# Knowledge, Behavior and Practices about Novel coronavirus (COVID-19) in Jizan region: Cross-sectional study 2020

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## Abstract

Background: SARSCoV2 disease 2019 (COVID-19) is a serious ongoing  pandemic that causes death worldwide. Unprecedented steps have been taken to contain the ongoing COVID-19 epidemic in Saudi Arabia. Compliance with personal measures is influenced by their knowledge, behavior, and practices toward COVID-19.

Aims: To determine the knowledge, behavior, and practice of COVID-19 among the population in Jizan City in Saudi Arabia.

Materials and Methods: A cross-sectional web-based survey was conducted on Jizan residents from December 2019 – April 2020. The data was collected through convenient sampling using internet-based surveys distributed to participants using the "snowball" technique. All residents over the age of 15 could participate in this study. Data analysis was performed using (SPSS).

Results: A total of 527 participants were included in this study. The survey revealed that 52.4% of participants had good knowledge (8.8 ± 2.34 points out of 12), 60.9% had good behavior (7.4 ± 2.19 points out of 10), and 36.2% had good practices towards COVID-19 (7.9 ± 2.46 points out of 12). It was found that age and level of education were significantly associated with good knowledge about the COVID-19 virus (p < 0.01). Moreover, age and occupation were significantly associated with good behavior toward the COVID-19 virus (p < 0.01). However, Occupation was the only factor significantly associated with good practice toward the COVID-19 virus (p < 0.05).

Conclusion: Jizan region residents   show good knowledge and behavior toward COVID-19 prevention. However, it is not accompanied by good practice toward COVID-19 . Thus, text messages from health authorities and governments are recommended. The above-related factors should be considered in the application of those interventions.

Keywords: COVID-19, Knowledge, behavior, Practices, Cross-sectional study

## Introduction

The novel coronavirus disease 2019 (COVID-19), caused by the COVID-19 virus, was first discovered in December 2019 in Wuhan, China. The Director-General of the WHO announced on January 2020 that the pandemic represents an international public health emergency.

Two other coronavirus strains, one from civet cats, spread SARS to humans during 2002-2003 and to areas of the Middle East . Standard guidelines to forestall contamination encompass regular hand washing, masking mouth and nose when coughing and sneezing, and fully cooking meat and eggs and avoiding close contact with all people showing signs and symptoms of respiratory illness, such as coughing and sneezing (1).

**People at risk :**
It affects anyone, especially people in close contact with animals or those infected by a new coronavirus. Older people who have diabetes, hypertension, lung or kidney disease, and heart disease appear to be more at risk of developing severe disease(2).

**Economic, Education, and Relational Effect of COVID-19 :**
According to a Reuters poll of economists (3), the economic impact of the COVID-19 coronavirus worldwide is negative. The novel coronavirus has hit global oil demand hard, "says the International Energy Agency. The pandemic could cost the airline industry $113 billion globally.

**Personal Protective Equipment (PPE) :**
 Using personal protective equipment (PPE) in health and environmental environments, as well as in cargo handling is mandated. PPE includes gloves, surgical masks, goggles or face covers, and gowns, as well as unique procedures, respirators (i.e., normal or similar to N95 or FFP2) and aprons. This paper is for those interested in delivering and managing PPE (4).

**Hypothesis:**
Much false knowledge, unhealthy behavior, and faulty practices may contribute to the community spread of novel coronavirus (COVID-19) disease among people living in Jizan.

**Goal:**
This study aims to assess the knowledge, behavior, and practices of the Jazan population about COVID-19. It also proposes to determine the knowledge, behavior, and practice regarding coronavirus among the population in Jizan City.

**Research objectives :**
First, to assess Jizan residents' knowledge about CoVID-19 and secondly, to identify risky behavior of Jizan residents that may favor community spread of COVID-19. Finally, to assess faulty practices that may increase COVID-19 Community spread.

