

EVALUATION OF KNOWLEDGE ON THE PREVENTIVE PRACTICE OF COVID-19 AMONG MIDDLE-AGED ADULTS IN SAUDI ARABIA – A CROSS-SECTIONAL QUESTIONNAIRE BASED STUDY

MAHMOOD BASIL A. AL-RAWI¹, ABDULLAH M. ALOBAID², AHMED M. AL-WATHINANI³, ABDULMOHSEN ABDULAZIZ ISLAM ALAMEEN⁴, WAJID SYED^{5*}

¹Department of Optometry, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia

²Department of Trauma and Accident, Prince Sultan bin Abdulaziz College for Emergency Medical Services, King Saud University, Riyadh, Saudi Arabia

³Department of Emergency Medical Services Prince Sultan Bin Abdulaziz College for Emergency Medical Services, King Saud University, Riyadh, Saudi Arabia

⁴Prince Sultan Military Medical City, King Saud University, Riyadh, Saudi Arabia

⁵Department of Clinical Pharmacy, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

*corresponding author: wali@ksu.edu.sa

Manuscript received: June 2022

Abstract

The lack of knowledge about the diseases can increase the risk of transmission of infection particularly in elderly patients. This study is aimed to evaluate the knowledge on the prevention practice of COVID-19 among Middle-aged adults in the Riyadh region in Saudi Arabia. A cross-sectional internet-based study was conducted among Saudi adults living in the Riyadh region of Saudi Arabia using Google forms. The data collection was carried out using a convenience sampling technique over four months in 2021 (February to May) using structured pre-validated self-administered questionnaires. All participants for this study were recruited through social media platforms. Descriptive analysis was performed using SPSS and a p-value of < 0.05 indicated statistically significant results. Among the respondents a greater proportion of them were males 92.9% (n = 171), most of them were aged between 41 - 45 years old. Of the respondent's, half of them were (n = 92) were employed and 64.7% (n = 119) of them were Saudis. The most common symptoms of COVID-19 identified by Saudi adults were fever 97.8% (n = 180) followed by cough, 85.3% (n = 157), sore throat 68% (n = 125) and headache 72% (n = 132). Most of them (n = 172; 96.1%) agreed that the COVID-19 spreads *via* respiratory droplets of infected individuals. The most common complications reported were pneumonia 85.3% (n = 157), respiratory failure 77.7% (n = 143). Almost all participants 99% (n = 183) agreed that isolation in the proper place is the best way to prevent the spread of COVID-19. Also, most of the respondents agreed that wearing medical masks also helps in controlling the infection with the COVID-19 (n = 173; 94%). The middle-aged adults from Riyadh Region showed adequate knowledge of COVID-19 preventative measures. However, there is a need to implement educational interventions and training programs on infection control practices for COVID-19 across the countries in need.

Rezumat

Lipsa cunoașterii simptomelor bolilor poate crește riscul de transmitere a infecției, în special la pacienții vârstnici. Acest studiu își propune să evalueze cunoștințele privind practica preventivă COVID-19 în rândul adulților de vârstă mijlocie din regiunea Riyadh, Arabia Saudită. Studiul transversal a folosit formulare tip *Google Forms*, iar colectarea datelor a fost efectuată folosind o tehnică de eșantionare convenabilă pe parcursul a patru luni în 2021 (din februarie până în mai), utilizând chestionare structurate, prevalidate, autoadministrare. Toți participanții la acest studiu au fost recrutați prin intermediul platformelor sociale. $p < 0,05$ a indicat rezultate semnificative statistice. Dintre respondenți, o proporție mai mare dintre aceștia erau bărbați 92,9% (n = 171), majoritatea având vârste cuprinse între 41 - 45 de ani. Jumătate (n = 92) dintre ei erau angajați și 64,7% (n = 119) dintre ei erau originali din Arabia Saudită. Cele mai frecvente simptome ale COVID-19 identificate de adulții saudiți au fost febra, 97,8% (n = 180) urmată de tuse, 85,3% (n = 157), dureri în gât 68% (n = 125) și cefalee 72% (n = 132). Majoritatea dintre ei (n = 172; 96,1%) au fost de acord că COVID-19 se răspândește prin picături respiratorii de la persoanele infectate. Cele mai frecvente complicații raportate au fost pneumonia 85,3% (n = 157), insuficiența respiratorie 77,7% (n = 143). Aproape toți participanții 99% (n = 183) au fost de acord că izolarea este cea mai bună modalitate de a preveni răspândirea COVID-19. De asemenea, majoritatea respondenților au fost de acord că purtarea măștilor medicale ajută și la controlul infecției cu COVID-19 (n = 173; 94%). Adulții de vârstă mijlocie din regiunea Riyadh au demonstrat că prezintă cunoștințe adecvate despre măsurile de prevenire COVID-19. Cu toate acestea, este necesar să se implementeze programe educaționale și de formare privind practicile de control al COVID-19 în toate țările necesare.

