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ORIGINAL RESEARCH

Knowledge, attitude and practice about coronavirus disease (COVID-19) pandemic and its psychological impact on students and their studies: A cross-sectional study among pharmacy students in Saudi Arabia

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Abstract

Background: Individuals' knowledge, attitude and practice towards preventive and precautionary measures of COVID-19 are essential to control the spread of the disease. Consequently, the aims of the study were to evaluate knowledge, attitude and practice of pharmacy students towards the pandemic and to assess its psychological impact on them to provide future guidance. **Methods:** A cross-sectional, questionnaire-based study was conducted via a web-based survey. All pharmacy students enrolled at Unaizah College of Pharmacy, Qassim University were invited to take part in the study. **Results:** A total of 232 out of 460 students took part in the study, giving a response rate of 50.43%. The mean total knowledge score was 9.87 ± 2.04 (maximum attainable score, 12). The majority of the participants (n=163; 70.3%) believed COVID-19 is a health threat to their community. Moreover, the majority (93%) also believed that the lockdown at the beginning of the pandemic was necessary to contain the pandemic. Encouragingly, 86.6% reported that they did not go to any crowded places during the pandemic with more female students avoiding crowded places compared to male students (91.6% versus 78.7% respectively, P = 0.005). The majority (91%) also reported that they were following the strategies recommended by the authorities to prevent the spread of the virus. Encouragingly, 54.3% reported that the pandemic either had no effect or just a limited effect on their studies. However, 38.5% reported that they felt always or frequently nervous or anxious during the pandemic. **Conclusion:** The study showed that pharmacy students had good knowledge as well as positive attitudes and good practices towards COVID 19 and the preventive measures. However, during the early months, the pandemic did have a negative psychological impact on a number of students. Consequently, proactive psychological and social support services to the students should be considered during the current and future pandemics as well as considering and proactively addressing key issues that could cause stress and anxiety among students when shifting to distance learning and assessments.

Keywords: Coronavirus, COVID-19, Mental health, Pharmacy, Saudi Arabia

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was first reported to the World Health Organization (WHO) country office in Wuhan, China on 31st December 2019 and on 30th January 2020 it was announced as a health emergency.[1-3] On 11th March, the WHO announced this disease as a global pandemic.[4] As of 9th January, 2021, there have been more than 87.3 million confirmed cases of COVID-19 with more than 1.89 million deaths globally.[5] The SARS-CoV-2 is a contagious virus and spreads from human to human primarily through respiratory droplets and potentially aerosol transmission.[6-8] The symptoms of COVID-19 infection include fever, cough, sore throat, fatigue and myalgia. In severe cases, it could lead to pneumonia, respiratory failure, cardiac arrest and death.[9] However, up to 70% of patients could have the virus without showing symptoms of the disease,[10-15] impacting on the control of the pandemic. Currently, preventive measures including social distancing, regular hand sanitization, regularly wiping surfaces, quarantining and the wearing face masks are the most effective methods to reducing the spread of the virus and its subsequent morbidity and mortality.[7,16-19] Whilst many treatments have been proposed to treat patients with COVID-19, to date only dexamethasone has been shown to be effective in well-conducted clinical trials including the UK Recovery Trial and the WHO Solidarity trial.[20,21] Consequently, many governments and health authorities, including the WHO, have been actively educating people to take preventive measures to reduce the spread including lockdown measures.[22-25]

However, we are aware that COVID-19 pandemic and the instigation of lockdown measures have negatively impacted on the management of non-communicable diseases (NCDs).[26,27] This includes a considerable impact on the mental health of the population exacerbated by a lack of social interactions and fears with future employment, [28-33] with COVID-19 and associated preventative measures increasing levels of anxiety, stress, frustration, depression, and insomnia as well as leading to emotional disturbance/alterations.[33-38]. Studies have also shown that work-related stress has increased among healthcare professionals (HCPs) during the pandemic.[39,40] For example, Akudjedu et al. reported that

63.2% of radiology workforce in the UK have experienced work-related stress during the pandemic.[40] In view of this, knowledge, attitude and practices towards the disease and associated preventive measures among the public and HCPs are an integral part to help control the spread of the pandemic and its impact. To date, there have been a number of studies assessing this among the general public,[41-47] healthcare professionals, [48-50] university students [51-54] as well as a mixed sample.[55] The findings suggest there was generally good knowledge and attitude towards COVID-19 and its associated preventative measures although room for behavioural improvement still exists.[41-45,48-55]

The first confirmed case of COVID-19 was reported in Saudi Arabia on 2nd March 2020. [56,57] Similar to other countries including South Korea, Taiwan and Vietnam that built on their experiences with other emerging infectious diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS),[25,58-60] Saudi Arabia was one of the first countries globally to introduce proactive and early precautionary measures to help reduce spread once introduced.[57,61-64] The proactive measures included travel restrictions, closing shopping malls and enforcing lockdown measures, implementing curfews, suspending schools, universities and prayers at mosques, and limiting the number of employees at workplaces except for essential and critical services.[57,61,62,64] As a result of these efforts, as of 9th January 2021, there were only 363692 confirmed cases and 6286 deaths in Saudi Arabia,[65] with preventative measures still in place. Online and distance learning at the schools and universities[66], as well as working from home, has been facilitated by major investments in digitalization, technology and artificial intelligence in Saudi Arabia in line with its 2030 vision.[67]

