COVID-19 Pandemic: Public Knowledge, Attitude, and Practice towards Social Distancing and its Impact on the Population and the Healthcare System in Saudi Arabia

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MM and AA Planned the project and supervised the findings of this work. Author AA generated the idea, design, data collection, data analysis, editing, writing proposal, literature review, writing manuscript. Author KA: Writing the proposal, literature review, writing manuscript, critical revision of the article and proofreading. Author NA contributed in the interpretation of the data, writing manuscript, and writing and revising the manuscript. Author KA: Writing proposal, literature review, and data collection. Author SA: Data collection and contributed to the final manuscript. Authors MM and AK article drafting, conception of the work and supervised the findings of this work. Authors AK, MM and AA revised and verified the manuscript before submission. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To determine the knowledge, attitude, and practice of Saudi population towards social distancing and COVID-19.

Study Design: Cross-sectional.

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Place and Duration of Study: This cross-sectional study was conducted in Riyadh city, the capital of the Kingdom of Saudi Arabia, during the national lockdown, between July 2020 and December 2020.

Methodology: This cross-sectional study was conducted in Riyadh, Saudi Arabia. A questionnaire composed of a total of 40 questions, which include socio-demographic, knowledge, attitude, and practice questions. According to the responses, a scale has been established in order to categorize the level of knowledge, attitude, and practice towards social distancing and COVID-19 into three categories; good, fair, and poor. One-way analysis of variance (ANOVA) and Independent t-test were used to determine the differences between categories. Multivariable linear regression analysis and Pearson’s correlation were performed in order to identify factors related to KAP.

Results: This study included 407 participants; more than half of them (54%) were females, while (46%) were males. All participants were 18 years and above. The participants showed a fair level of knowledge, a positive attitude, and good practices toward COVID-19.

Conclusion: The findings of this study suggest that Riyadh residents, especially females, have a fair level of knowledge, a positive attitude, and good practices toward COVID-19 and social distancing. More emphasis should be targeted on less educated population and men. This study may help policymakers to identify the target less knowledgeable groups for COVID-19 prevention and health education.

Keywords: Attitude; COVID-19; Knowledge; Practice; Saudi Arabia; Social.

1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which spread throughout China and received worldwide attention [1,2]. COVID-19 can result in severe sequelae ranging from pneumonia to severe hypotension, impairs sufficient blood perfusion to the organs, eventually resulting in multi organs failure [3]. The symptoms of COVID-19 are overlapping with other diseases. Thus a confirmatory tool is needed. The diagnostic investigations for COVID-19 are Chest CT and reverse-transcription polymerase chain reaction (RT-PCR) tests [4].

Social distancing is considered one of the comprehensive techniques to prevent the dissemination of many communicable diseases. Therefore, the impact of Social distancing plays a crucial role in controlling infectious diseases [5].

On March the second, 2020, the Kingdom of Saudi Arabia (KSA) announced the first case of COVID-19 in Qatif city, located in the eastern area of KSA. Immediately, the Saudi government issued strict rules such as social distancing, closed many unnecessary stores, which led to fewer incidence compared with other countries.

It is essential to understand the meaning of social distancing and its indications. Yet, people still confuse between social distancing, quarantine, and isolation. Social distancing indicates the reduction of interactions between people in the community, in which individuals may be infectious but have not yet been identified hence not isolated [6]. On the other hand, quarantine is indicated to persons suspected of having been exposed to a contagious disease but are not ill, either because they did not become infected or because they are still in the incubation period. Isolation is to separate ill persons with contagious diseases from non-infected persons [6].

The population knowledge and awareness during any pandemic play a huge role in limiting the transmission, and the course of any disease spread across the nation. For instance, the H1N1 influenza outbreak during 2009-2010 elicited a total of 36,000 deaths and over 200,000 hospitalizations while millions of the US population got the disease, one of the policies applied regarding healthcare pandemic control was the Optimal control theory (OCT) [7].

In OCT the social distancing and antiviral therapy are indicated in which combining social distancing implantation with therapy is theoretically controlling 99% of the disease if applied in early times of the outbreak [7].

