MEDICAL SCIENCE

To Cite:
Alshammari SA, Alaraifi DK, Albassam FA, Alzahrani SA, AlWatban LH, Alharbi RM, Alkhalil MJ. Knowledge, attitudes and preventive behaviors toward COVID-19 among school students in Riyadh, Saudi Arabia. *Medical Science* 2023; 27: e343ms3167
doi: https://doi.org/10.54905/disssi.v27i139.e343ms3167

Authors' Affiliation:
[1]Dept Family & Community Medicine, College of Medicine, King Saud University Medical City, King Saud University, Riyadh, Saudi Arabia
[2]Medical Intern, College of Medicine, King Saud University Medical City, King Saud University, Riyadh, Saudi Arabia

[*]**Corresponding Author**
Dept Family & Community Medicine, College of Medicine, King Saud University Medical City, King Saud University, Riyadh, Saudi Arabia
Email: amsahsa@gmail.com

Contact List

Sulaiman Abdullah Alshammari	amsahsa@gmail.com
Dimah Khalid Alaraifi	Dimahalaraifi@gmail.com
Fatimah Abdulrahman Albassam	Fatimahbassam@gmail.com
Shahad Awadh Alzahrani	Shahadalzahrani11@gmail.com
Layan Hassan AlWatban	Alwatbanlayan@gmail.com
Rawan Mohammed Alharbi	Rawanmsabil@gmail.com
Marwah Jassim Alkhalil	Marwah.j.97@gmail.com

ORCID List

Sulaiman Abdullah Alshammari	0000-0001-9596-5590
Dimah Khalid Alaraifi	0009-0003-9036-5037
Fatimah Abdulrahman Albassam	0009-0009-5763-7559
Shahad Awadh Alzahrani	0009-0009-6158-0030
Layan Hassan AlWatban	0009-0005-3434-5095
Rawan Mohammed Alharbi	0009-0007-4742-597X
Marwah Jassim Alkhalil	0009-0006-2382-0185

Peer-Review History
Received: 18 June 2023
Reviewed & Revised: 22/June/2023 to 25/August/2023
Accepted: 29 August 2023
Published: 02 September 2023

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

DISCOVERY
SCIENTIFIC SOCIETY

Knowledge, attitudes and preventive behaviors toward COVID-19 among school students in Riyadh, Saudi Arabia

Sulaiman Abdullah Alshammari[1*], Dimah Khalid Alaraifi[2], Fatimah Abdulrahman Albassam[2], Shahad Awadh Alzahrani[2], Layan Hassan AlWatban[2], Rawan Mohammed Alharbi[2], Marwah Jassim Alkhalil[2]

ABSTRACT

Background: Coronavirus is highly contagious with no known effective treatment yet. However, being well-informed about the disease and how it spreads and adopting preventative measures can stop or slow its transmission. *Objectives:* This study examines school students' knowledge, attitudes, and behaviors about COVID-19 in Riyadh. *Method:* Students aged 12 to 18 participated in this cross-sectional study from different schools in Riyadh from April to June 2022. The data was collected through an online survey using a pre-validated Arabic questionnaire. *Results:* Among 253 students, 91.3% showed a high level of knowledge about the transmission of COVID-19. Furthermore, students reported that fever 94.5%, loss of taste and smell 92.5%, and headache 87.7% were the top three common symptoms. The older versus younger OR=0.306, 95%CI: (0.092-1.024), p<0.05, and secondary school students versus intermediate school students OR=0.243, 95%CI: (0.072-0.819) p<0.02 predicted the high knowledge score. 69.2% of students favor informing the health authorities when they have symptoms, and 71.9% agreed to be isolated if they contacted an infected person. The female students were keener than male students to practice the preventive measures (P-value <0.0001). Social media was the primary source of information. *Conclusion:* Most participants were well-informed, held rational attitudes, and took preventive measures against COVID-19. Respondents learned about COVID-19 via social media, demonstrating its positive influence on public health awareness. Our study may not reflect Riyadh schoolchildren's COVID-19 knowledge, attitudes, and preventative behaviors. It provides essential information to assist health organizations in creating and implementing preventive initiatives.

Keywords: Knowledge, Attitudes, Preventive Behaviours, COVID-19, School

Students

1. INTRODUCTION

The COVID-19 pandemic was triggered by the novel Coronavirus (SARS-CoV-2) initially presenting as a cluster of 'viral pneumonia' cases in December 2019 in Wuhan, China. The World Health Organization identified the COVID-19 outbreak as a pandemic on March 11, 2020 (Organization WH, 2020). Common symptoms of COVID-19 include an elevated temperature, lethargy, and a dry cough. At the same time, loss of taste or smell, nasal congestion, sore throat, headache, muscle or joint discomfort, vomiting, and diarrhea are some less common symptoms that may affect some people. Coronavirus is considered a very contagious infection, and preventing its spread is necessary since there is no effective treatment yet. The best technique for avoiding and slowing COVID-19 transmission is to be well-informed about the disease and how it spreads. Moreover, adopting the appropriate preventative measures is essential in lowering virus transmission (Organization WH, 2020b).

The first confirmed case in Saudi Arabia occurred on March 23, 2020 KoSA-MoH, (2020); following that, the number of patients began to increase in Saudi Arabia and peaked on June 18, 2020, with 4919 cases reported daily and 39 deaths. After that, the instances decreased until December 2020, when the cases began to rise again, peaking on January 19, 2022, with 5928 reported cases and 2 cases of death (Reuters-global-tracker, 2022). Since the first few cases were reported, the Ministry of Health has launched public awareness campaigns to educate the population about how COVID-19 is transmitted from one person to another. The Saudi Ministry of Health (MOH) joined the World Health Organization (WHO) in urging the international community to adopt several precautions to limit the risk of contracting or transmitting COVID-19.

