bangladesh (Rabbani *et al.,* 2020), and Ethiopia (Feleke, Wale & Yirsaw, 2021) studies, where only 34.8%, 35.7%, 39.8%, and 10.6% of participants, respectively, stated that the transmission from animals was unlikely.

The study results showed a significant association between knowledge scores and practice ($p$=0.029). Similar findings were previously reported in Bangladesh (Kundu *et al.,* 2021). Moreover, knowledge among the study participants was associated with gender and majors, consistent with the findings of some studies (Ferdousi *et al.,* 2020; Badi *et al.,* 2021; Modi *et al.,* 2021), but contrary to others (Alzoubi *et al.,* 2020). Most of the sample (81.6%) had a piece of good knowledge about COVID-19, with higher scores among females (M±SD=9.99±1.70), which might reflect the fact that females are more eager and studious than males. The study results also showed that 59% of the female participants maintained online social connection and

communication compared to only 36% of males. Although upholding social bonds is among the strategies used to improve mental health during the lockdown period, it could also indicate that women sought information more than men, thus increasing their knowledge. Moreover, the difference in knowledge scores between medical and non-medical students might be explained by the fact that medical students are taught about viruses during their studies. A high knowledge score was also observed among those who had a family member infected with COVID-19, which could be a driver for seeking information to help their relatives.

Regarding attitude, most participants (73.7%) believed COVID-19 to be a severe disease, posing a health threat to the community, with 80.8% considering that lockdowns and curfews during the early stages of the pandemic were required to control it but may harm the economic situation. This result is in agreement with those of previous studies among students (Alrasheedy *et al.,* 2021; Badi *et al.,* 2021; Hasan *et al.,* 2021) and the general populations in Saudi Arabia (Alahdal, Basingab & Alotaibi, 2020; Alhajjaj, Aldarweesh & Alghawi, 2020), India (Almutairi *et al.,* 2020; Shukla & Deotale, 2020), and Pakistan (Ali *et al.,* 2020). In line with previous findings (Hussein *et al.,* 2020; Maheshwari *et al.,* 2020; Alrasheedy *et al.,* 2021; Elsayed Emara *et al.,* 2021), the Yemenis expressed an optimistic attitude toward the COVID-19 pandemic, where more than half (62.3%) of the study participants believed that the pandemic would be successfully controlled. However, this result contrasted the findings from Sudan (Badi *et al.,* 2021) and Pakistan (Noren *et al.,* 2020), where only 23.4% and 43.6%, respectively, considered that the outbreak would be overcome soon.

Although most study participants believed COVID-19 to be a severe disease and were knowledgeable about preventing it by avoiding the crowds, 71.3% kept attending crowded places and gatherings, and 66.7% did not wear masks when leaving home, contrasting with the findings from Morocco showing that almost all participants avoided crowds and about 93% of them frequently wore masks (Fakhri *et al.,* 2021). Slightly more than half (53.3%) of the participants reported following the strategies recommended by authorities to prevent the infection and limit the spread of COVID-19. The significantly higher risk of going to crowded places among males (77.6%) could be ascribed to their desire to gather with others to spend time, discuss daily issues, and chew Khat (Catha edulis, which leaves are chewed for their stimulating effect), a social habit widely spread in the country (Anaam *et al.,* 2012). The significantly higher risk of not wearing masks when leaving homes among the students could be due to their belief that nothing would happen if it were not their fate and the conviction that their body immunity might protect them from infection. Moreover, it is widely believed that COVID-19 is a myth or merely a political issue exaggerated by big-business companies and broad media coverage. However, poor practices could also be due to the absence of stringent precautionary directives or penalties enforced by the government.

A statistically significant association was found between practice and knowledge and between practice and attitude, in line with previous findings (Peng *et al.,* 2020; Lee, Kang & You, 2021; Provenzano *et al.,* 2021). A statistically significant association was also found between attitude and gender, supported by previous literature (Peng *et al.,* 2020; Al Ahdab, 2021; Badi *et al.,* 2021) and contrasted by an Indian study (Maheshwari *et al.,* 2021). The association between practice and gender found in this study also agreed with other findings (Al Ahdab, 2021; Badi *et al.,* 2021; Maheshwari *et al.,* 2020).

A challenging finding was that one-quarter of study participants reported being psychologically affected by the pandemic. However, this rate was lower than those reported in other studies (Son *et al.,* 2020; Wang *et al.,* 2020; Noreen *et al.,* 2021; Lee *et al.,* 2021). The anxiety rate in the study was higher than that found in a Chinese study (18.78%) (Jia *et al.,* 2021) but similar to previous reports from Saudi Arabia (38.5%) (Alrasheedy *et al.,* 2021), Malaysia (29.8%) (Sundarasen *et al.,* 2020), Ethiopia (27.7%) (Aylie, Mekonen & Mekuria, 2020), and Bangladesh (33.3%) (Khan *et al.,* 2020).

More than half of the study participants (51.6%) reported that the COVID-19 pandemic had either no or a limited effect on their studies, with only 26.1% reporting having difficulty concentrating, in agreement with findings from Saudi Arabia (Alrasheedy *et al.,* 2021), but lower than what was reported in two studies from the United States, where 73.5% and 89% of students, respectively, reported having difficulties in focusing on academic work during the pandemic (Kecojevic *et al.,* 2020; Son *et al.,* 2020) and one study from Australia showing that 81% of students were concerned about the impact of COVID-19 on their studies (Lyons *et al.,* 2020). These high rates could be due to several factors, such as the sudden shift to online learning, less interaction with others, major changes in living style, and increased emotional and psychological distress (Aucejo *et al.,* 2020; Kapasia *et al.,* 2020; Kecojevic *et al.,* 2020; Lyons *et al.,* 2020; Son *et al.,* 2020; Sundarasen *et al.,* 2020). It is believed that the low impact of COVID-19 on the psychological

health of the students compared to other studies could be due to their religious beliefs and the implementation of proactive strategies.

***Strengths and limitations***

This study is the first to address the KAP of undergraduate students toward COVID-19 in the country. Therefore, it provides valuable insights into health education and preventive measures toward the COVID-19 pandemic in Yemini universities and its impact on students. As the study has a cross-sectional design, a strict causal interpretation of the results is not possible. Although the response rate of the target population was acceptable and the results comparable to other findings, the sample was unrepresentative of the entire population.

## Conclusion

The findings of this study suggested that undergraduate students in Yemen had good knowledge and positive attitudes toward COVID-19, but poor practice, reflected by the low adherence to preventive measures. Health education and awareness campaigns targeting this population could improve practices in facing future crises. However, the results also revealed that gender and majors should be taken into consideration by policymakers when tailoring public health education programmes to improve preventive measures against this pandemic. Although students adopted several strategies to better cope with the psychological stress, negative consequences were shown, thus the need for more social and proactive psychological support.

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## Disclosure

The author declare that no competing interest exists.

## Ethics approval

This study was conducted following the Declaration of Helsinki and was approved by the Ethics Committee of the Scientific Issues, Al-Rowaad Medical College (Ref: AMC/131, September 26, 2021).

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