To date, COVID-19 caused death more than MERS or SARS and it is the major pandemic across the globe nowadays. Although it needs further management other than spreading awareness and social acts to the general population. Still, the social distancing methods
are the most effective methods by far [8]. Therefore, this study aims to determine the knowledge, attitude, and practice of Saudi population towards social distancing and COVID-19, and to identify the less knowledgeable groups, factors influencing their level of knowledge, and how to increase the awareness and knowledge in these groups in order to reduce the incidence of the disease.

2. MATERIALS AND METHODS

This cross-sectional study was conducted in Riyadh city, the capital of the Kingdom of Saudi Arabia (KSA), in July 2020 during the national lockdown. Inclusion criteria were adults aged 18 years old and above and lives in Riyadh city. The sample was calculated using EPI INFO (Epidemiological Information Package), version 7.2. The minimum required sample size was calculated to be 385 participants at 95% confidence interval, 50% expected frequency and using a margin of error of ± 5%.

Due to the national lockdown it was not feasible to conduct a community-based sampling procedure. Therefore, it was decided to collect the data online using google forms. The online questionnaire was sent through social media platforms. The questionnaire was developed by the authors, according to most and recent guidelines provided by the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the Saudi Ministry of Health (MOH) [9-12]. In addition, the questionnaire was reviewed and content validated by three highly-qualified consultants in public health and community medicine.

The questionnaire was composed of a total of 40 questions which include socio-demographic, knowledge, attitude and practice questions. According to the responses a scale has been established in order to categorize the level of knowledge, attitude, and practice (KAP) of the participants into three categories: good, fair, and poor. The scores for good knowledge, attitude, and practice were ranged 9-19, 9-11, and 8-11, respectively. Scores for fair knowledge, attitude, and practice were ranged 5-9, 5-7, and 5-7, respectively. Any participant with lower scores categorized as poor.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. For descriptive analysis using frequencies and percentages for categorical variables, means and standard deviation for continuous variables. One-way analysis of variance (ANOVA) and Independent t-test were used to determine the differences between categories. Multivariable linear regression analysis and Pearson’s correlation were performed in order to identify factors related to KAP. A P-value of ≤ 0.05 was considered statistically significant.

3. RESULTS

A total of 407 participants, 54% (220) are females and males 46% (187). The majority of the participants are Saudi citizens 97% (395). Relationship status in Table 1 shows most of them are married 29.5% (120), and 13.8% of them were from the North of Riyadh 55.8% (230) were between the ages of 18 and 24, and the mean age is 29 years.

As shown in Table 1, most of the participants have a bachelor’s degree 60% (224), followed by high school education 20.6% (84). Also, more than half of the participants are students 55.8% (227) and employed 26% (106). All of the participants are living in Riyadh city, Saudi Arabia.

The participants were grouped according to the area, majority of them were from the North of Riyadh 55.8%, the second most group were from East of Riyadh 21.1%. While the West, South and center of Riyadh city constituted 9.8%, 7.4% and 5.9% respectively. Out of all the participants, only 3.2% infected with SARS-CoV-2. The majority of participants (86.2%) didn't have any chronic diseases, while 13.8% of them complained of chronic diseases such as asthma, diabetes mellitus, and hypertension constituted 5.2%, 2.5%, and 1.2% respectively.

Regarding KAP levels, as demonstrated in Fig. 1, participants who had good, fair and poor levels of knowledge about COVID-19 constituted 47.4%, 48.6% and 3.9% respectively. The mean knowledge is 6.29 (SD = 1.36, range: 1-9), indicating fair knowledge. For attitude, the vast majority of participants 90.2% (367) scored good level of attitude compared with other participants 9.3% (38) and 0.5% (2) who scored fair and poor attitude respectively, and the mean of the attitude scores is 21.85 (SD = 2.63, range: 7-26), indicating a good and positive attitude. For practice, 75.5% (307) consider having a good
level of practice compared to other participants 21.6% (88) and 2.9% (12) are fair and poor respectively, the mean score is 8.23 (SD = 1.39, range; 4-10), indicating a good practice. In addition, In Table 2, the KAP levels are demonstrated in detail for each variable.