Important preventative measures include maintaining a distance of at least 1 meter from others, putting on a properly fitted mask, and regularly washing hands or using an alcohol-based cleanse (Li et al., 2020). The MOH has also imposed strict restrictions to control viral transmissions, prohibiting outdoor activities, and limiting social interactions, mosque prayers, and online schooling. These Strong infection control measures are the most important intervention for limiting the virus's spread in healthcare settings and the general public (Saudi Press Agency, 2020; Alrashed et al., 2020). After one and half years of online schooling, the Ministries of Education and Health announced the resumption of the in-person attendance of intermediate and secondary school fully vaccinated students. Later on, January 23, 2022, these two ministries officially confirmed the resumption of primary school in-person attendance in Saudi Arabia (Blom et al., 2022).

Regardless of the significant national steps taken to prevent the outbreak, the effectiveness of these measures is mostly determined by public behavior. With the resumption of in-person attendance for all school students from all levels, it is important to assess students' knowledge, attitude, and practice toward COVID-19, influencing their commitment to adopt measures to prevent COVID-19 from spreading. This study assesses the knowledge, attitudes, and preventive behaviors toward COVID-19 among school students in Riyadh, Saudi Arabia, from April to June 2022.

2. MATERIALS AND METHODS

Study Design and settings

A cross-sectional study was conducted among school students in Riyadh, Saudi Arabia. Large groups of male and female students from different schools (governmental and private) in all Riyadh areas (north, south, central, east, and west) were subject to multiple questions to measure their knowledge, attitudes, and preventive behaviors toward COVID-19. The ages of the selected sample were 12 to 18 years old only. Students under 12 and above 18 years old were excluded. Not only was age the main factor of the selected sample, but also the capability. Special needs students with hearing, visual, or cognitive impairment were also excluded from the selected sample.

Sampling We used the following formula for cross-sectional studies.

$n = Z2\ [p(1-P)] / d2$

$n = (1.96)2\ [0.8164\ (1-0.8164)] / (0.05)2$

According to a previous study published in 2020 in Saudi Arabia Al-Hanawi et al., (2020), the overall knowledge about COVID-19 was 81.64% based on that knowledge with a 95% confidence interval (CI) and 5% margin of error, the optimal sample size calculated will be 230. 10% was added to compensate for the no response to end up with a sample size of 253 students.

Data collection

Data was collected from 312 students through an online self-administered survey distributed between school students using simple random sampling. 67 were excluded for not meeting the inclusion criteria (Figure 1). After coordinating with school authorities, the link was distributed via different social media platforms such as WhatsApp, Twitter, and Telegram. Data collection started from April to June 2022. The questionnaire was based on a pre-validated Arabic questionnaire developed and published by Abdelhafiz AS et al. (Abdelhafiz et al., 2020).

The investigators modified the questionnaire to adapt to the school students' situation in Saudi Arabia. We added the following questions: level of education of the students and the parents, history of COVID-19 infection, and history of receiving COVID-19 vaccine. Also, we deleted the following questions: area of collecting the questionnaire, family income, history of smoking, thinking that COVID-19 is a biological weapon, considering that the salary should not be reduced during COVID-19 quarantine, the willingness to get vaccinated if the vaccine existed and buying protective tools if it was in the appropriate price. We also modified the area of residence into five areas (north, south, central, east, and west) to fit Riyadh City more instead of urban and non-urban areas. Finally, the questionnaire consists of the following Study Variables:

1- Demographic variables such as age, sex, level of education, and residence.
2- Clinical situations such as previous infection and history of chronic diseases
3- Knowledge about the COVID-19 virus (27 items).
4- Attitude toward COVID-19 precautions (4 items).
5- Practice of preventive measures (13 items).

We use (Yes, No, and Not Sure) answers for the knowledge and Attitude toward COVID-19 precautions section. Moreover, we give 1 point for the correct response and zero for an incorrect or not sure response for the knowledge questions. However, a 5-point Likert scale (Certainly No, Mostly No, Not Sure, Probably Yes, Definitely Yes) was used for the Practice of preventive measures. Five academic experts (two family physicians, two school teachers, and one preventive medicine professor) reviewed the questionnaire. Before conducting the full-fledged research and data collection, the questionnaire was piloted on 20 students to ascertain clarity and applicability and to explore any obstacles or constraints. The estimated time needed to complete it was about 15 minutes. The authors modified the questionnaire according to the findings of the pilot investigation and excluded the participants who took part in the pilot study from the main study. Cronbach's alpha for the scale of the modified instrument was 80.2%.

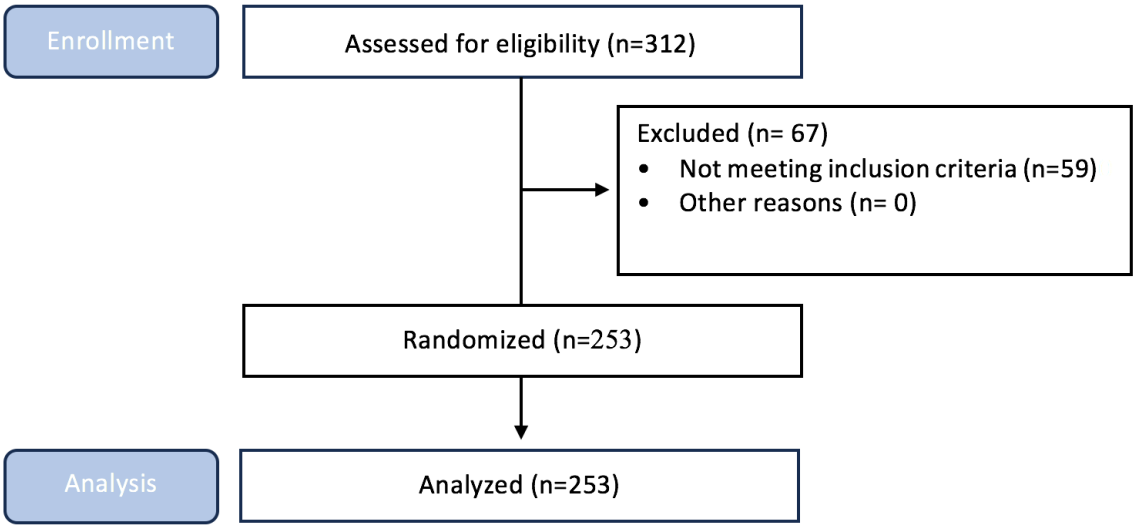

Figure 1 Flow chart of the study

Data analysis

Data were analyzed by IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). We calculated frequencies, percentages, median, and range to describe categorical and quantitative variables. Since the normality test showed the knowledge score median is 20, the range 25, min 1 - max 26, Skewness -2.091, and Kurtosis 8.813, We categorized the total score of the 27 knowledge questions into two as adequate (median score and above) and Inadequate (below median score) knowledge.