Keywords: pneumonia, coronavirus, knowledge, fever, cough, flue, COVID-19

Introduction

During the first week of January 2020, an acute respiratory syndrome coronavirus-2, often known as SARS-CoV-2, caused widespread alarm among the people, becoming a national and international problem. It was classified as a serious pandemic by the World Health Organization (WHO) [1, 2]. As of July 6 2021, COVID-19 had been linked to 183,700,343 confirmed cases and 3,981,756 total deaths in 219 nations and territories [3]. As COVID-19 remains one of the most serious challenges for many countries throughout the world. Despite this, many countries are still fighting COVID-19, new strains of international level [4, 5]. In the recent months, Saudi Arabia and other countries, witnessed a substantial increase in COVID-19 infections, raising concerns about the possibility of new strains of the virus, which raise new pandemic [6, 7]. Furthermore, the Saudi public is being cautioned by the government about new preventive measures issued by the Saudi Ministry of Health if the public continues to ignore COVID-19 procedures [6, 7]. Although adherence to the guidelines published by the Ministry of Health is critical to the effectiveness of any approach to combat COVID-19, understanding the disease is also important [8-10]. Controlling the spread of new communicable illnesses requires knowledge of disease prevention and control [11, 12]. Lack of knowledge and practice in the area of chronic diseases was linked to greater morbidity and mortality, jeopardizing disease prevention and control [11, 12]. Additionally, the Ministry of Health in Saudi Arabia imposed several infectious control measures, similar to other international countries which include wearing masks, hand hygiene, and social distancing which contribute not only to the prevention of COVID-19, but also to decrease the incidences of other viral infections and pneumonia [13-15]. The Centres for Disease Control and Prevention (CDC) in conjunction with the National Institutes of Health (NIH) released several guidelines for the prevention and possible control of the COVID-19 infection which include social contacts restrictions, utilization of clinical supplies including face masks, hand sanitizers [16]. The Saudi Arabian Ministry of Health followed the CDC's advice to curb the spread of the disease. It is vital to follow the directions of the health care authorities to be successful in controlling the disease. The disease knowledge, which comprises knowledge of the causative agent, transmission and symptoms, has a significant impact on this practice [14, 15]. Numerous studies document that the gap or lack of knowledge about the diseases can increase the risk of infection transmission [14, 15, 17]. A previous study by Yasser and Thagfan reported that 96% of Saudi adults were aware of the clinical symptoms of COVID-19 and 57.9% were correctly identified that a stuffy nose and sneezing were less common in persons

infected with the virus. Similarly, in an early epidemic of COVID-19 [14], Zhong *et al.* observed a 90% knowledge score among the Chinese population [18], while the average knowledge score for Americans was 80% [19]. In Saudi Arabia, Alnasser *et al.* reported 89.6% of the knowledge score [11], while another similar study by Alhazmi *et al.*, in Saudi Arabia reported that 46% of them knew about complications of COVID-19 infection [20]. Therefore, this study aimed to investigate the Saudi public knowledge on the prevention measure of COVID-19 in Saudi Arabia.

Materials and Methods

A cross-sectional web-based online study was conducted between February and May 2021 targeting Saudi adults who were residents of Riyadh, the capital of Saudi Arabia. Data collection was carried out using valid, self-administered structured online questionnaires. Adults aged 18 and above, who were able to read and understand the local language were included in the study, illiterates, and other individuals who were left from the Riyadh region and living in other parts of the country were excluded from the study. The data collection was carried out using a convenience sampling procedure. This study was approved by the Institutional Ethical Committee College of Medicine King Saud University, Riyadh, Saudi Arabia.