**Table 1. Social and demographic characteristics of the study participants (N=407)**

| Variable                        | Mean | SD  | Min | Max | N   | %   |
|---------------------------------|------|-----|-----|-----|-----|-----|
| Knowledge                       | 6.29 | 1.36| 1   | 9   | 193 | 47.4|
| Good                            |      |     |     |     | 198 | 48.6|
| Fair                            |      |     |     |     | 16  | 3.9 |
| Poor                            |      |     |     |     |     |     |
| Attitude                        | 21.85| 2.63| 7   | 26  | 367 | 90.2|
| Good                            |      |     |     |     | 38  | 9.3 |
| Fair                            |      |     |     |     | 2   | 0.5 |
| Poor                            |      |     |     |     |     |     |
| Practice                        | 8.32 | 1.39| 4   | 10  | 307 | 75.4|
| Good                            |      |     |     |     | 88  | 21.6|
| Fair                            |      |     |     |     | 12  | 2.9 |
| Poor                            |      |     |     |     |     |     |
| Gender                          |      |     |     |     |     |     |
| Male                            | 187  | 46  |     |     | 187 | 46  |
| Female                          | 220  | 54  |     |     | 220 | 54  |
| Nationality                     |      |     |     |     |     |     |
| Saudi                           | 395  | 97  |     |     | 395 | 97  |
| Non-Saudi                       | 12   | 3   |     |     | 12  | 3   |
| Age                             |      |     |     |     |     |     |
| 18-24                           | 230  | 56.5|     |     |     |     |
| 25-34                           | 69   | 17  |     |     |     |     |
| 35-44                           | 45   | 11.1|     |     |     |     |
| 45-54                           | 42   | 10.3|     |     |     |     |
| Above 55                        | 21   | 5.2 |     |     |     |     |
| Education                       |      |     |     |     |     |     |
| Diploma                         | 42   | 10.3|     |     |     |     |
| Bachelor’s degree               | 244  | 60  |     |     |     |     |
| Master’s degree or higher       | 32   | 7.9 |     |     |     |     |
| Uneducated                      | 1    | 0.2 |     |     |     |     |
| High school graduate            | 84   | 20.6|     |     |     |     |
| Middle school graduate          | 4    | 1   |     |     |     |     |
| Occupation                      |      |     |     |     |     |     |
| Freelance                       | 4    | 1   |     |     |     |     |
| Student                         | 227  | 55.8|     |     |     |     |
| Unemployed                      | 25   | 6.1 |     |     |     |     |
| Retired                         | 29   | 7.1 |     |     |     |     |
| Non health care provider        | 106  | 26  |     |     |     |     |
| Health care worker              | 16   | 3.9 |     |     |     |     |
| Place of residence in Riyadh    |      |     |     |     |     |     |
| South                           | 30   | 7.4 |     |     |     |     |
| East                            | 86   | 21.1|     |     |     |     |
| North                           | 227  | 55.8|     |     |     |     |
| West                            | 40   | 9.8 |     |     |     |     |
| Center                          | 24   | 5.9 |     |     |     |     |
| Participants infected with COVID-19 | | | | | | |
| Yes                             | 13   | 3.2 |     |     |     |     |
| No                              | 394  | 96.8|     |     |     |     |
| Marital Status                  |      |     |     |     |     |     |
| Widowed                         | 5    | 1.2 |     |     |     |     |
| Single                          | 277  | 68.1|     |     |     |     |
| Married                         | 120  | 29.5|     |     |     |     |
| Divorced                        | 5    | 1.2 |     |     |     |     |
| Variables             | Knowledge N (%) | Attitude N (%) | Practice N (%) |
|-----------------------|-----------------|----------------|----------------|
|                       | Good            | Fair           | Poor           | N   | Good | Fair | Poor | N   | Good | Fair | Poor | N   |