## Research Methods

**Study area:**
This study was conducted in the Jizan region, which lies in the southwest corner of Saudi Arabia with a population of 1.5 million, according to a 2010 census.

**Study design:**
The present study is a cross-sectional-web-based survey type of epidemiologic study. It is comprehensive and cheap to perform, making enrolling large numbers of participants or collecting data easier. The data are captured directly in electronic format.

The primary reason for choosing a Web-based survey method is the lock-down measures announced by the government as a trial to minimize the impact of the corona pandemic Along with the imposed deadline to conduct this in the following steps; survey development, data collection, and data analysis were other reasons for its choice. Collecting the required sample size in the proposed duration made it impossible to conduct a community-based survey (5).

**Study duration:**
It was conducted from December 2019- April 2020.

**Sample frame:**
All Jizan residents who use electronic media could participate

**Sample type:**
Convenient type of sampling using an internet-based survey, respecting the regulations of the Kingdom of Saudi Arabia and not increasing the spread of the disease (6).

**Sample technique :**
In the "snowball" technique, the electronic survey was disseminated to a select group known to the researchers, who were then requested to distribute it among their contacts further. This approach referred to as the "snowball" technique, limits the ability to control the survey recipients substantially. Consequently, it becomes more challenging to send reminders or conduct follow-up surveys. Furthermore, due to the lack of visibility into the precise number of survey copies circulated, it becomes infeasible to calculate a response rate.

**Study populations:**
Jizan residents aged 15 years old or above

**Sample size:**
The sample size for this study is estimated to be 500 people based on a sample size formula for a cross-sectional study design. The margin of error selected was 0.05, with a 95% confidence level.

**Data collection tools:**
A web-based questionnaire was designed after reviewing many articles to collect the sociodemographic characteristics, Knowledge, behavior, and practices

regarding the disease, its nature, mode of transmission, symptoms, signs, period of incubation, and preventive measures (7).

**The questionnaire included the following scales:** Personal data including gender, age, and academic level. Secondly, sociodemographic characteristics such as gender, age, education, and occupation. Thirdly, the Knowledge, behavior and practices about the disease, its nature, mode of transmission, symptoms and signs, period of incubation, period of communicability, and preventive measures.

**Knowledge :**
It included questions about the main clinical symptoms of COVID-19 (fever, myalgia, and dry cough). Also, it involved expectations and perceptions of effective treatment available, the incubation period, ways of transmission, and how lockdown limits the spread of the virus.

**Behavior questions:** Questions about what the individual believes in and follows in recent days, e.g., Visiting crowded places, wearing a face mask on going out of home, wearing a face mask when feeling sick

**Practice :**
It involved questions about practices carried out during the last two weeks. For example, drinking lemon with honey to prevent corona infection, mastic incense to prevent novel corona infection, using prevention instruments, washing hands after returning home, and changing clothes. These questions were answered on an Agree /Disagree basis with an additional "Neutral" option. A correct answer was assigned 2 points, and an incorrect/unknown answer was assigned 0 points.

The total score ranged from 0 to 12 for each knowledge and practice item, with a higher score of 9-12 denoting a good, 5-8 with an average, and 0-4 with a poor score system. The total score ranged from 0 to 10 for behavior, with a higher score ranging from 7-10 denoting a good, 4-6 with an average, and 0-3 with a poor score system (Tables I, II, III).

**Pilot study:**
The pilot study was conducted on 20 members to adjust the time needed to respond to the questionnaire and to modify the questions that needed modification. The results of the pilot study were not included in the study results. Cronbach's alpha was estimated to be 0.7.

**Data analysis:**
Data were presented and analyzed using the chi-square. The P-value was calculated. The Confidence level was chosen at 95%. The statistical analysis was carried out by using the SPSS package v19.

**Ethical consideration :**
Ethical approval was received from the scientific research unit at Jazan University. The survey ensured confidentiality as no personal information on the participants' identity was required to be disclosed and was strictly voluntary, as mentioned in the recruitment statement of the participant for the survey.