As a consequence of the pandemic, universities across countries including Saudi Arabia shifted their teaching to complete virtual and distance learning. However, we are aware this is likely to pose additional challenges to students at this anxious time, with levels of mental health disorders is already a concern among the population,[68-82] and potentially exacerbated in university students. For instance, studies from the United States (US) reported that over 70% of the college students had increased stress and anxiety levels arising from the COVID-19 pandemic, although lower levels have been seen in China.[74,83,84] However, we were unaware of any study conducted to date in Saudi Arabia to evaluate the knowledge, attitude and practice (KAP) regarding COVID-19 and its impact on pharmacy students' mental health status.

This is important given the growing role for pharmacists in delivering healthcare, which has become even more critical during the pandemic to give advice on prevention to patients as well as help with availability and advice about medicines for patients with NCDs given the concerns reported in literature regarding the negative impact of the pandemic on the management of NCDs.[23,26,85-87] Pharmacy students are future key HCPs in the community helping to control the spread of future infectious diseases, as well as the impact of any unintended consequences of any future pandemic and its management. Therefore, we believe it is important to ascertain their KAP regarding COVID-19 and its impact on their mental health. Consequently, the findings can be used to provide guidance to implement future initiatives.

Methodology

Study design and settings

A cross-sectional, questionnaire-based study was conducted via a web-based survey. All doctor of pharmacy (PharmD) students (2^{nd} - 6^{th} year) of Unaizah College of Pharmacy, Qassim University were invited to participate in the study. A universal sampling method was used to collect the data using an online method. Consequently, all the 460 enrolled students in the college were invited to participate.

Development of the questionnaire

A KAP questionnaire was adopted with permission from the original authors.[43] The Cronbach's alpha coefficient for the KAP questionnaire from our study was 0.728, which was seen as acceptable and shows consistency.[88,89] An additional section was subsequently added. This included six questions to assess the psychological impact of COVID-19 on students' life and studies based on a review of the literature and the authors' experiences with this topic. The preliminary draft was discussed among the authors and was slightly modified after successive rounds of discussions. The modifications were minor and linguistic in nature to be suitable in the local context. To further ensure applicability, suitability and clarity in our setting, and to establish face and content validity, the draft questionnaire was given to four academicians for their review and comments. In addition, it was sent to ten pharmacy students for their review, comments and suggestions including its clarity, simplicity, and understanding. The questionnaire was subsequently refined

and finalized following their comments before distribution. The responses during the pilot testing were not included in the full study.

The final questionnaire was designed and implemented using a Web-based survey platform with security features (Survey Monkey 2020, California). This included 12 statements to examine participants' knowledge about COVID-19 (Table 2). A correct statement was given as a score of 1, and an incorrect one or do not know given a score of zero. The maximum knowledge score was 12. There were three attitude questions and three practice questions (Table 4). The last section included six questions to assess the psychological impact of COVID-19 on students' life and studies. The students were also given a list of choices about potential strategies adopted to improve their mental health status during curfew/lockdown periods based on previous studies and feedback. They were also given free space to write down any additional activities they were practicing.

Administration of the survey

The final paper questionnaire was converted to an online web-based survey. Before administration, the web-based survey was tested on different web browsers to ensure robustness. In addition, the layout was checked on different devices including laptops, tablets, and smart phones to ensure ease of reading and answering the questions. Other technical and security features were also considered including IP addresses and no more than one response from the same device. A message with a link to the web-based survey was sent to the class leaders to invite all the registered students at Unaizah College of Pharmacy to participate in the study. The invitation message was sent via WhatsApp to all the ten class leaders (one leader for each class; five in male campus and five in female campus for the professional PharmD years 2nd - 6th year). Subsequently, the class leaders delivered the invitation to their colleagues via the class WhatsApp groups. The invitation included the aim of the study, the estimated time to answer the questionnaire and statements on anonymity of responses. The participation in the survey was strictly voluntary. Consent to take part in the study was assumed once participants responded to the online survey. The survey was conducted from 9th till 29th May 2020. After the original/initial invitation, three reminders were subsequently sent to participants to enhance the response rate.

Data Analysis

Statistical analyses (data screening, descriptive and inferential analysis) were performed using IBM SPSS statistics 20.0. Descriptive statistics were used to summarize the students' responses to the KAP statements. These included frequencies, percentages, means, and standard deviations. Inferential statistics were used to ascertain the association between demographics and KAP level. Chi-square test for independence (χ^2 test), and its alternative Fisher's exact test, were used to examine the association for categorical variables while independent-samples t-test and one-way ANOVA were used to examine the difference in the participants' knowledge score in terms of their demographic characteristics, i.e. gender, education level, age, and health condition. A *p*-value of <0.05 was considered statistically significant.