We used Mann Whitney U and Kruskal-Wallis test to compare the median scores among the various demographic and disease characteristics groups. Also, we categorized the knowledge score into <median and > median (%) to conduct Bivariate relationships of each categorical variable with knowledge score groups. This association was examined by the Chi-square test. While the binary logistic regression was applied, the status of the knowledge score was used as the dependent variable, while the age, sex, education level, chronic diseases, and past COVID-19 infection were used as independent variables. The probability of high knowledge score over the probability of knowledge score was presented as an odds ratio. A *p*-value <0.05 was considered significant at a 95% confidence interval.

Ethical approval

Ethical approval for this study was granted on May 29, 2022, by King Saud University institutional review board following the Helsinki Declaration (Approval number: E-22-6846). All participants gave their consent after being informed about this study's purpose. Information/Data is anonymous, and confidentiality is maintained. There are no rewards for those who participated, although we highly appreciate their cooperation with us in this study.

3. RESULTS

This study included 253 students from all over Riyadh. Of the participants, 134 (53%) were females, and 119 (47%) were males; 105 (41.50%) were 12-15 years old, and 148 (58.50%) were 16-18 years old. 108 (42.7%) were infected with COVID-19. Regarding the level of education of the parents, the majority of them had bachelor's degrees, fathers 105 (41.5%), mothers 110 (43.5%) (Table 1).

Table 1 Socio-demographic and clinical characteristics of the participants (n=253)

	Frequency	%
Age groups (year)		
11 – 15 y	105	41.50%
16 – 18 y	148	58.50%
Sex		
Male	119	47.00%
Female	134	53.00%
Region of Residence		
South of Riyadh	25	9.90%
North of Riyadh	80	31.60%
East of Riyadh	117	46.20%
West of Riyadh	12	4.70%
Middle of Riyadh	19	7.50%
Level of school studying		
Intermediate school	107	42.30%
Secondary school	146	57.70%
Father's education		
Below University	85	33.6%
University	168	66.4%
Mother's education		
Below University	114	45.1%
University	139	54.9%
Do you have any medical conditions?		
Yes	44	17.40%
No	209	82.60%
Have you got infected with Covid-19?		
Yes	108	42.7
No	145	57.3

The outcome measured three categories: Knowledge about COVID-19, Attitude toward COVID-19 precautions, and practice of preventive measures. Table 2 displays the differences in general knowledge regarding the transmission, symptoms, and prevention of the Coronavirus COVID-19 versus the students' responses. 231 (91.3%) of students indicated a high level of knowledge by knowing that the transmission route of COVID-19 was droplets and 206 (81.4%) knew it could spread through the surfaces touched by an infected person, and 195 (77.1%) knew that even if the infected person has no symptoms, Coronavirus can be transmitted.

Regarding the common symptoms of COVID-19, students reported fever, loss of taste and smell, and headache as the most common symptoms, as they were reported by 239 (94.5%), 234 (92.5%), and 222 (87.7%), respectively. 243 (96.0%) knew the virus was more dangerous during advanced age and having chronic diseases. Over 249 (98.4%) respondents agreed on the importance of hand washing, whereas 246 (97.2%) respondents agreed on mask-wearing during sickness and cleaning surfaces is a good practice (Figure 2).

Table 2 Knowledge about COVID-19 among the participants (n=253)

Knowledge items	Yes	No	Not sure
	No. (%)	No. (%)	No. (%)
Covid-19 spread by			
Droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales	231 (91.3%) *	8 (3.2%)	13 (5.1%)
Surfaces touched by a person who has the disease	206 (81.4%) *	13 (5.1%)	34 (13.4%)
Coins and Banknotes	146 (57.7%)	31 (12.3%)	76 (30.0%)
Pets	41 (16.2%)	125 (49.4%)	87 (34.4%)
Stool (in public bathrooms for example)	63 (24.9%)	100 (39.5%)	90 (35.6%)
Can the Corona virus be transmitted from a person who is infected but has no symptoms?	195 (77.1%)	16 (6.3%)	42 (16.6%)
Common symptoms include			
Fever	239 (94.5%) *	3 (1.2%)	11 (4.3%)
Dry cough	200 (79.1%) *	17 (6.7%)	36 (14.2%)
Body aches and pains	214 (84.6%)	15 (5.9%)	24 (9.5%)
Runny nose	165 (65.2%)	24 (9.5%)	64 (25.3%)
Diarrhea	93 (36.8%)	82 (32.4%)	78 (30.8%)
Nasal congestion	211 (83.4%)	12 (4.7%)	30 (11.9%)
Difficulty breathing	216 (85.4%)	12 (4.7%)	25 (9.9%)
Loss of test and smell	234 (92.5%)	9 (3.6%)	10 (4.0%)
Headache	222 (87.7%)	7 (2.8%)	24 (9.5%)
Skin rash	21 (8.3%)	149 (58.9%)	83 (32.8%)
The virus may be more dangerous for the elderly and those with chronic diseases?	243 (96.0%)	4 (1.6%)	6 (2.4%)
Measures to prevent viral spread include			
Proper hand washing and hygiene	249 (98.4%)	0 (0%)	4 (1.6%)
Maintaining an appropriate distance between yourself and anyone with symptoms	242 (95.7%)	4 (1.6%)	7 (2.8%)
Avoiding touching eyes, nose and mouth	233 (92.1%)	11 (4.3%)	9 (3.6%)
Putting on face masks in public spaces	246 (97.2%)	2 (0.8%)	5 (2.0%)
Taking antibiotic	79 (31.2%)	103 (40.7%)	71 (28.1%)
Eating garlic	60 (23.7%)	106 (41.9%)	87 (34.4%)