**Table I. The total score of the Knowledge level**

| Score system | Knowledge level |
| --- | --- |
| 1-3 | Deficient knowledge |
| 4-6 | Average knowledge |
| 7-10 | Good knowledge |

**Table II. The total score of the Practice level**

| Score system | Practice level |
| --- | --- |
| 1-3 | Poor |
| 4-6 | Average |
| 7-10 | Good |

**Table III. The total score of the Behavioral level**

| Score | Behavioral level |
| --- | --- |
| 1-3 | Poor |
| 4-6 | Average |
| 7-10 | Good |

## Results

**Characteristics of the participants**

A total of 527 respondents from the general population residing in the Jizan region actively participated in completing the questionnaires. Of the total, 356 individuals (67.6%) were identified as females, while 171 individuals (32.4%) were categorized as males. The breakdown of their ages was as follows: 14.6% fell within the age range of 15 to 20 years, 75.5% were aged between 20 to 40 years, and 9.9% were above 40. Concerning their highest educational level, 332 participants (63%) possessed a Bachelor's degree, while 146 participants (27.7%) had completed their secondary education or diploma studies. The study encompassed 224 students (42.5%), 95 employees in the governmental sector (18%), 81 unemployed individuals (15.4%), and 77 housewives. Over half of the participants (53.9%) hailed from rural areas. 36% of the respondents reported a monthly income exceeding 5,000 SAR (36.6%). Meanwhile, 27.9% reported a monthly income lower than 5,000 SAR, and 187 participants (35.5%) reported having no income. Overall, Table 1 shows the Socio-demographic characteristics of the participants in the study.

**Table 1: Socio-demographic characteristics of study participants (n=527)**

| Variable | Category | Frequency | Percent |
|---|---|---|---|
| Age (Years) | 15 - 20 | 77 | 14.6% |
| | 20 - 40 | 398 | 75.5% |
| | More than 40 | 52 | 9.9% |
| Gender | Male | 171 | 32.4% |
| | Female | 356 | 67.6% |
| Educational level | Illiterate | 4 | 0.8% |
| | Intermediate or less | 28 | 5.3% |
| | Secondary or diploma | 146 | 27.7% |
| | Bachelor | 332 | 63% |
| | Master degree or above | 17 | 3.2% |
| Occupation | Student | 224 | 42.5% |
| | Housewife | 77 | 14.6% |
| | Government sector | 95 | 18% |
| | Private sector | 40 | 7.6% |
| | Unemployed | 81 | 15.4% |
| | Retired | 10 | 1.9% |
| Residence | Village | 284 | 53.9% |
| | City | 243 | 46.1% |
| Monthly income (SAR) | Less than 5,000 | 147 | 27.9% |
| | More than 5,000 | 193 | 36.6% |
| | Not found | 187 | 35.5% |

**Knowledge, behavior and Practices about Novel Coronavirus (COVID-19)**
Two points were given for answering the correct answers and zero points for incorrect/unknown answers to assess the knowledge, behaviors, and practices about Coronavirus. Then, the means of total scores were calculated (Table 2).