Results

Demographic characteristics of the participants

A total of 232 out of 460 registered students took part in the study, giving a response rate of 50.43%. The mean age of the participants was 22.5 ± 1.70, and the majority of the participants were females (n=143; 61.64%). The participants were from all professional PharmD years (2nd - 6th year) with the highest proportion from the sixth year (n=64; 27.6%) followed by fourth year PharmD students (n=55; 23.8%). The vast majority of participants (n=214; 92.2%) did not have any coexisting diseases. Details of the demographics of the participants are given in Table 1.

[Please insert Table 1 here]

Knowledge, attitude and practice regarding COVID 19

Knowledge about COVID-19 among participants

The mean total knowledge score was 9.87 ± 2.04 out of the maximum attainable score of 12. Consequently, the overall rate of correct answers for the knowledge statements was 82%. The details are presented in Table 2.

[Please insert Table 2 here]

An analysis was performed to examine whether there were any statistically significant differences in the participants' knowledge score in terms of their demographic characteristics, i.e. gender, education level, age, and health condition (Table 3). No statistically significant differences were noted ($P > 0.05$). Consequently, as the univariate analysis showed no statistically significant associations, multivariate regression analysis was not conducted.

[Please insert Table 3 here]

Attitude and practice towards COVID 19 among participants

The majority of the participants (n=165; 71.1%) agreed that COVID-19 will finally be successfully controlled. At the early stages of the pandemic, the majority (n=163; 70.3%) believed that COVID-19 is a health threat to the community. Moreover, the vast majority of participants (n=216; 93%) were of the opinion that the lockdown situation will improve the situation in Saudi Arabia. Regarding practices towards COVID-19, 201 participants (86.6%) did not go to any crowded places during these days and 155 participants (66%) reported wearing a mask when leaving home. Moreover, the vast majority of participants (n = 211; 91%) reported that they were following the strategies recommended by the authorities, e.g. the Ministry of Health, to prevent infection and spread of COVID-19. The details of the replies to the attitude and practice questions are summarized in Table 4.

[Please insert Table 4 here]

The subsequent statistical analysis showed that there was no significant association between participants' characteristics i.e. their gender, education level, age, and health condition, and their attitude towards COVID-19 ($P > 0.05$) (Table S1). Similarly, a statistical analysis was performed to examine whether there were any associations between the sociodemographic characteristics and practices of the participants. As shown in Table S2, there was a statistically significant association between gender and the practice of going out to crowded places during the pandemic ($P = 0.005$). In this study, 131 (91.6%) of female participants reported avoiding any crowded places compared to 70 (78.7%) male participants.

Psychological Impact of COVID 19 on participants

Impact of COVID 19 on mental status of participants

More than one third of students (n= 89; 38.5%) reported that they felt always or frequently nervous or anxious during the current pandemic. Similarly, one third of students (n= 79; 34%) reported feeling down during the pandemic. However, a lower number (n= 59; 26%) reported always or frequently feeling little interest in doing things during COVID 19 pandemic. Details of the impact of COVID 19 on the mental status of students are given in Table 5.

[Please insert Table 5 here]

Impact of COVID-19 on overall concentration

When asked to what extent this pandemic had caused trouble concentrating, the majority of students (n=171; 73.7%) reported that the COVID-19 pandemic had no or limited impact on their overall concentration. However, approximately one quarter of participants (n=61; 26.3%) were affected. Figure 1 summarizes participant's responses.

[Please insert Figure 1 here]

Impact of COVID 19 on students' studies

More than half of the participants (n= 126; 54.3%) reported that the COVID-19 pandemic has either had no effect on their studies or just a limited effect. However, a considerable proportion of participants (n= 106; 45.7%) were affected by this pandemic. Details of the impact of COVID-19 on students' studies are summarized in Figure 2.

[Please insert Figure 2 here]

Overall, there was no significant association between participants' demographic characteristics, i.e. gender, education level, age, and health condition, and the statements related to the potential impact of COVID-19 on their concentration and studies ($P > 0.05$) (Table S3).

Strategies used to improve psychological health during the lockdown

Maintaining social connections through online communication followed by staying close to normal life activities and eating healthy food/doing exercise were among the most common strategies the participants adopted to improve their mental health during the lockdown (Table 6). Many additional activities were reported in the free space. These included watching movies, reading the Quran (the holy

book of Muslims), learning languages, providing families and community with reliable information about COVID-19, learning new things, e.g. painting and cooking, and playing online games.