Design of the questionnaires and data collection procedure

The survey tool was prepared after an extensive literature review, with similar studies published both nationally and internationally [11, 12, 14, 15, 17]. The questionnaires for this study were clustered into three parts. The first part of the survey deals with participants' demographics and basic information with a total of 5-items including respondents' gender, age, educational qualification, employment status and knowledge about the COVID-19 disease. The second part of the survey deals with COVID-19 knowledge on the preventive questionnaires including causative agent, mode of transmission, incubation period, complications, possible treatment and prevention control strategies (10-items). The third part contains one 1-item which asks respondents about the most common signs and symptoms of COVID-19. All the study questionnaires were assessed using closed-ended questionnaires and binary answers questionnaire. The prepared study tool was subjected to face and content validity by the team of 2 members (senior nursing professors and a researcher) from a college of pharmacy, King Saud University, Riyadh, Saudi Arabia, who were experts in preparing the research questionnaires.

The survey was then translated into the Arabic language by an independent translator and reviewed again for the appropriateness of the language. The questionnaire was then piloted among randomly selected ten

respondents. The respondents recruited in the pilot study were young Saudi adults and did not include in the final results. The reliability test was determined using Cronbach alpha of the questionnaire for knowledge 0.75, suggesting that questionnaires can be used to carry out the study. For data collection, we prepared a survey in Google forms.

The knowledge score on preventive practice measures was calculated for the knowledge questionnaire, by giving 1 score for to correct answer and 0 for the wrong answer. The mean knowledge score was prepared after computing all the individual items' scores. For data collection, we prepared a survey in Google forms using a convenience sampling procedure. The data was collected using social media as the potential platform, initially the survey was sent to our families and friends. The data collection was followed a snow-ball procedure, where respondents were approached in person through social media such as WhatsApp, Twitter, or Facebook. Before data collection, there was a separate question in the Google form, which explained the study's importance and confidentiality of the data, and respondents who filled the first questionnaire were considered as informed consent and directed to the main study.

Data analysis

The collected data were analysed using the IBM SPSS Statistics 22 (IBM Inc., Chicago, IL, USA) and IBM SPSS 22 (IBM Inc., Chicago, IL, USA) software. Descriptive statistics, frequencies, and percentages were used to summarize the data. Mean knowledge scores were calculated for the knowledge questionnaires. The non-parametric tests such as the Mann-Whitney U test and Kruskal–Wallis test were used, to find any difference between the knowledge scores concerning demographic characters of the respondents. A p-value of less than 0.05 was considered statistically significant.

Results and Discussion

A total of 184 respondents have completed the questionnaire. Among the respondents a greater proportion of them were males 92.9% (n = 171) than females 7.1% (n = 13). Approximately half of the participants (48.9%) were aged between 40 - 45 years old and one third (29.9%) of them were elderly aged 57 - 60 years. Among the respondents, 50% (n = 92) were employed. Furthermore, about 64.7% (n = 119) of them were Saudi nationals. With regards to the educational level, most of them, 83.2% (n = 153) were holding bachelor's degrees. Furthermore, details are presented in Table I.

Table I
Demographics of the respondents

Variables	n	%	
Gender	Male	171	92.9
	Female	13	7.1
Age (years)	41 - 45	90	48.9
	46 - 50	15	8.2
	51 - 56	24	13
	57 - 60	55	29.9
Nationality	Saudi	119	64.7
	Non-Saudi	65	36.3
Employment status	Employed	92	50
	Unemployed/students	92	50
Level of your educational	Primary school	1	0.5
	Secondary school	5	2.7
	Bachelor's degree	153	83.2
	Master's degree	9	4.9
	Ph.D. and above	16	8.7
Have you heard about the emerging coronavirus?	Yes	180	97.8
	No	4	2.2