| Gender                |                 |                |                |     |      |      |      |     |      |      |      |     |
| Male                  | 81(43.31)       | 97(51.87)      | 9(4.81)        | 187 | 123  | 65.77| 10(5.34) | 187 | 123(65.77) | 54(28.87) | 10(5.43) | 187 |
| Female                | 112(50.90)      | 101(45.90)     | 7(3.18)        | 220 | 184  | 83.63| 2(0.90) | 220 | 184(83.63) | 34(15.45) | 2(0.9)   | 220 |
| Age                   |                 |                |                |     |      |      |      |     |      |      |      |     |
| 18-24                 | 111(48.26)      | 115(50)        | 4(1.73)        | 230 | 153  | 66.52| 67(29.13) | 10(4.34) | 230 | 153(69.55) | 67(29.13) | 10(4.34) | 230 |
| 25-34                 | 38(55.07)       | 28(40.57)      | 3(4.34)        | 69  | 57   | 82.60| 11(15.94) | 69  | 57(83.60) | 11(15.94) | 1(1.44)  | 69  |
| 35-44                 | 19(42.22)       | 23(51.11)      | 6(66.66)       | 45  | 38   | 84.44| 1(1.44) | 45  | 38(84.44) | 6(13.33)  | 1(1.44)  | 45  |
| 45-54                 | 17(40.47)       | 21(50)         | 4(9.52)        | 42  | 0    | 0    | 0    | 0   | 0    | 42   | 39(92.85) | 3(7.14) | 0   | 42  |
| 55 and above          | 8(38.09)        | 11(52.38)      | 2(9.52)        | 21  | 0    | 0    | 0    | 21  | 0    | 21   | 20(95.23) | 1(4.76) | 0   | 21  |
| Education             |                 |                |                |     |      |      |      |     |      |      |      |     |
| Diploma               | 17(40.47)       | 25(59.52)      | 0              | 42  | 41   | 97.61| 1(2.38) | 0   | 42   | 40(95.23) | 2(4.76) | 0   | 42  |
| Bachelor's degree     | 118(48.36)      | 116(47.54)     | 10(4.09)       | 244 | 216  | 88.52| 26(10.65) | 2(0.81) | 244 | 182(74.59) | 56(22.95) | 6(2.45) | 244 |
| Master's degree or    | 17(53.12)       | 14(43.75)      | 1(3.12)        | 32  | 30   | 93.75| 2(6.25) | 0   | 32   | 25(78.12) | 6(18.75) | 1(3.12) | 32  |
| higher                |                 |                |                |     |      |      |      |     |      |      |      |     |
| Uneducated            | 0               | 1(100)         | 0              | 1   | 1(100) | 0    | 0    | 1   | 1(100) | 0   | 0    | 1   |
| High school           | 39(46.42)       | 40(47.61)      | 5(5.95)        | 84  | 4    | 4.76 | 24(28.57) | 0   | 84   | 55(65.47) | 24(28.57) | 5(5.95) | 84  |
| graduate              | 2(50)           | 2(50)          | 4              | 4   | 1(100) | 0    | 0    | 4   | 4(100) | 0   | 0    | 4   |
| Middle school         |                 |                |                |     |      |      |      |     |      |      |      |     |
| graduate              |                 |                |                |     |      |      |      |     |      |      |      |     |
| Occupation            |                 |                |                |     |      |      |      |     |      |      |      |     |
| Freelance work        | 2(50)           | 0              | 2(50)          | 4   | 2(50) | 0    | 2(50) | 2(50) | 0    | 2(50) | 2(50) | 0   | 4   |
| Student               | 113(49.77)      | 111(48.89)     | 3(1.32)        | 227 | 206  | 90.74| 21(9.25) | 0   | 158(69.60) | 59(26) | 10(4.40) | 227 |
| Unemployed            | 9(36)           | 15(60)         | 1(4)           | 25  | 23   | 92(82.04)| 2(8)    | 2(8) | 18(72) | 7(28) | 0    | 25  |
| Retired               | 9(31.03)        | 19(65.51)      | 1(3.44)        | 29  | 29   | 100  | 0    | 0   | 27(93.10) | 2(6.89) | 0    | 29  |
| Non health care       | 52(49.05)       | 45(42.45)      | 9(8.49)        | 106 | 92   | 86.79| 14(13.20) | 0   | 91(85.84) | 14(13.20) | 1(0.94) | 106 |
| worker                | 8(50)           | 8(50)          | 16             | 15  | 15   | 93.75| 1(6.25) | 0   | 11(68.75) | 4(25) | 1(0.94) | 16  |
| Health care worker    |                 |                |                |     |      |      |      |     |      |      |      |     |
According to ANOVA, results have shown a significant difference between knowledge scores and age variables ($P < 0.05$). Gender is significantly different between attitude scores. Practice scores are significantly different between age, gender, occupation, and marital status.