[Please insert Table 6 here]

Discussion

To the best of our knowledge, we believe this is the first study to evaluate the KAP regarding COVID-19 and its impact on pharmacy students' life and their studies in Saudi Arabia. The response rate of 50.43% was comparable to other studies conducted during the pandemic on this topic. [54,78] Pharmacy students appeared to have good knowledge about the current pandemic with 82% having appropriate knowledge, and for most knowledge items, the vast majority of students gave correct answers. This is encouraging especially with the survey being conducted in the early stage of the pandemic in Saudi Arabia, and that it is consistent with other studies showing university students had good knowledge of the pandemic.[51-53,90] Hamza et al. (2020) researching senior pharmacy students from Egypt found the mean score of COVID-19 related knowledge was 83%,[90] and Peng et al (2020) found that 82.3% of students in Shaanxi Province, China, also had good knowledge.[52] However, our students had better knowledge than those reported by Singh et al. (2020) in which the overall level of COVID-19 knowledge among students from India was only 66%.[54] One area of concern with our study was the fact that in the statement "eating or contacting wild animals would result in the infection by the COVID-19 virus" only 52.2% of pharmacy students answered it correctly while 26.3% were not sure. However, the students in our study had better knowledge compared to the finding from a Jordanian study in which only 34.8% of medical students stated that transmission from animals is unlikely.[53]

Encouragingly, the majority of pharmacy students believed COVID 19 is a serious disease and poses a health threat to the community with 93% believing lockdown and curfew during the early stages of the pandemic was required for controlling the pandemic. This is similar to a study in India where 99.1% of students believed lockdown is a good strategy to control the pandemic [54] as well as previous studies

conducted with the general population in Saudi Arabia,[63,91] India,[92,93] and Pakistan.[94] Perhaps not surprisingly, 91% of the student pharmacists stated they were following the strategies recommended by authorities to prevent the spread of the virus, reflected by 86.6% of participants reporting they did not go to any crowded places during the pandemic, consistent with the findings of Hamza et al. (2020).[90] In our study, female pharmacy students were more likely to report avoiding crowded places compared to males (91.6% versus 78.7%, respectively), in line with findings among the Saudi public in which females were more likely to follow precautionary and preventive measures compared to males (53.6% versus 40.6% respectively),[63] students from China in which female students had better scores from practice statements towards COVID-19 compared to males[63] and in Egypt where female students were 3.6 times more likely to avoid visiting crowded places than male students.[90]

In our study, 66% of participants reported wearing a mask when leaving home, similar to a study conducted among students in Jordan.[51] A recent study in Egypt also reported that approximately 50% of pharmacy students were wearing a mask when leaving home.[90] However, another study from Jordan reported that only 9.7% of students from six medical schools often or always wear a mask as a precautionary measure to prevent infection with the virus during the initial stage of the pandemic.[53] This difference, despite evidence suggesting that wearing a face mask could reduce the risk of infection,[16,95-97] could be explained by the fact that at the beginning of the pandemic, there were inconsistency regarding the advice for face masks although this changed.[96-98] Moreover, there was also a global shortage of masks initially with appreciable price rises in some countries.[25,99-103] This was seen initially in Saudi Arabia where approximately 35% of community pharmacies in some areas had face masks for sale from April 20 to May 15 2020.[104] Appreciable national efforts were subsequently made to ensure wide availability of masks to the public. Following this, facemask wearing became mandatory in public in Saudi Arabia enforced by penalty of 1000 SR on 30th May for violations.[105] Consequently, we believe these activities resulted in the response rates seen in our study.

Of concern is that almost one third of students in our study reported being psychologically affected by the pandemic, lower though than studies in the US.[74,84] However, similar to a study in Malaysia where 29.8% of surveyed students reported having anxiety,[75] in Ethiopia where the prevalence of anxiety and stress among university students was 27.7% and 32.5%, respectively,[76] and in Bangladesh where the prevalence of anxiety and stress among students was 33.3% and 28.5%, respectively.[79] Consequently, support such as psychological counselling services and other support services are important for

students during the pandemic. This could include digital psychological interventions such as digital applications, teleconsultations, and hotlines,[75,82] as well as workshops on coping mechanisms and strategies.[75] Alongside this, the shift to the emergency online learning should be undertaken in a smooth and careful way as this will be new to students and to avoid overloading students.[75] Encouragingly, more than half of the participants in our study (54.3%) reported that the pandemic has either had no or a limited effect, with only 26.3% reporting having difficulty concentrating. These findings are better than studies in the US where 75.3% and 89% of surveyed students respectively reported having difficulties in concentrating on academic work during the pandemic,[74,77] and 58.6% had issues with online learning.[77] A study with medical students from Australia also showed that 81% of students were concerned about the impact of the pandemic on their studies.[78] The high rates could be due to several factors. These include the abrupt shift to online distance learning and assessments, major changes in living environments/conditions, increased social isolation/less interaction at campus, as well increased as emotional and psychological distress.[74,75,77,78,80,106] These are all considerations for the future.

We believe the lower impact of COVID-19 on the psychological health of our students compared to other studies could be due to several factors. These include the Saudi government taking early preventive measures such as reassurance of the public about the current situation and frequent updates and announcement about their ongoing efforts to control the virus through many awareness campaigns conducted by Ministry of Health (MOH) and other government organizations using a variety of methods.[57,64,107] In addition, it was believed the Saudi government provided adequate resources and funding to help address the impact of the current pandemic. Alongside this, an appreciable investment in technology infrastructure and telehealth in recent years in line with Saudi vision 2030 was made.[67,108] This investment resulted in 19 applications and digital platforms in the health care sector being used during the pandemic, facilitating the provision of health services including telemedicine and telecare.[67] In addition, Qassim University had good technology infrastructure and e-learning systems even before the pandemic, and it was considered one of the most active e-learning universities in Saudi Arabia.[67] In addition, proactive strategies from students were helpful including staying as close to their normal life as possible, eating healthy food and doing exercise, maintaining social connection and communication online, and viewing the current situation as an opportunity to spend more time with family members and improve their skills in independent learning (Table 6).