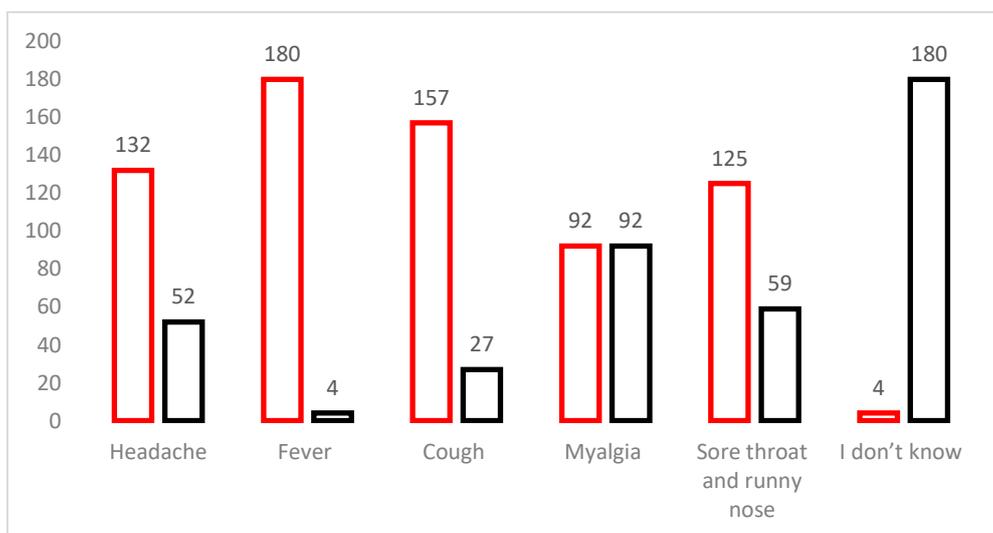


Figure 1.
Symptoms of COVID-19

Around 72% (n = 132) of the respondents said headache was the main symptom of COVID-19, while a majority of 97.8% (n = 180) thought fever, 85.3% (n = 157) thought cough and roughly 67% (n = 125) thought sore throat was the main symptom. Figure 1 shows a description of the responders.

Of the participant's majority, 97.8% (n = 180) knew about the emerging coronavirus and its outcomes, while 92.9% (n = 171) of the respondents believed that SARS-CoV-2 virus is the causative microorganism of COVID-19. A large majority of the respondents (n = 172; 96.1%) agreed that the COVID-19 virus spreads *via* respiratory droplets of infected individuals. However, slightly less than half (n = 90, 48.9%) of the respondents agreed that 7 - 14 days is the incubation period of novel coronavirus. Although, the majority of the respondents (n = 157, 85.3%)

believed that pneumonia is a virus-related consequence, mortality (n = 152, 82.6%), and respiratory failure (n = 143, 77.7%) were also mentioned. 65.2% (n = 120) agreed that supportive care is the COVID-19 treatment. The vast majority of respondents (n = 181) agreed that avoiding crowded settings, or public transportation, and practicing appropriate hand hygiene with soap and water are effective approaches for reducing COVID-19 infection. Almost majority of the participants (n = 183) felt that the best strategy to prevent the spread of COVID-19 is isolation in the proper location. In addition, the majority of respondents (n = 173; 94%) believed that wearing medical masks aids in the control of the COVID-19 infection. For each questionnaire, Table II shows the respondent's frequency.

Table II

Frequency of respondents on the knowledge of the preventive practice of COVID-19

Questionnaire	n	%	
Type of micro-organism responsible to cause COVID-19	Bacteria	1	0.5
	Fungus	1	0.5
	Virus	171	92.9
	Protozoa	1	0.5
	I don't know	10	5.4
The COVID-19 spreads <i>via</i> droplets of infected individuals	Correct	172	96.1
	Incorrect	7	3.9
The incubation period of novel coronavirus	2 - 7 days	9	4.9
	2 - 14 days	66	35.9
	7 - 14 days	90	48.9
	7 - 21 days	9	4.9
	I don't know	10	5.4
The complications of COVID-19	No complication	4	2.2
	Pneumonia	157	85.3
	Respiratory failure	143	77.7
	Death	152	82.6
	I don't know	15	8.2
The treatment of COVID-19 involves	Supportive care	120	65.2
	Antiviral therapy	37	20.1
	Vaccination	14	7.6
	I don't know	13	7.1
Proper hand wash is one method of preventing COVID-19	Correct	180	97.8
	Incorrect	4	2.2
To prevent infection, individuals should avoid crowded places	Correct	181	98.4
	Incorrect	3	1.6
Ordinary individuals can wear medical masks to prevent infection	Correct	173	94
	Incorrect	11	6
People who have contact with someone infected with the COVID-19 virus should be immediately isolated	Correct	181	98.4
	Incorrect	3	1.6
Isolation and treatment of people are effective ways to reduce the spread of the virus	Correct	183	99.5
	Incorrect	1	0.5