An effective vaccine against the virus is currently available	186 (73.5%)	30 (11.9%)	37 (14.6%)
An effective treatment against the virus is currently available	41 (16.2%)	135 (53.4%)	77 (30.4%)
Antibiotics can treat the disease	31 (12.3%)	112 (44.3%)	110 (43.5%)

*Correct answer

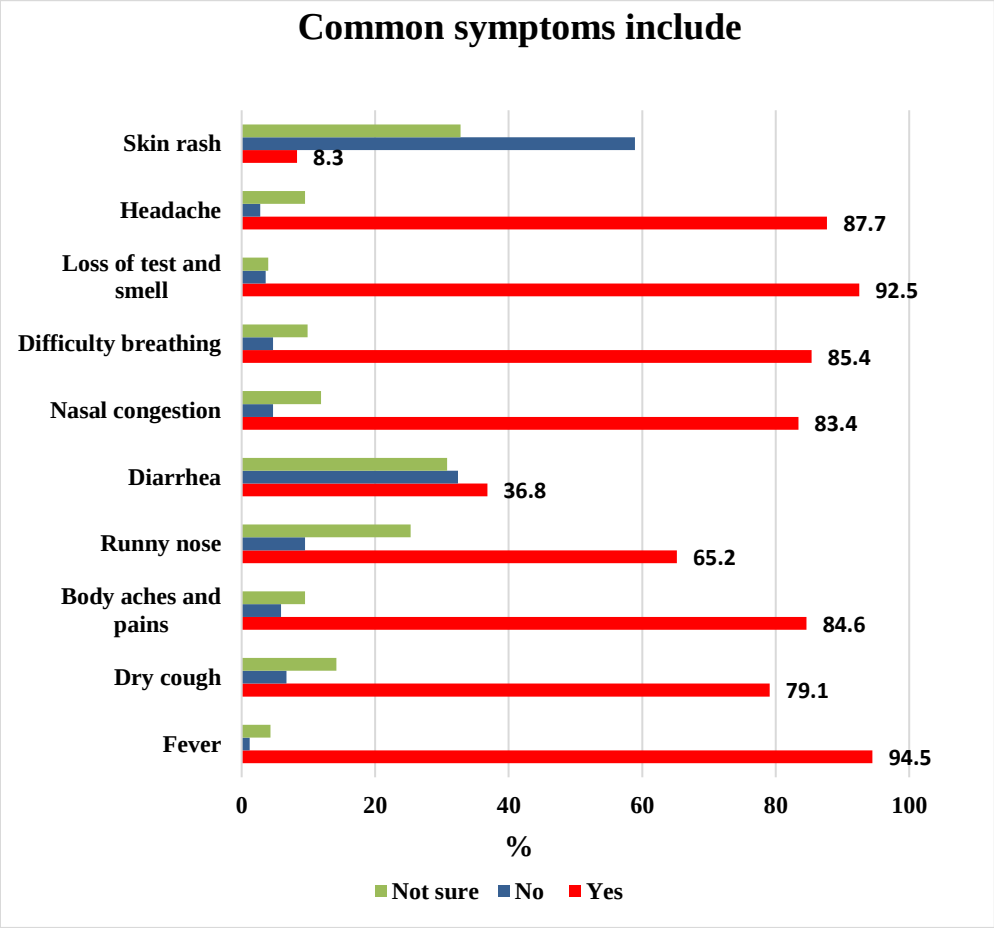

Figure 2 Bar diagram illustrates the common symptoms of COVID-19 as stated by the students.

Regarding students' perceptions about COVID-19, 159 (62.8%) think that infection with this virus is dangerous, and 177 (70%) worry about the probability of them or one of their families getting infected. 114 (45.1%) think that the dangers of the Coronavirus have been overstated in the media. However, 174 (68.8%) believe that infection with COVID-19 is not associated with stigma (Table 3, Figure 3).

Table 3 Perceptions of the participants about COVID-19 (n= 253)

Perceptions items	Yes		No		Not sure	
	No.	%	No.	%	No.	%
I think that infection with this COVID-19 is dangerous	159	62.8%	60	23.7%	34	13.4%
I am worried about the probability of me or one of my family getting infected with this virus	177	70.0%	68	26.9%	8	3.2%
Infection with COVID-19 is associated with stigma	32	12.6%	174	68.8%	47	18.6%

I've noticed that the media has exaggerated the dangers of the Corona virus.	114	45.1%	100	39.5%	39	15.4%