However, we believe there are several lessons learned that could be useful to enhance the quality of pharmacy education globally during the pandemic and beyond to reassure students and reduce any associated anxiety and stress. We believe having good e-learning infrastructure including distance learning platforms is essential for the higher education institutions currently and in the future. This includes taking into consideration the appropriate re-structuring and formatting when converting traditional in-person teaching of courses to distance learning courses. We also believe that more investment in having telecommunication technology is necessary where pertinent to facilitate and sustain effective distance communication with students, academic faculty members, and administrative staff. Moreover, the availability of telemedicine and tele-delivery of supports services for pertinent students in a timely manner is also recommended during the pandemic and beyond. Furthermore, effective mechanisms are needed to ensure early identification and assistance of students from vulnerable groups such as those with pre-existing mental health problems with telemedicine and other services to ensure their mental health is not exacerbated by the pandemic. There is also a need to support students with currently limited access to digital devices or the internet, or having problems with accommodation, during the pandemic to help alleviate the impact of the pandemic on their mental health.[82]

Limitations

We are aware that the study had a number of limitations. Firstly, it was conducted with pharmacy students from only one University. Consequently, it might not be generalized to other student populations in this and other universities in Saudi Arabia. Secondly, being an online survey, we relied on the responders accurately documenting their understanding and feelings without the ability to check this. However, this typically applies to all online surveys. Despite these limitations, we believe the study does provide useful insights into students' perspectives and the impact of the pandemic on this population in Saudi Arabia and wider. Consequently, we believe the findings are useful to provide further guidance to education and health policy makers.

Conclusion

Pharmacy students in Saudi Arabia appeared to have good knowledge, positive attitude and good practices towards COVID 19 and the recommended preventive measures. In addition, several strategies were adopted by the students to stay positive and to cope with the situation during this pandemic. However, during the early months of the pandemic, this did have a negative psychological impact on a number of students. Consequently, proactive psychological and social support services to students should be considered essential during the pandemic. Alongside this, considering and proactively addressing key issues that could cause stress and anxiety among students when shifting to distance learning and assessments. More efforts may be needed to ensure that face-to-face courses are subsequently delivered in a suitable online format with pertinent assessments and tasks without overload. In addition, offering telemedicine and other support services to help preserve the mental health of students.

Abbreviations

COVID-19, Coronavirus disease; HCPs, Healthcare professionals; KAP, Knowledge, Attitude and Practice; MERS, Middle East Respiratory Syndrome; MOH, Ministry of Health; NCDs, non-communicable diseases; PharmD, Doctor of Pharmacy; SARS, Severe Acute Respiratory Syndrome; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SD, Standard deviation; UK, United Kingdom; US, United States; WHO, World Health Organization.

Ethical approval

Ethical approval was obtained from the Committee of Health Research Ethics, Deanship of Scientific Research, Qassim University (Approval No. 19-11-01).

Data Sharing Statement

The data will be available from the corresponding author upon reasonable request.

Disclosure

The authors declare that they have no competing interest.

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Table 1: Demographic characteristics of participants (N=232)

Characteristics	n (%)
Age (Mean ± SD)	22.5 ± 1.70
Gender	
Male	89 (38.36)
Female	143 (61.64)
Year of Study	
2nd	39 (16.8)
3rd	35 (15)
4th	55 (23.8)
5th	39 (16.8)
6th	64 (27.6)
Coexisting disease	
Yes	18 (7.8)
No	214 (92.2)

Table 2: Knowledge about COVID 19 among participants (N=232)[a]

Questions	Yes n(%)	No n(%)	Don't know n(%)
K1. The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and muscle pain.	**209 (90.1)**	15 (6.5)	8 (3.4)
K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus.	**167 (72)**	34 (14.7)	31 (13.4)
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.	**212 (91.4)**	6 (2.6)	14 (6.0)
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.	**200 (86.2)**	17 (7.3)	15 (6.5)
K5. Eating or contacting wild animals would result in the infection by the COVID-19 virus.	50 (21.6)	**121 (52.2)**	61 (26.3)
K6. Persons with COVID-19 cannot spread the virus to others when the symptoms of COVID-19 are not present	12 (5.2)	**204 (87.9)**	16 (6.9)
K7. The COVID-19 virus spreads via respiratory droplets of infected individuals.	**210 (90.5)**	8(3.4)	14 (6.0)
K8. Ordinary individuals can wear general medical masks to prevent the infection by the COVID-19 virus.	**143 (61.6)**	67 (28.9)	22 (9.5)
K9. It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus.	25 (10.8)	**200 (86.2)**	7 (3.0)
K10. To prevent the infection by COVID-19, individuals should avoid going to crowded places and avoid gatherings.	**216 (93.1)**	8 (3.4)	8 (3.4)
K11. Test, Trace and Isolate (TTI) are the effective ways to reduce the spread of COVID-19.	**189 (81.5)**	2 (9)	41 (17.7)
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.	**218 (94)**	4 (1.7)	10 (4.3)