The average score for preventive knowledge among the respondents was 7.23 (SD = 0.89) (range 0 - 8). There was a strong association between the demographics of the respondents and their knowledge scores. On the knowledge scale, males scored significantly higher (7.26) than females (6.84) (p = 0.0001). Similarly, respondents aged 51 to 55 years had a higher COVID-

19 preventive knowledge score (7.45) than respondents of other ages, as indicated in Table III (p < 0.0001). Participants who were employed scored higher than those who were unemployed (p < 0.0001). Table III shows the statistically significant relationship between the preventive knowledge score and the demographics of the study participants.

Table III

Statistically significant relationship between the preventive knowledge score and the demographics of the study participants

Characteristics	Knowledge score (mean \pm SD)	Mean rank	p – value
Gender	Male	7.26 \pm 0.86	94.13
	Female	6.84 \pm 1.21	71.04
Age group	41 - 45 years	7.37 \pm 0.84	101.41
	46 - 50 years	5.93 \pm 1.27	36.70
	51 - 55	7.45 \pm 0.72	105.6
	56 – 60	7.25 \pm 0.61	87.41
Employment	Employed	7.34 \pm 0.83	86.23
	Unemployed	7.11 \pm 0.94	98.77
Nationality	Saudi	7.41 \pm 1.01	97.90
	Non-Saudi	7.40 \pm 0.58	89.55

*Mann-Whitney U; **Kruskal Wallis Test

The global spread of COVID-19 has resulted in enormous losses, not only in terms of public health, but also in terms of way of life. Prevention strategies and understanding of the disease are critical in minimizing infection rates and controlling the outbreak of this new infectious disease. In Saudi Arabia, just a few investigations are carried out during the second phase of COVID-19, assessing the general public's understanding of the continuing coronavirus. The purpose of this study is to determine whether Saudi adults are aware of the COVID-19. In this study, the mean knowledge score on a prevention measure of COVID-19 was 7.23% (SD = 0.89), which is similar to previous studies published in Saudi Arabia [12, 20]. Al-Hanawi *et al.*, on the other hand, found a high-level mean knowledge score of 17.96% [12]. Similarly, Alhazmi *et al.* reported an 81.3% knowledge score [20].

Although Tamang *et al.* performed a national study among Nepalese, it was found that 76% (n = 603) were knowledgeable about COVID-19 [21]. Akhtar *et al.* discovered that 20% of the student population knew the signs and symptoms of COVID-19, 22.5% knew the mechanisms of transmission [22]. The use of diverse study questionnaires or rating scales, as well as the type of study respondents and the study's sample size, could explain the disparities in knowledge between the current study and earlier studies at both the national and worldwide levels. In this study majority of the respondents correctly identified the causative agent and mode of transmission of the COVID-19, while the previous study by Alhazmi *et al.* reported similar findings [20]. In this study, 96.1% of the respondents correctly identified COVID-19 as a respiratory disease. These results are greater than those published in a previous study by Mabrouk *et al.*, who found that 90% of respondents correctly identified a respiratory condition. Our results, however, were lower in some elements, such as the incubation time. Slightly less than half (48.9%) were recognized it as 7 to 14 days in comparison to the Al-Rasheedi *et*

al. study where 94% of the respondents have recognized it correctly [23].