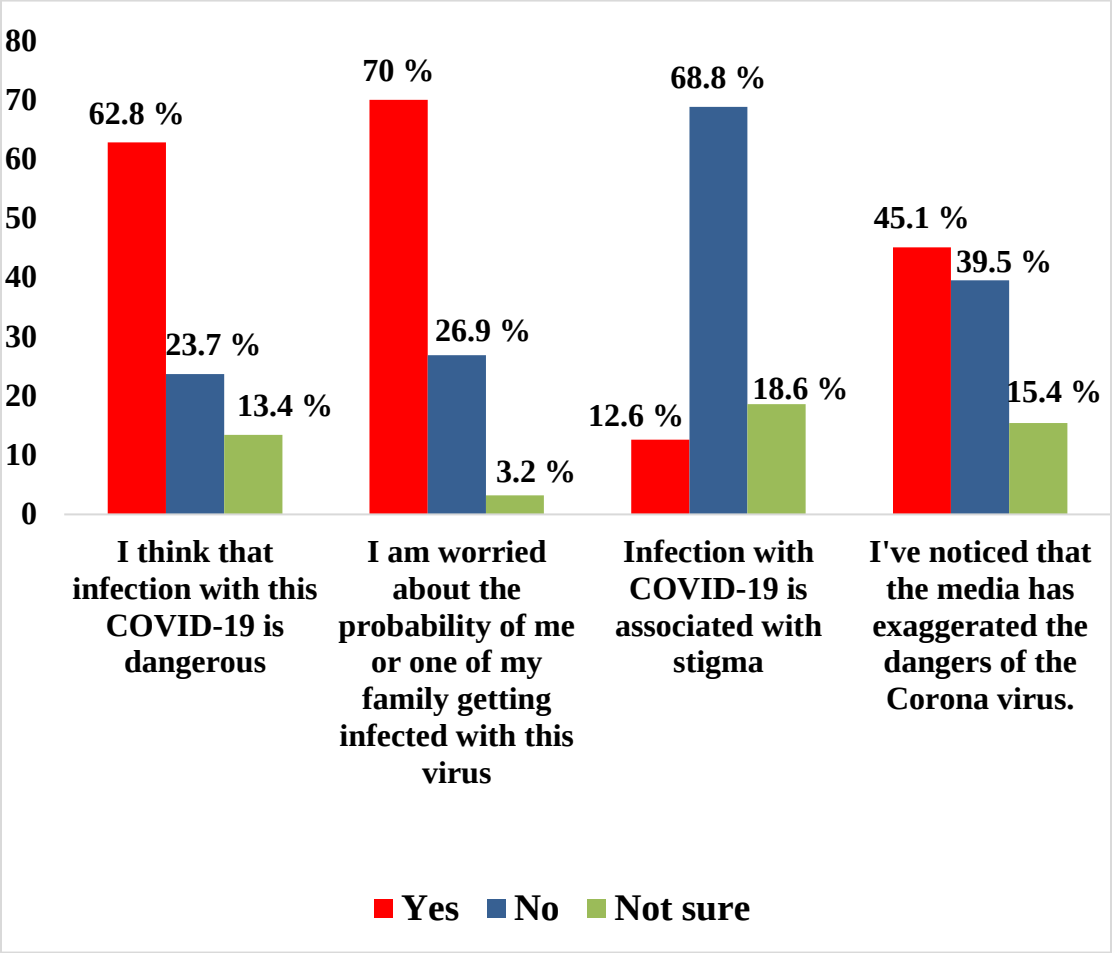

Figure 3 Bar diagram of the participants' perceptions about COVID-19

In regards to preventive measures, only 59 (23.3%) agreed with avoiding handshakes, and 83 (32.8%) avoided hugs; regarding hand washing, 159 (62.8%) washed their hands regularly and for enough periods. While people using face masks represent 138 (54.5%). 175 (69.2%) of the respondents were in favor of attitudes towards limiting the spread of COVID-19 by informing the health authorities when they have any of the symptoms associated with the disease, 182 (71.9%) agreed to be isolated if they contacted to a person infected with the virus. 152 (60.1%) agreed to use home tests for the detection of COVID-19 if they an available. 97 (38.3%) agreed that If flyers or brochures that include information about the disease are distributed, they will read them and follow the instructions mentioned (Table 4).

The total scores of preventive measures and practices that could limit the spread of COVID-19 were calculated, then comparisons were made with the demographic variables. We found no statistical differences except between male and female students (P-value < 0.0001). We found that female students are more careful than male students in taking preventive measures to limit the spread of the Coronavirus (Table 5).

Table 4 Attitude of the participants towards the preventive measures to limit the spread of COVID-19 (n= 253)

	Certainly No	Mostly No	Not sure	Probably Yes	Definitely Yes
	No. %	No. %	No. %	No. %	No. %
When I meet my friends and colleagues, I usually greet them with a handshake.	59 23.3%	60 23.7%	10 4.0%	58 22.9%	66 26.1%
When I meet my friends and colleagues, I usually greet them with a hug.	83 32.8%	66 26.1%	17 6.7%	54 21.3%	33 13.0%
I wash my hands regularly and for enough period of time.	23 9.1%	16 6.3%	15 5.9%	40 15.8%	159 62.8%
I usually put a face mask to protect myself from the risk of infection.	20 7.9%	31 12.3%	17 6.7%	47 18.6%	138 54.5%
If I found out that I contacted a person infected with the virus, I will inform the health authorities.	24 9.5%	26 10.3%	25 9.9%	44 17.4%	134 53.0%
If I have any of the symptoms associated with the disease, I will inform the health authorities.	22 8.7%	12 4.7%	15 5.9%	29 11.5%	175 69.2%
If I found out that I contacted a person infected with the virus, I agree to be isolated at home for a certain period of time until it is proven that I am free from the disease.	25 9.9%	7 2.8%	14 5.5%	25 9.9%	182 71.9%
If I found that I contacted a person infected with the virus, I agree to be isolated at an isolation hospital for a certain period of time until it is proven that I am free from the disease.	33 13.0%	30 11.9%	28 11.1%	40 15.8%	122 48.2%
If there is an available home test for the detection of COVID-19, I am willing to do it.	23 9.1%	13 5.1%	18 7.1%	47 18.6%	152 60.1%
I usually follow the updates about the spread of the virus in my country.	36 14.2%	42 16.6%	23 9.1%	59 23.3%	93 36.8%
I usually follow the updates about the spread of the virus worldwide	40 15.8%	43 17.0%	37 14.6%	68 26.9%	65 25.7%
If a lecture about the virus is organized either online or offline, I am willing to attend it.	64 25.3%	59 23.3%	43 17.0%	46 18.2%	41 16.2%

If flyers or brochures that include information about the disease are distributed, I will read them and follow the instructions mentioned in them.	34 13.4%	40 15.8%	31 12.3%	51 20.2%	97 38.3%

Table 5 Comparison total score of preventive measures and practices that could limit the spread of COVID-19 with respect to demographic characteristic variables.

		N	Mean	Std. Deviation	Minimum	Maximum	P-value
Age group	Low - 15 y	105	47.762	11.444	13.0	65.0	0.608
	16 - 18 y	148	47.007	11.565	13.0	65.0	
Sex	Male	119	44.538	11.727	13.0	65.0	< 0.0001
	Female	134	49.791	10.743	13.0	65.0	
Region of Residence	South of Riyadh	25	47.720	11.831	16.0	65.0	0.780
	North of Riyadh	80	47.575	10.085	13.0	63.0	
	East of Riyadh	117	46.906	13.054	13.0	65.0	
	West of Riyadh	12	44.75	8.688	25.0	55.0	
	Middle of Riyadh	19	49.895	7.788	39.0	61.0	
Level of school studying	Intermediate school	107	47.579	11.627	13.0	65.0	0.759
	Secondary school	146	47.130	11.439	13.0	65.0	
Do you have any medical conditions?	Yes	44	48.136	10.487	16.0	60.0	0.605
	No	209	47.148	11.716	13.0	65.0	
Have you got infected with COVID -19?	Yes	108	47.019	11.962	13.0	65.0	0.720
	No	145	47.545	11.177	13.0	65.0	

In regards to the sources of information about COVID-19, most of the students, 235 (92.9%), considered social media platforms as the primary information source, followed by family & friends 180 (71.1%), and TV 150 (59.3%).