[a]Due to rounding, percentages may not add up to 100%. Note: Correct answers are presented in bold

Table 3: The difference among participants in terms of total Knowledge Score

Variables	n	Total Knowledge Score Mean (SD)	p-value[a]
Gender			
Male	89	9.71 (2.22)	0.352
Female	143	9.97 (1.93)	
Age			
19-21	64	9.88 (2.05)	0.948
22-24	136	9.84 (2.07)	
≥ 25	32	9.97 (1.99)	
Year of study			
2nd	39	9.77 (2.26)	0.758
3rd	35	9.80 (2.21)	
4th	55	9.98 (1.82)	
5th	39	9.54 (2.25)	
6th	64	10.06 (1.89)	
Coexisting disease			
Yes	18	10.00 (1.94)	0.773
No	214	9.86 (2.06)	

[a] Independent - samples t-test and one-way ANOVA were used.

Table 4: Attitude and practice towards COVID 19 among participants[a]

Questions	Yes n(%)	No n(%)	Not sure n(%)
Attitude			
A1. Do you agree that COVID-19 will finally be successfully controlled?	165 (71.1)	17 (7.3)	50 (21.6)
A2. Do you think that COVID-19 is a threat for your community?	163 (70.2)	25 (10.8)	44 (19)
A3. I think that the lockdown would improve the overall well-being of the society in terms of controlling COVID-19 pandemic situation	216 (93)	6 (2.6)	10 (4.4)
Practice			
P1. In recent days, have you gone to any crowded place?	31 (13.4)	201 (86.6)	0 (0)
P2. In recent days, have you worn a mask when leaving home?	155 (66.8)	77 (33.2)	0 (0)
P3. Are you following the strategies recommended by authorities (e.g. Ministry of Health) to prevent the infection and spread of COVID-19?	211 (91)	7 (3)	14 (6)

[a]Due to rounding, percentages may not add up to 100%.

Table 5: Impact of COVID 19 on mental status of participants[a]

Descriptions	Always n (%)	Frequently n (%)	Occasionally n (%)	Rarely n (%)	Never n (%)
Feeling nervous/ anxious	37 (16)	52 (22.5)	75 (32)	53 (23)	15 (6.5)
Feeling hopeless/ down	33 (14)	46 (20)	59 (25)	55 (24)	39 (17)
Feeling little interest in doing things	27 (12)	32 (14)	53 (23)	63 (27)	57 (25)

[a]Due to rounding, percentages may not add up to 100%.

Table 6: Strategies used to improve mental health during the lockdown period[a]

Strategies	n (%)
Staying close to your normal life	152 (65.52)
Eating healthy food and doing exercise	145 (62.50)
Maintaining social connection and communication online	154 (66.38)
Viewing the current situation as an opportunity to spend more time with family members	123 (53.02)
Relying on authorities' information (e.g. Ministry of Health) to keep updated with the level of risk	132 (56.90)
Avoiding too much exposure to news about COVID-19	82 (35.34)
Viewing the current situation as an opportunity to improve skills in independent learning	121 (52.16)
Others	16 (6.90)

[a]This is a multiple response question

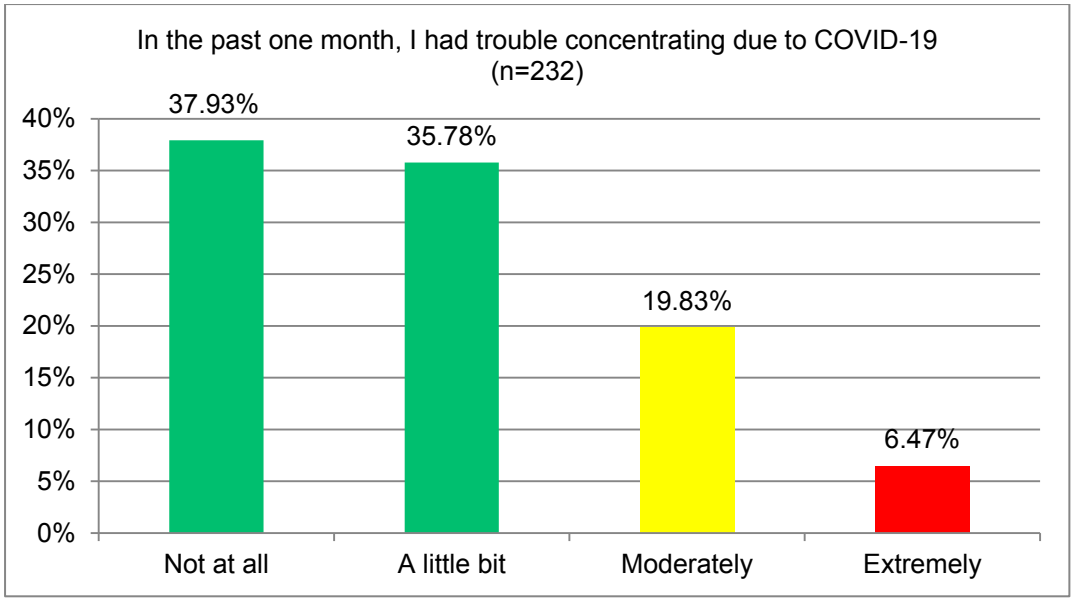

Figure 1: Impact of COVID-19 on overall concentration of students.