According to our findings, the majority of study respondents were aware of COVID-19. Similar results were reported by Mabrouk *et al.* [27], Yasser and Thagfan [14], and Mahmood *et al.* [24]. Our findings are better than the previous study by Yasser and Thagfan (91.7%) among the general public in Saudi Arabia [14]. Mahmood *et al.* among the general public of Pakistan 42.9% [24]. According to the current scenario, the COVID-19 virus is primarily spread between people through respiratory droplets or droplets of infected individuals who have respiratory symptoms (*e.g.*, coughing or sneezing). If a person comes into the close (within 1 m) contact, there is a risk of infecting his or her mucosa or eyes. When it came to prevention measures, the majority of the participants felt that wearing a facemask and avoiding crowds or keeping a social distance helps control the illness. Furthermore, this study results revealed that individuals who had contacted an infected person with COVID-19 should be immediately isolated in a proper place to reduce or control the chance of spreading the infection also most of the participants agreed that isolation and treatment are the effective ways to prevent the virus. These findings were consistent with previous findings by Alahdal *et al.*, Alahmadi and Thagfan., Chiu *et al.*, Wajid *et al.*, Alhazmi *et al.* and Mahmood *et al.* [10, 14, 15, 17, 20, 24,].

In this study, most common symptoms of COVID-19 identified by Saudi adults were fever 97.8% (n = 180), followed by cough, 85.3% (n = 157), sore throat 68% (n = 125) and headache 72% (n = 132), while the previous two studies, enclosed by Mahmood *et al.* and Jan *et al.* identified fever, cough and shortness of breath [24, 25]. The knowledge of the clinical presentation of the diseases in the current study was similar to earlier studies in China [15, 17, 18, 26]. The most common complications reported in this study were pneumonia, respiratory failure (77.7%). The mean score on the prevention knowledge of

COVID-19 was significantly different among males and females, where males have scored a higher prevention knowledge score of 7.26 ± 0.86 in comparison to females ($p < 0.0001$). Similarly, the mean prevention knowledge score was higher among elderly aged between 51 to 55 years (7.45 ± 0.72) in comparison to younger aged group ($p < 0.0001$). Similarly, the employment status of the respondents and nationality were significantly different in the COVID-19 prevention knowledge score ($p < 0.0001$). In this study, a higher level of prevention knowledge could be the reason for the Saudi Ministry of Health's continued awareness and strict laws and regulations. Although there are several limitations to this study: first, the data is limited to the central region, with a small sample size that cannot be representative of the entire Saudi population; second, this study used self-administered questionnaires via an online platform, which could lead to response bias.

Conclusions

In conclusion, the current study's findings revealed that Saudi individuals in the Riyadh region had acceptable knowledge of COVID-19 prevention practices. However, there is a need to raise awareness of the many COVID waves, which are still occurring, as well as to implement educational programs on infection control techniques for COVID-19 in all nations. Hopefully, COVID-19 will be phased out on a national and international scale shortly.

Acknowledgement

This study was supported by the Research Supporting Project, King Saud University, Saudi Arabia, (RSP-2021/378) who provided funding for this work.

Conflict of interest

The authors declare no conflict of interest.