Most of the participants 91% (370) answered correctly regarding the possible ways of transmission of COVID-19. More than half of the participants 70% (286) demonstrated well knowledge regarding the preventive measures used to prevent the spread of COVID-19. However, our data showed that 18.2% (74) of the participants did not know the duration of the incubation period of COVID-19.

Elderly and patients with chronic diseases were the answer of 65.3% (267) participants when they were asked about the most susceptible group for the complications caused by COVID-19 infection. On the other hand, among the participants, only 4.7% (19) disagreed that the quarantine is an effective preventive measure for the spread of COVID-19, and 4.4% (18) of the participants do not know whether quarantine is really effective at preventing the spread of the virus or not.

The majority of the participants 90.4% (368) agreed that wearing a face mask is only necessary when getting out of their residence, and 52.8% (215) of the participants said there is no difference in the way of wearing a face mask for either infected or non-infected individuals.

The majority of the respondents learned the correct way of washing hands during the COVID-19 pandemic 80.1% (326), while only 19.9% (81) did not learn the correct way and still using their usual way for washing hands. Although the majority 93.6% (381) of participants always wear medical face masks when they go out of their residence. Nevertheless, participants who sometimes wear medical face masks and do not wear medical face masks are 3.4% (14) and 2.9% (12), respectively.

The practice towards wearing medical gloves when going out of residents was found that nearly half of the participants 44.2% (180) wear medical gloves, sometimes wear medical gloves and do not wear medical face masks are 3.1% (130), and 23.8% (97), respectively.

A high proportion of study participants 62.9% (256) provided the correct way for wearing a medical face mask, while 20.1% (82) of participants do not know the correct way for wearing a medical face mask, and 13.8% (56) of participants do not have any idea about the correct way for wearing a medical face mask and only a few of the participants 3.2% (13) do not wear a medical face mask.

The reason for compliance with the guidelines of social distancing in half of the participants 50.1% (204) is for individual’s own safety and to follow the orders regulated by the Ministry of Interior (MOI). However, 5.9% (24) the reason was only the concern of violating the law and its consequences. About 56.8% (204) of participants agreed that social distancing has a good impact on the community, yet 21.9% (89) opposed their opinion.

Five points Likert scale was used to assess agreement or disagreement with KAP statements, the five scores ranging from strongly agree to strongly disagree are shown in Table 3.
Table 3. Responses to attitude statements regarding COVID-19 and social-distancing

| Statement                                                                 | N (%) | Strongly Agree | Agree | Neutral | Disagree | Strongly disagree |
|----------------------------------------------------------------------------|-------|----------------|-------|---------|----------|-------------------|
| The extent to which you think social distancing is an effective way to reduce the spread of infection. |       | 309 (75.9)     | 77 (18.9) | 15 (3.7) | 2 (0.5) | 4 (1)             |
| Compulsory quarantine helps reduce the incidence of disease compared to non-compulsory quarantine. |       | 264 (64.9)     | 95 (23.3) | 38 (9.3) | 8 (2)    | 2 (0.5)           |
| Family gatherings are a source of infection risk.                          |       | 265 (65.1)     | 114 (28)  | 22 (5.4) | 3 (0.7)  | 3 (0.7)           |
| To what extent do you comply with the guidelines provided by the Ministry of Health? |       | 193 (47.4)     | 185 (45.4) | 22 (5.4) | 7 (1.7)  | 0 (0)             |
| The extent of commitment to personal hygiene                             |       | 221 (54.2)     | 162 (39.8) | 19 (4.6) | 3 (0.7%) | 2 (0.5)           |