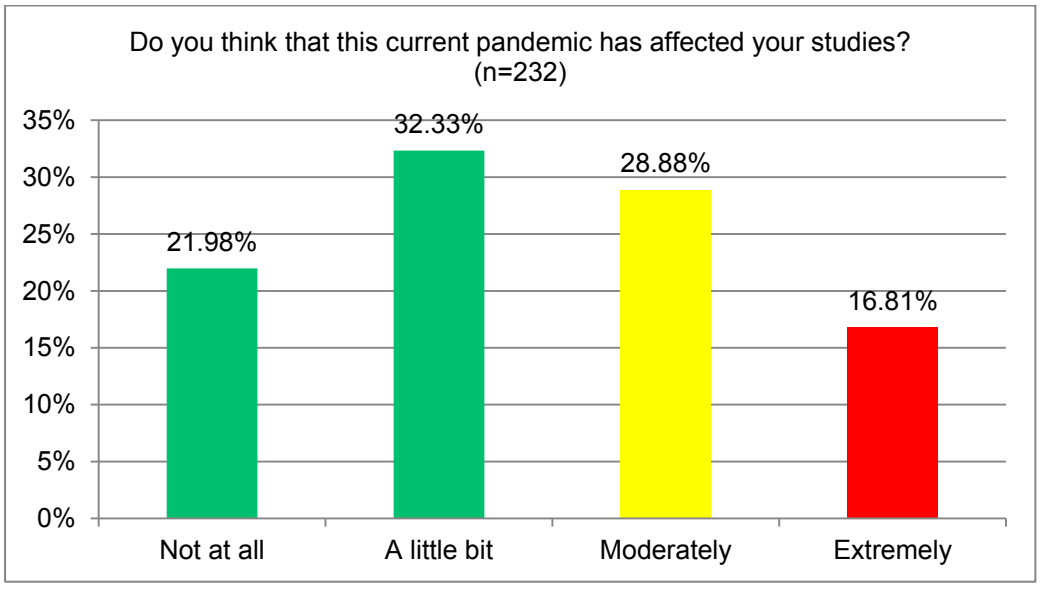

Figure 2: Impact of COVID-19 on the students' study during the early stage of the pandemic.

Table S1: Association between participants' demographic characteristics and attitudinal statements*

Attitude statement	A1			P value**	A2			P value**	A3			P value**
Variables	**Yes**	**No**	**Not sure**		**Yes**	**No**	**Not sure**		**Yes**	**No**	**Not sure**	
Gender												
Male	65(73.0)	9(10.1)	15 (16.9)	0.234	66(74.2)	11(12.4)	12 (13.5)	0.222	81(91)	3 (3.4)	5(5.6)	0.601
Female	100 (69.9)	8 (5.6)	35 (24.5)		97 (67.8)	14 (9.8)	32(22.4)		135(94.4)	3 (2.1)	5 (3.5)	
Age												
19-21	44(68.8)	4(6.3)	16(25)	0.665	47(73.4)	3(4.7)	14(21.9)	0.445	58(90.6)	0(0.00)	6(9.4)	0.054
22-24	95(69.9)	11(8.1)	30(22.1)		93(68.4)	18(13.2)	25(18.4%)		128(94.1)	4(2.9)	4(2.9)	
≥ 25	26(81.3)	2(6.3)	4(12.5)		23(71.9)	4(12.5)	5(15.6)		30(93.8)	2(6.3)	0(0.00)	
Year												
2nd	26 (66.7)	2(5.1)	11(28.2)	0.901	28 (71.8)	2 (5.1)	9 (23.1)	0.655	37(94.9)	0(0.0)	2 (5.1)	0.277
3rd	26 (74.3)	2 (5.7)	7 (20.0)		23 (65.7)	3(8.6)	9(25.7)		31(88.6)	1(2.9)	3(8.6)	
4th	36 (65.5)	6 (10.9)	13 (23.6)		39(70.9)	9(16.4)	7(12.7)		52(94.5)	1(1.8)	2(3.6)	
5th	30 (76.9)	3 (7.7)	6(15.4)		26(66.7)	5(12.8)	8(20.5)		35(89.7)	1 (2.6)	3 (7.7)	
6th	47(73.4)	4 (6.3)	13 (20.3)		47(73.4)	6(9.4)	11(17.2)		61(95.3)	3 (4.7)	0 (0.0)	
Coexisting disease												
Yes	14(77.8)	0 (0.0)	4 (22.2)	0.646	12(66.7)	1(5.6)	5(27.8)	0.578	16(88.9)	1(5.6)	1(5.6)	0.356
No	151(70.6)	17(7.9)	46(21.5)		151(70.6)	24(11.2)	39(18.2)		200(93.5)	5 (2.3)	9(4.2)	