References

- Dos Santos WG, Natural history of COVID-19 and current knowledge on treatment therapeutic options. *Biomed Pharmacother.*, 2020; 129: 110493: 1-18.
- World Health Organization (WHO), World Health Organization. Naming the coronavirus disease (COVID-19) and the virus that causes it.
- World Health Organization (WHO). World Health Organization Coronavirus (COVID-19) Dashboard, <https://covid19.who.int/>.
- Xu S, Li Y, Beware of the second wave of COVID-19. *Lancet*, 2020; 395(10233), 1321-1322.
- Nicholson P, Krings T, Time for a "Second Wave" of COVID-19 Data. *AJNR Am J Neuroradiol.*, 2021; 42(2): 262-263.
- Arab news. New Saudi health alert after virus cases surge, www.arabnews.com/node/1801331/saudi-arabia.
- Ministry of health MOH News, www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-09-27-006.aspx.
- Roy D, Tripathy S, Kar SK, Sharma N, Verma SK, Kaushal V, Study of knowledge, attitude, anxiety & perceived mental healthcare need in Indian population during COVID-19 pandemic. *Asian J Psychiatr.*, 2020; 51: 102083: 1-7.
- Latunji OO, Akinyemi OO, Factors influencing health-seeking behaviour among civil servants in Ibadan, Nigeria. *Ann Ib Postgrad Med.*, 2018; 16(1): 52-60.
- 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.
- Alnasser AHA, Al-Tawfiq JA, Al-Kalif MSH, Shahadah RFB, Almuqati KSA, Al-Sulaiman BSA, Alharbi KKS, Alabbad FYM, Alabbad JYM, Alquwaiz IAI, Almashama IKI, Public Knowledge, Attitudes, and Practice towards COVID-19 Pandemic in Saudi Arabia: A Web-Based Cross-Sectional Survey. *Med Sci (Basel)*, 2021; 9(1): 11: 1-12.
- 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: 1-10.
- Ministry of Health, Saudi Arabia. COVID-19 dashboard, <https://covid19.moh.gov.sa/>.
- Alahmadi YM, Al Thagfan SS, A nationwide study on the knowledge, awareness, and practices towards COVID-19 in Saudi Arabia. *Trop J Pharm Res.*, 2021; 20: 161-167.
- Chiu NC, Chi H, Tai YL, Peng CC, Tseng CY, Chen CC, Tan BF, Lin CY, Impact of Wearing Masks, Hand Hygiene, and Social Distancing on Influenza, Enterovirus, and All-Cause Pneumonia During the Coronavirus Pandemic: Retrospective National Epidemiological Surveillance Study. *J Med Internet Res.*, 2020; 22(8): e21257.
- Centers for Disease Control and Prevention (CDC). (2020-03-24). How to protect yourself, www.cdc.gov/coronavirus/2019-ncov/prepare/prevention.html.
- Varlas VN, Borş RG, Năsui BA, Mititelu M, Gheorghiu ARA, Pop AL, Key points in fertility preservation treatment strategies during COVID-19 pandemic. An update on pharmacological therapies. *Farmacia*, 2021; 69(2): 189-199.
- 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.
- Clements JM, Knowledge and Behaviors Toward COVID-19 Among US Residents During the Early Days of the Pandemic: Cross-Sectional Online Questionnaire. *JMIR Public Health Surveill*, 2020; 6(2): e19161.
- Alhazmi A, Ali MHM, Mohieldin A, Aziz F, Osman OB, Ahmed WA, Knowledge, attitudes and practices among people in Saudi Arabia regarding COVID-

- 19: A cross-sectional study. *J Public Health Res.*, 2020; 9(3): 1867: 345-353.
21. Tamang N, Rai P, Dhungana S, Sherchan B, Shah B, Pyakurel P, Rai S, COVID-19: a National Survey on perceived level of knowledge, attitude and practice among frontline healthcare Workers in Nepal. *BMC Public Health*, 2020; 20(1): 1905: 1-10.
22. Akhtar S, Alharbi AH, Jamal QMS, Nair KS, Knowledge and Source of Information of COVID-19 among Students of Health Informatics, Qassim University, Saudi Arabia. *J Pharmaceut Res Int.*, 2020; 32(24): 28-35.
23. Al-Rasheedi M, Alhazmi Y, Ali AM, ALrajhi M, Alharbi NS, Alsuhaibani S, Mohammed A, Alharbi G, Public and healthcare providers awareness of Coronavirus (COVID-19) in Qassim Region, Saudi Arabia. *Saudi J Biol Sci.*, 2021; 28(1): 90-98.
24. Mahmood S, Hussain T, Mahmood F, Ahmad M, Majeed A, Beg BM, Areej S, Attitude, Perception, and Knowledge of COVID-19 Among General Public in Pakistan. *Front Public Health*, 2020; 8: 602434: 1-8.
25. Jan BL, Albadrni B, Syed W, Ahmad A, Alkharfy KM, Knowledge and attitude of pharmacy students towards COVID-19 pandemic and its impact on their education and learning. *Farmacia*, 2022; 70(2): 372-378.
26. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung KSM, Lau EHY, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu W, Chen C, Jin L, Yang R, Wang Q, Zhou S, Wang R, Liu H, Luo Y, Liu Y, Shao G, Li H, Tao Z, Yang Y, Deng Z, Liu B, Ma Z, Zhang Y, Shi G, Lam TTY, Wu JT, Gao GF, Cowling BJ, Yang B, Leung GM, Feng Z, Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med.*, 2020; 382(13): 1199-1207.