Table 4. Regression results of KAP-related factors for COVID-19

| Variable                      | B     | SE    | Beta  | t     | Sig.   | 95.0% Confidence Interval for B |
|-------------------------------|-------|-------|-------|-------|--------|--------------------------------|
|                               |       |       |       |       |        | Lower Bound                      |
| Knowledge R² = 0.089          |       |       |       |       |        | Upper Bound                      |
| Freelancer                    | -24.466 | 7.366 | -0.159 | -3.321 | *0.001 | -38.947                         |
| Retired                       | -5.047  | 3.54  | -0.086 | -1.426 | 0.155  | -12.007                         |
| Divorced                      | 19.377  | 6.703 | 0.141  | 2.891  | *0.004 | 6.2                              |
| Female                        | 3.96   | 1.534 | 0.13   | 2.581  | *0.01  | 0.944                           |
| Age                           | -0.178 | 0.077 | -0.141 | -2.312 | *0.021 | -0.329                          |
| Attitude R² = 0.23            |       |       |       |       |        |                                 |
| Freelancer                    | -29.142 | 4.609 | -0.284 | -6.323 | *0     | -38.203                         |
| Female                        | 5.185  | 0.941 | 0.255  | 5.51   | *0     | 3.335                           |
| Master’s degree or higher     | 4.814  | 1.638 | 0.144  | 2.939  | *0.003 | 1.594                           |
| Student                       | 2.18   | 1.01  | 0.107  | 2.158  | *0.032 | 0.194                           |
| South                         | -3.383 | 1.719 | -0.087 | -1.968 | *0.05  | -6.762                          |
| Practice R² = 0.16            |       |       |       |       |        |                                 |
| Unmarried                     | -5.167 | 1.356 | -0.191 | -3.81  | *0     | -7.833                          |
| Female                        | 5.851  | 1.235 | 0.231  | 4.738  | *0     | 3.423                           |
| Student                       | -3.825 | 1.453 | -0.122 | -2.632 | *0.009 | -6.681                          |
| Widow                         | 13.185 | 5.341 | 0.115  | 2.465  | *0.014 | 2.665                           |

*Significant
Regression analysis showed that females have higher scores of knowledge and practice ($P < 0.05$) compared to other variables. Also, females and students who live in the center of Riyadh city with diplomas or masters or higher degrees appear to have a higher level of attitude in comparison to others ($P < 0.05$) [Table 4].

4. DISCUSSION

In order to contain the disease and prevent its spread, the population must be aware of the disease's causes, transmission, and preventive methods. Thus, the knowledge of the disease is a crucial factor to contain and prevent the spread of COVID-19 among the population.

The majority of the participants demonstrated fair levels of knowledge regarding COVID-19, similar to the Chinese study and a study conducted in Saudi Arabia, [13,14]. The results of our study showed a significant relationship between knowledge and age, although occupation, gender, and region of Riyadh did not show a significant relationship with knowledge, similar to the findings of Ferdous et al. [15]. In 2020, Al-Hanawi et al. found a significant relationship between attitude and female gender, similar to our findings [14]. Also, most of the participants were females, with a percentage of 54%, similar to studies conducted in China, Malaysia, and Pakistan in the year of [13,16,17]. Good attitude and practice behaviors toward the pandemic was clearly demonstrated by the participants of this study.

More than half of the participants are between 18-24 years old, and this age group is more commonly active on social media, in which there are many verified health care accounts, which can provide general and preventive information regarding COVID-19; this hypothesis can explain the significant relationship between age and knowledge. However, this should be an area of study for future researches. Saleem et al. found a good level of knowledge, attitude, and practice among the participants toward COVID-19, reflecting the importance of social media as a source of COVID-19 information [18]. Knowledge about the possible ways of COVID-19 transmission was excellent among the participants of this study, in contrast to a study conducted by Afzal et al. in which the participants showed an unsatisfied level of knowledge about the possible ways of COVID-19 transmission [17]. Most of the participants agreed that social distancing is an effective measure for preventing the spread of COVID-19 infection, similar to other studies [16,18,19]. Our participants knew about serious complications of COVID-19 infection, similar to what Al-Hanawi et al. and Peng et al. found in 2020 [14,20]

According to our study, the majority of the Riyadh population have learned the correct way of handwashing and hand hygiene during the COVID-19 pandemic. Interestingly, a study shows that only 44.2% of doctors were aware of the proper techniques of hygiene [21]. Wearing a mask can decrease the chance of having an infection by COVID-19, especially in social occasions [22-24]. Fortunately, a vast majority 93.6% of our participants wear masks when they go out of their home, which maybe considered to decrease the risk of getting the infection during any social occasions.

Governmental interventions toward the COVID-19 pandemic were essential to deal with the spread of the virus. Many non-pharmaceutical interventions (NPIs) were issued, such as national lock-down, airline restrictions, mass gathering cancellations, and more. Moreover, the most important types of the NPIs were the closure of educational institutions, small gatherings cancellation, and airport restrictions, these were the most effective measures to limit the spread of the COVID-19 [25]. Saudi Arabia applied early measures such as travel restrictions and social distancing in February and a national lock-down to unsure restrict of Covid-19 spread. On the other hand, brazil did not order a national lock-down rather than a cordon sanitize only, in which cases spiked in numbers. Nevertheless, socioeconomic, environmental, and demographical variations of the populations have essential roles regarding the rate of cases spread [26,27].