**Due to rounding, percentages may not add up to 100%. **Chi-square test and its Fisher's exact test were used.*

Table S2: Association between participants' demographic characteristics and practice statements*

practice statement	P1		P value**	P2		P value**	P3			P value**
Variables	**Yes**	**No**		**Yes**	**No**		**Yes**	**No**	**Not sure**	
Gender										
Male	19(21.3)	70(78.7)	0.005	60(67.4)	29(32.6)	0.877	77(86.5)	4(4.5)	8(9.0)	0.182
Female	12(8.4)	131(91.6)		95(66.4)	48(33.6)		134(93.7)	3(2.1)	6(4.2)	
Age										
19-21	7(10.9)	57(89.1)	0.569	45 (70.3)	19 (29.7)	0.544	55 (85.9)	3(4.7)	6 (9.4)	0.495
22-24	18(13.2)	118(86.8)		87(64.0)	49(36.0)		126(92.6)	4(2.9)	6 (4.4)	
≥ 25	6 (18.8)	26 (81.3)		23 (71.9)	9(28.1)		30 (93.8)	0(0.0)	2 (6.3)	
Year										
2nd	1(2.6)	38 (97.4)	0.303	26 (66.7)	13 (33.3)	0.969	33(84.6)	2(5.1)	4(10.3)	0.406
3rd	6 (17.1)	29 (82.9)		23 (65.7)	12 (34.3)		31(88.6)	2(5.7)	2(5.7)	
4th	8(14.5)	47(85.5)		36 (65.5)	19 (34.5)		49(89.1)	3(5.5)	3(5.5)	
5th	6(15.4)	33(84.6)		28 (71.8)	11 (28.2)		37(94.9)	0(0.0)	2(5.1)	
6th	10(15.6)	54(84.4)		42(65.6)	22(34.4)		61(95.3)	0(0.0)	3(4.7)	
Coexisting disease										
Yes	1 (5.6)	17 (94.4)	0.311	12 (66.7)	6 (33.3)	0.989	16 (88.9)	0 (0.0)	2 (11.1)	0.480
No	30(14.0)	184(86.0)		143(66.8)	71(33.2)		195(91.1)	7 (3.3)	12(5.6)	

**Due to rounding, percentages may not add up to 100%. ** Chi-square test and its Fisher's exact test were used.*

Table S3: Association between participants' demographic characteristics and the statements related to impact on COVID-19 on their concentration and studies*

statement	Impact of COVID-19 on overall concentration				P value**	Impact of COVID 19 on studies				P value**
Variables	Not at all	A little bit	Moderately	Extremely		Not at all	A little bit	Moderately	Extremely	
Gender										
Male	33 (37.1)	29 (32.6)	17 (19.1)	10 (11.2)	0.135	17 (19.1)	29 (32.6)	21(23.6)	22 (24.7)	0.062
Female	55 (38.5)	54 (37.8)	29 (20.3)	5 (3.5)		34 (23.8)	46 (32.2)	46 (32.2)	17 (11.9)	
Age										
19-21	22(34.4)	21(32.8)	16(25.0)	5(7.8)		8(12.5)	26(40.6)	15(23.4)	15(23.4)	0.154
22-24	53(39.0)	49(36.0)	25(18.4)	9(6.6)	0.844	36(26.5)	38(27.9)	42(30.9)	20(14.7)	
≥ 25	13 (40.6)	13 (40.6)	5 (15.6)	1 (3.1)		7 (21.9)	11 (34.4)	10 (31.3)	4 (12.5)	
Year										
2nd	16(41.0)	14(35.9)	6(15.4)	3(7.7)	0.858	7 (17.9)	18 (46.2)	6 (15.4)	8 (20.5)	0.523
3rd	10 (28.6)	13 (37.1)	10 (28.6)	2 (5.7)		7 (20.0)	15 (42.9)	9 (25.7)	4 (11.4)	
4th	19 (34.5)	22(40.0)	10(18.2)	4(7.3)		13(23.6)	14(25.5)	18(32.7)	10(18.2)	
5th	17 (43.6)	10 (25.6)	8 (20.5)	4 (10.3)		10(25.6)	12(30.8)	11(28.2)	6(15.4)	
6th	26 (40.6)	24 (37.5)	12 (18.8)	2 (3.1)		14(21.9)	16(25.0)	23(35.9)	11(17.2)	
Coexisting disease										
Yes	8 (44.4)	5 (27.8)	5 (27.8)	0(0.0)	0.499	5 (27.8)	8 (44.4)	5 (27.8)	0 (0.0)	0.230
No	80 (37.4)	78 (36.4)	41 (19.2)	15 (7.0)		46(21.5)	67(31.3)	62(29.0)	39(18.2)	

**Due to rounding, percentages may not add up to 100%. ** Chi-square test and its Fisher's exact test were used.*