Table 6 Binary logistic regression of influence of age, sex, area of residence, education, chronic medical condition and past infection with COVID -19 on the participants Knowledge towards COVID -19

Variables	Inadequate(< median) 96 (37.9%)	Adequate(≥ median) 157 (62.1%)	Unadjusted		adjusted	
			OR (95%CI)	P-value	OR (95%CI)	P-value
Age						
11-15 16-18	40 (38.1) 56 (37.8)	65 (61.9) 92 (62.2)	Reference 1.011 (0.604-1.692)	0.96	0.306 (0.092-1.024)*	0.05
Sex						
Female Male	50 (37.3) 46 (38.7)	84 (62.7) 73 (61.3)	Reference 0.945 (0.568-1.571)	0.98	0.978 (0.575-1.665)	0.93
Area of residence						
North of Riyadh Not North of Riyadh	29 (36.3) 67 (38.7)	51 (63.8) 106 (61.2)	Reference 0.900 (0.520-1.558)	0.70	1.189 (0.659-2.144)	0.56
School Level						

Intermediate Secondary school	45 (42.1) 51 (34.9)	62 (57.9) 95 (65.1)	Reference 1.352 (0.810-2.258)	0.24	0.243 (0.072-0.819)*	0.02
Father education						
Below Univercity Univesity	34 (40.0) 62 (36.9)	51 (60.0) 106 (63.1)	Reference 1.146 (0.667-1.947)	0.63	0.814 (0.445-1.487)	0.50
Mother education						
Below Univesity Univercity	44 (38.6) 52 (37.4)	70 (61.4) 87 (62.6)	Reference 1.052 (0.631-1.751)	0.84	1.094 (0.617-1.941)	0.75
Medical Conditions						
NO YES	80 (37.7) 16 (39.0)	132 (62.3) 25 (61.0)	Reference 0.947 (0.477-1.881)	0.87	0.971 (0.481-1.962)	0.93
COVID 19 Infection						
NO YES	57 (39.3) 39 (36.1)	88 (60.7) 69 (63.9)	Reference 1.352 (0.810-2.258)	0.60	0.824 (0.485-1.400) p.475	0.47

*= statistically significant, OR= odds ratio, CI= confidence interval

The unadjusted OR (95%CI) showed no significant difference in the median knowledge scores among the various groups. Binary logistic regressions showed the influence of age, sex, area of residence, education, chronic medical conditions, and past infection with Covid-19 on the participants' Knowledge of COVID-19. After adjustment, only older versus younger OR=0.306, 95%CI: (0.092-1.024), p<0.05, and Secondary school students versus Intermediate school students OR=0.243, 95%CI: (0.072-0.819) p<0.02predicted the high knowledge score (Table 6).

4. DISCUSSION

Since identifying the COVID-19 pandemic, the major way to limit the spread of the disease is to raise awareness of this contagious virus (Alshammari et al., 2020). Therefore, preventative strategies are crucial for lowering infection rates and preventing disease spread. This finding shows the importance of public adherence to preventive and control measures, determined by their knowledge, attitudes, and practices. In this study, 91.3% of the participants had a high level of knowledge about the disease's transmission routes, the spread of the virus through droplets and contaminated surfaces, and the potential transfer from asymptomatic infected people. These findings correspond with those reported in Egypt Shehata et al., (2021), where they demonstrated a good understanding of the COVID-19 transfer process among children. Additionally, similar results from two previous studies in Saudi Arabia among adults showed an appropriate level of knowledge with percentages of 81.64% and 89.4%, respectively (Al-Hanawi et al., 2020; Bazaid et al., 2020).

Similar findings were reported from different older populations; older participants in Malaysia, KSA, and China had higher levels of knowledge (Azlan et al., 2020; Zhong et al., 2020; Alahdal et al., 2020). Most participants in our study were aware of the typical clinical symptoms of COVID-19, as 94.5%, 92.5%, and 87.7% of the population recognized fever, taste and smell loss, and headache as the top 3 symptoms, respectively. However, 36.8% of our participants think that diarrhea is one of the symptoms of COVID-19. This result is similar to a study conducted in Egypt, where they found less knowledge regarding diarrhea as part of COVID-19 clinical manifestations (Shehata et al., 2021). Only 51.9% of Palestinian university students knew that diarrhea could be one of the COVID-19 infection presentations (Salameh et al., 2021). In addition, only 8.3% of our study reported that skin rash is one of the clinical symptoms which has been included as one of the COVID-19 symptoms recently (Organization WH, 2020b). Another Saudi research stated that 63% of their study population excluded skin rash from COVID-19 symptoms (Alahdal et al., 2020).

In regards to knowledge of preventive measures, in this study, a total of 98.4% of students agreed that hand washing is essential for preventing the COVID-19 virus, and 97.2% and 95.7% of respondents were aware of the need to wear a face mask and keeping enough social distance respectively. Similarly, in Egypt, 97% of school children had a prevention score >50%, which indicates a high level of knowledge (Shehata et al., 2021). Studies conducted in Italy and Jordan also showed enough knowledge of preventive practices (Gallè et al., 2020; Khasawneh et al., 2020). Other surveys revealed a high awareness of preventive measures (Al-Hanawi et al., 2020; Gallè et al., 2020; Khasawneh et al., 2020; Alahdal et al., 2020). Surprisingly, a study in Saudi Arabia showed that nearly 13% of respondents agreed that socializing with family and friends can reduce the spread of COVID-19 (Alahdal et al., 2020). A survey conducted in the US showed that 30.2% of their participants needed to be made aware of the preventive measures for COVID-19 (Wolf et al., 2020).