The study findings suggest that only (3.2%) got infected with (Covid-19).

Epidemiologic study shows a significant decrease in some respiratory infections such as influenza, enterovirus, and all-cause pneumonia during the COVID-19 pandemic. Wearing a mask, hand hygiene, and social distancing not only reduced the impact of COVID-19; these strategies also led to a decrease in other respiratory infections [28]. COVID-19 vaccine applicant approval is based on safety and efficacy. Therefore, early access to a safe and efficient vaccine and the establishment of an adequate immunization are key factors in resolving this pandemic [29-33].
Up to date, the pandemic in Saudi Arabia hasn't ended yet. The total number of cases is 447,178 case, the number of recovered patients is 429,663, the number of intensive care unit admitted people is 1,335, and the number of deaths is 7,320 [34]. Currently, the Saudi government tested more than 18,968,030 COVID-19 tests and more than 13,670,000 vaccination doses. These numbers suggest that there's a gap in knowledge, attitude, and practice among Riyadh residents. The results of this study may help in determining which defect must be addressed, either knowledge or attitude or practice, and therefore helps to fill the gaps in any of these areas, by TV programs, social media, campaigns in Riyadh city, and subsequently, may help in the reduction of new cases of covid-19 infection in Riyadh city.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccinations alone are not enough to reduce the risk of case spikes toward the population. Non-pharmacological and behavioral interventions have their own impact on suppressing the transmission of the SARS-CoV-2, such as isolation, quarantine, physical distancing, hand hygiene, and face masks [35]. Inappropriate adherence to the CDC guidelines may increase the risk of resurge SARS-CoV-2 spike cases.

The high risk of SARS-CoV-2 activities plays a high risk factor spread such as a large scale of social gathering without distancing, poor hygiene of hands, poor awareness regarding the recent guidelines, and the refusal of vaccination due to misleading beliefs. However, a study demonstrates that 1086 Americans reported seeking coping mechanisms, emotional support, and stress management to deal with the new behavioral changes, which the new health guidelines were suggested [36]. Therefore, structural campaigns to the population of Saudi Arabia on how to deal and cope with the difficulties of new behavioral adaptations may prevent the spike of cases that may arise from poor health guidelines adherence among the general population. As well as ensuring the administrators of social gathering places to have disinfected equipments and fresh ventilated area with limited the number of customers per hour while maintaining physical distancing.

Another solution is the tracing and testing of symptomatic patients of SARS-CoV-2 in their early stages, as another study in the UK mentions that 75% of individuals with symptomatic infection would need to be tested in order for decreasing the risk of second wave to occur and to have the ability for schools reopening [37].

Also, one of the causes of SARS-CoV-2 curve fluctuation is due to seasonal environmental changes, such as cold and warm climates, as SARS-CoV-2 infectivity increases by 8.72% in cold climates and decreases around 29.10% during hot climates [38]. More health public approaches from institutions might be required more during cold climates to control any further spikes in the future.

This study has some limitations, as this study was conducted in Riyadh city, the capital of Saudi Arabia. However, the results may not be generalizable to other cities of Saudi Arabia. In addition, this study used an online survey that allowed only those who have internet access to participate.

5. CONCLUSION

The findings of this study suggest that Riyadh residents have a fair level of knowledge, a positive attitude, and good practices toward COVID-19. Females have higher scores of knowledge and practice. In addition, females and students who live in the center of Riyadh city with diplomas or masters or higher degrees appear to have a higher level of attitude. It was found that a significant difference between knowledge scores and age variables. Gender is significantly different between attitude scores, and practice scores are significantly different between age, gender, occupation, and marital status. More emphasis should be targeted on less educated population and men. This study may help policymakers to identify the target less knowledgeable groups for COVID-19 prevention and health education.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.
CONSE NT AND ETHICAL APPROVAL

Ethical approval for this study conduction and data collection was reviewed and approved by the Institutional Review Board (IRB) committee of Al-Imam Muhammad Ibn Saud Islamic University, Chairman Prof. AbdulAziz Al-Akaabba and Dr. Arezki Azzi (project approval number: 35-2020). Written Informed consent was obtained from all participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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