This study found that 70% of the students were worried about the possibility of spreading COVID-19 to them or their families. An observation was also reported in Nepal, where most students expressed a major concern regarding the infection by this virus Subedi et al., (2020); according to a study conducted in the US, 24.6% of participants were also worried about it (Wolf et al., 2020). Moreover, 92% of respondents in UAE were concerned that a family member might be infected with COVID-19, compared to 63% who were worried about getting infected (Baniyas et al., 2021). According to this study, 62.8% of students perform excellent hand hygiene. Additionally, 69.2% believed reporting COVID-19 symptoms to the appropriate medical authorities is important to prevent the disease from spreading. Moreover, 70% of those students agreed to isolate themselves when they contacted with infected people. A higher percentage was reported among school children in Egypt; 97% of participants had practice scores>50% (Shehata et al., 2021).

Moreover, most school students in Nepal follow preventive practices (Subedi et al., 2021). On the other hand, a lower percentage was found among school students in Ethiopia; 47% of the respondents had good practices of COVID-19 prevention (Yesuf and Abdu, 2022). Also, children in China adhered to preventive measures less frequently. Only 42.05% of primary school students experienced good hand washing; girls reported 1.12 times higher adherence than boys. In addition, only 32.47% used a face mask properly (Chen et al., 2020). Similarly, females were significantly more willing to follow preventive practices than males. This finding was also reported in several other studies conducted among adults Al-Rawajfah et al., (2021), Bazaid et al., (2020) in these studies, females were more likely than men to follow the preventive practices.

Finally, social media platforms were the main source of information regarding COVID-19 among most of this study's respondents, which was reported in multiple other studies (Yesuf and Abdu, 2022; Hager et al., 2020; Sharma et al., 2021; Xu et al., 2020). Although, a study reported having the highest trust in the Ministry of Health and the least faith in social media (Salameh et al., 2021). From the pandemic's early days, the health authority developed appropriate mitigation strategies to bridge the gap in perception of susceptibility, seriousness, benefits and motivation, and barriers among people toward COVID-19. This was successfully reflected in the high knowledge level, a positive attitude, and good precautions and practices related to COVID-19 in the current study (Alshammari et al., 2021; Alshammari et al., 2022b).

Furthermore, logistic regression findings showed that higher age and school grades predicted high student knowledge. This finding is logical since as children grow older and progress with their years of education comprehend the strategies to prevent and decline COVID-19 cases. During their efforts, the authority developed 19 online applications for people to use (Hassounah et al., 2020). Furthermore, due to previous investments in distance education, Saudi Arabia's 6 million pupils were able to access distance education (virtual school experience) one day after schools shut down due to the COVID-19 epidemic by using a custom-built "Madrasati" ("My School") platform. Students improved their digital literacy, independent learning, and critical thinking abilities (Blom et al., 2022).

Limitations of the study

The study was based on data collected from a single geographical region; therefore, the results cannot be generalized to schools in other areas of the country. We depended on participants' self-reporting of the practice of preventive measures, not subjected to independent verification. Recall bias is another potential limitation.

5. CONCLUSION

In this study, most participants showed a high knowledge level, a positive attitude, and good precautions and practices related to COVID-19. The majority of our study's respondents relied on social media platforms as a major provider of information about COVID-19, demonstrating the positive impact of social media platforms on public health awareness. Our study may not reflect the knowledge, attitudes, and preventive behaviors toward COVID-19 of all school students in Riyadh. However, it provides useful and valuable information that can help health organizations to design and implement prevention programs.

Acknowledgement

We thank the participants who were all contributed samples to the study.

Author Contributions

Sulaiman Alshammari: Conceptualization, Investigation, Supervision, Writing - Reviewing and Editing. Dimah Alaraifi, Fatimah Albassam, Shahad Alzahrani, Layan AlWatban, Rawan Alharbi, Marwa Alkhalil: Conceptualization, Methodology, Investigation, Data analysis, Writing - Original Draft.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES AND NOTES

1. Abdelhafiz AS, Mohammed Z, Ibrahim ME, Ziady HH, Alorabi M, Ayyad M, Sultan EA. Knowledge, Perceptions, and Attitude of Egyptians Towards the Novel Coronavirus Disease (COVID-19). J Community Health 2020; 45(5):881-890. doi: 10.1007/s10900-020-00827-7
2. Alahdal H, Basingab F, Alotaibi R. An analytical study on the awareness, attitude and practice during the COVID-19 pandemic in Riyadh, Saudi Arabia. J Infect Public Health 2020; 13(10):1446-1452. doi: 10.1016/j.jiph.2020.06.015
3. Al-Hanawi MK, Angawi K, Alshareef N, Qattan AMN, Helmy HZ, Abudawood Y, Alqurashi M, Kattan WM, Kadasah NA, Chirwa GC, Alsharqi O. Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. Front Public Health 2020; 8:217. doi: 10.3389/fpubh.2020.00217
4. Alrashed S, Min-Allah N, Saxena A, Ali I, Mehmood R. Impact of lockdowns on the spread of COVID-19 in Saudi Arabia. Inform Med Unlocked 2020; 20:100420. doi: 10.1016/j.imu.2020.100420
5. Al-Rawajfah OM, Al-Mugeed KA, Alaloul F, Al-Rajaibi HM, Al-Omari O. COVID-19 knowledge, attitude, and precautionary practices among health professional students in Oman. Nurse Educ Pract 2021; 52:103041. doi: 10.1016/j.nepr.2021.103041
6. Alshammari AS, Alshammari H, Alshammari S. Factors Associated with Adherence to COVID-19 Preventive Measures Among Saudi Arabians. Cureus 2021; 13(4):e14623. doi: 10.7759/cureus.14623
7. Alshammari S, Alalshaikh N, Alhosan Z, Alghtani Y, Alkublan K, Alquhidan M. Phone consultation during COVID-19 in the outpatient clinic at King Khalid University Hospital: What can we infer from this exciting experience for future practice? Med Sci 2022b; 26:ms190e2271. doi: 10.54905/disssi/v26i123/ms190e2271
8. Alshammari TM, Altebainawi AF, Alenzi KA. Importance of early precautionary actions in avoiding the spread of COVID-19: Saudi Arabia as an Example. Saudi Pharm J 2020; 28(7):898-902. doi: 10.1016/j.jsps.2020.05.005
9. Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. Plos One 2020; 15(5):e0233668. doi: 10.1371/journal.pone.0233668
10. Baniyas N, Sheek-Hussein M, Al-Kaabi N, Al-Shamsi M, Al-Neyadi M, Al-Khoori R, Ajab S, Abid M, Grivna M, Abu-Zidan FM. COVID-19 knowledge, attitudes, and practices of United Arab Emirates medical and health sciences students: A cross sectional study. PLoS One 2021; 16(5):e0246226. doi: 10.1371/journal.pone.0246226
11. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. PLoS One 2020; 15(12):e0243695. doi: 10.1371/journal.pone.0243695
12. Blom A, Boni A, Gregory L. Learning from Saudi Arabia's journey to digital and distance education, Published on Education for Global Development 2022.
13. Chen X, Ran L, Liu Q, Hu Q, Du X, Tan X. Hand Hygiene, Mask-Wearing Behaviors and Its Associated Factors during the COVID-19 Epidemic: A Cross-Sectional Study among Primary School Students in Wuhan, China. Int J Environ Res Public Health 2020; 17(8):2893. doi: 10.3390/ijerph17082893
14. Gallè F, Sabella EA, Da-Molin G, De-Giglio O, Caggiano G, Di-Onofrio V, Ferracuti S, Montagna MT, Liguori G, Orsi GB, Napoli C. Understanding Knowledge and Behaviors Related to CoViD-19 Epidemic in Italian Undergraduate Students: The EPICO Study. Int J Environ Res Public Health 2020; 17(10):3481. doi: 10.3390/ijerph17103481
15. Hager E, Odetokun IA, Bolarinwa O, Zainab A, Okechukwu O, Al-Mustapha AI. Knowledge, attitude, and perceptions towards the 2019 Coronavirus Pandemic: A bi-national survey in Africa. PLoS One 2020; 15(7):e0236918. doi: 10.1371/journal.pone.0236918
16. Hassounah M, Raheel H, Alhefzi M. Digital Response During the COVID-19 Pandemic in Saudi Arabia. J Med Internet Res 2020; 22(9):e19338. doi: 10.2196/19338
17. Khasawneh AI, Humeidan AA, Alsulaiman JW, Bloukh S, Ramadan M, Al-Shatanawi TN, Awad HH, Hijazi WY, Al-Kammash KR, Obeidat N, Saleh T, Kheirallah KA. Medical Students and COVID-19: Knowledge, Attitudes, and Precautionary Measures. A Descriptive Study from Jordan.

Front Public Health 2020; 8:253. doi: 10.3389/fpubh.2020.00253
18. KoSA-MoH. MOH Reports First Case of Coronavirus Infection 2020.
19. Li JY, You Z, Wang Q, Zhou ZJ, Qiu Y, Luo R, Ge XY. The epidemic of 2019-novel-coronavirus (2019-nCoV) pneumonia and insights for emerging infectious diseases in the future. Microbes Infect 2020; 22(2):80-85. doi: 10.1016/j.micinf.2020.02.002
20. Organization WH. General's Opening Remarks at the Media Briefing on COVID-19. World Heal Organ 2020; 4.
21. Organization WH. WHO target product profiles for COVID-19 vaccines 2020b; 3-29.
22. Reuters-global-tracker C. Saudi Arabia: the latest coronavirus counts, charts and maps 2022.
23. Salameh B, Basha S, Basha W, Abdallah J. Knowledge, Perceptions, and Prevention Practices among Palestinian University Students during the COVID-19 Pandemic: A Questionnaire-Based Survey. Inquiry 2021; 58:469580219939 44. doi: 10.1177/0046958021993944.
24. Saudi Press Agency. Kingdom's government decides to suspend attendance at workplaces in all government agencies for period of (16) days except for health, security, military and electronic security center 2020.
25. Sharma PYSK, Piyush AR, Yadav SK. Knowledge, attitude and practices regarding COVID-19 among school students of North India. Indian J Forensic Community Med 2021; 8:2 7-32. doi: 10.18231/j.ijfcm.2021.005
26. Shehata MA, Adel A, Armaneous AF, El-Sonbaty MM, Abdel-Atti M, El-Hariri HM, Kamel IH. Egyptian school children awareness and precautions in Covid19 pandemic: a cross sectional survey study. Bull Natl Res Cent 2021; 45(1): 39. doi: 10.1186/s42269-021-00495-0
27. Subedi D, Bhandari S, Gaire A, Kandel M, Subedi S, Karki S. Knowledge, Attitude, and Practices Associated with COVID-19 Among School Students in Bharatpur, Chitwan District of Nepal. Int J Med Stud 2020; 8:231–237. doi: 10.5195/ijms.2020.66
28. Wolf MS, Serper M, Opsasnick L, O'Conor RM, Curtis L, Benavente JY, Wismer G, Batio S, Eifler M, Zheng P, Russell A, Arvanitis M, Ladner D, Kwasny M, Persell SD, Rowe T, Linder JA, Bailey SC. Awareness, Attitudes, and Actions Related to COVID-19 Among Adults with Chronic Conditions at the Onset of the U.S. Outbreak: A Cross-sectional Survey. Ann Intern Med 2020; 173(2):100-109. doi: 10.7326/M20-1239
29. Xu H, Gonzalez-Mendez MJ, Guo L, Chen Q, Zheng L, Chen P, Cao X, Liu S, Sun X, Zhang S, Qiao Y. Knowledge, Awareness, and Attitudes Relating to the COVID-19 Pandemic Among Different Populations in Central China: Cross-Sectional Survey. J Med Internet Res 2020; 22(10):e22628. doi: 10.2196/22628
30. Yesuf M, Abdu M. Knowledge, attitude, prevention practice, and associated factors toward COVID-19 among preparatory school students in Southwest Ethiopia, 2021. PLoS One 2022; 17(1):e0262907. doi: 10.1371/journal.pone.0262907
31. Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT, Li Y. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. Int J Biol Sci 2020; 16(10):1745-1752. doi: 10.7150/ijbs.45221