**Table 2: Overall Knowledge, Behavior, and Practices about Novel Coronavirus   (COVID-19)**
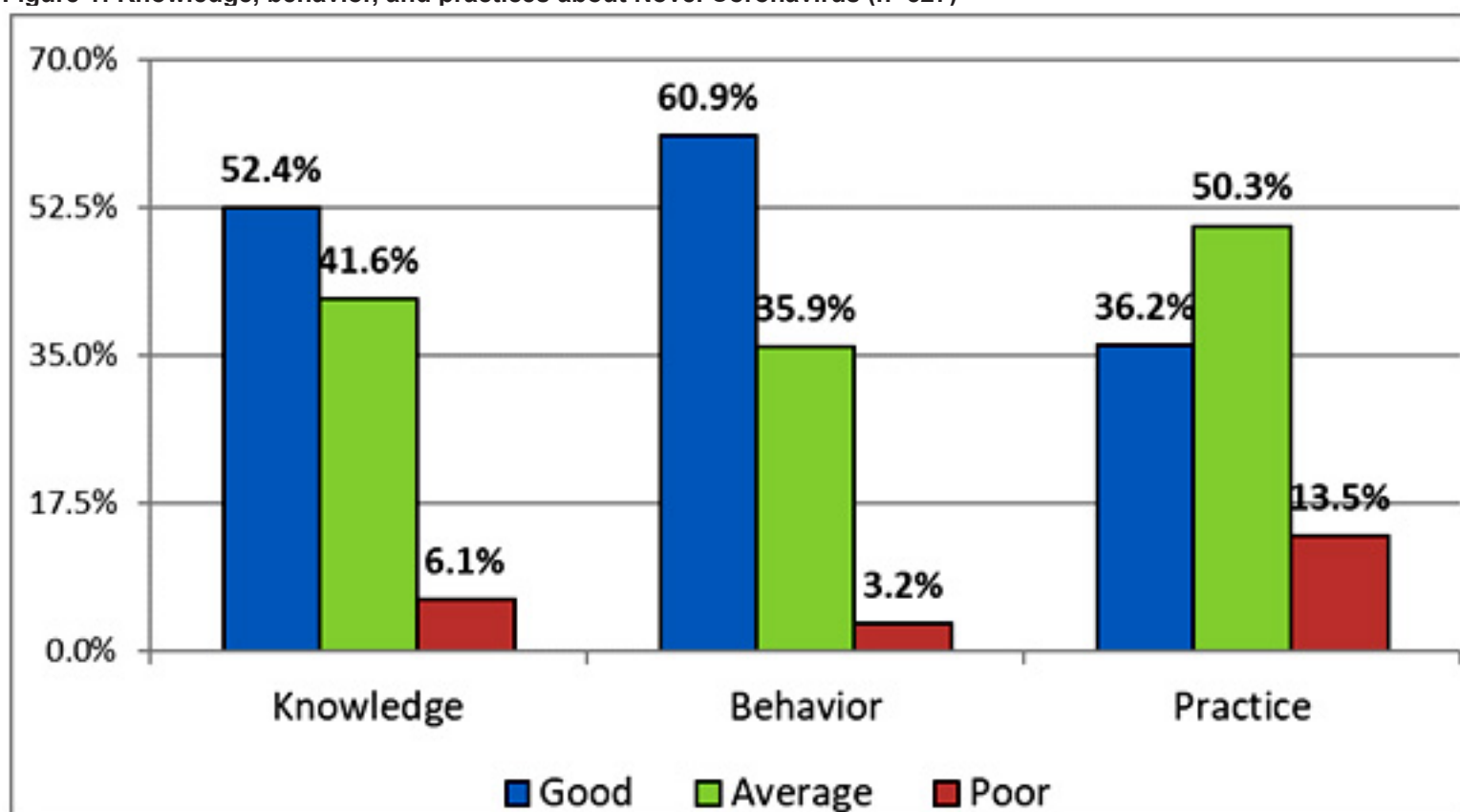
| Variable | Score | | | |
|---|---|---|---|---|
| | Mean | SD | Minimum | Maximum |
| Knowledge | 8.8 | +2.34 | 0 | 12 |
| Behavior | 7.4 | + 2.19 | 0 | 10 |
| Practice | 7.9 | +2.46 | 0 | 12 |

Out of a total score of 12 points, the mean knowledge score was 8.8 ± 2.34. 52.4% of participants had good knowledge about the COVID-19 virus, 41.6% had average knowledge, and 6.1% had poor knowledge (Figure 1).

Additionally, out of a total score of 10 points, the mean behavior score was 7.4 ± 2.19. 60.9% of participants had good behavior toward the COVID-19 virus, 35.9% had average behavior, and 3.2% had poor behavior (Figure 1).
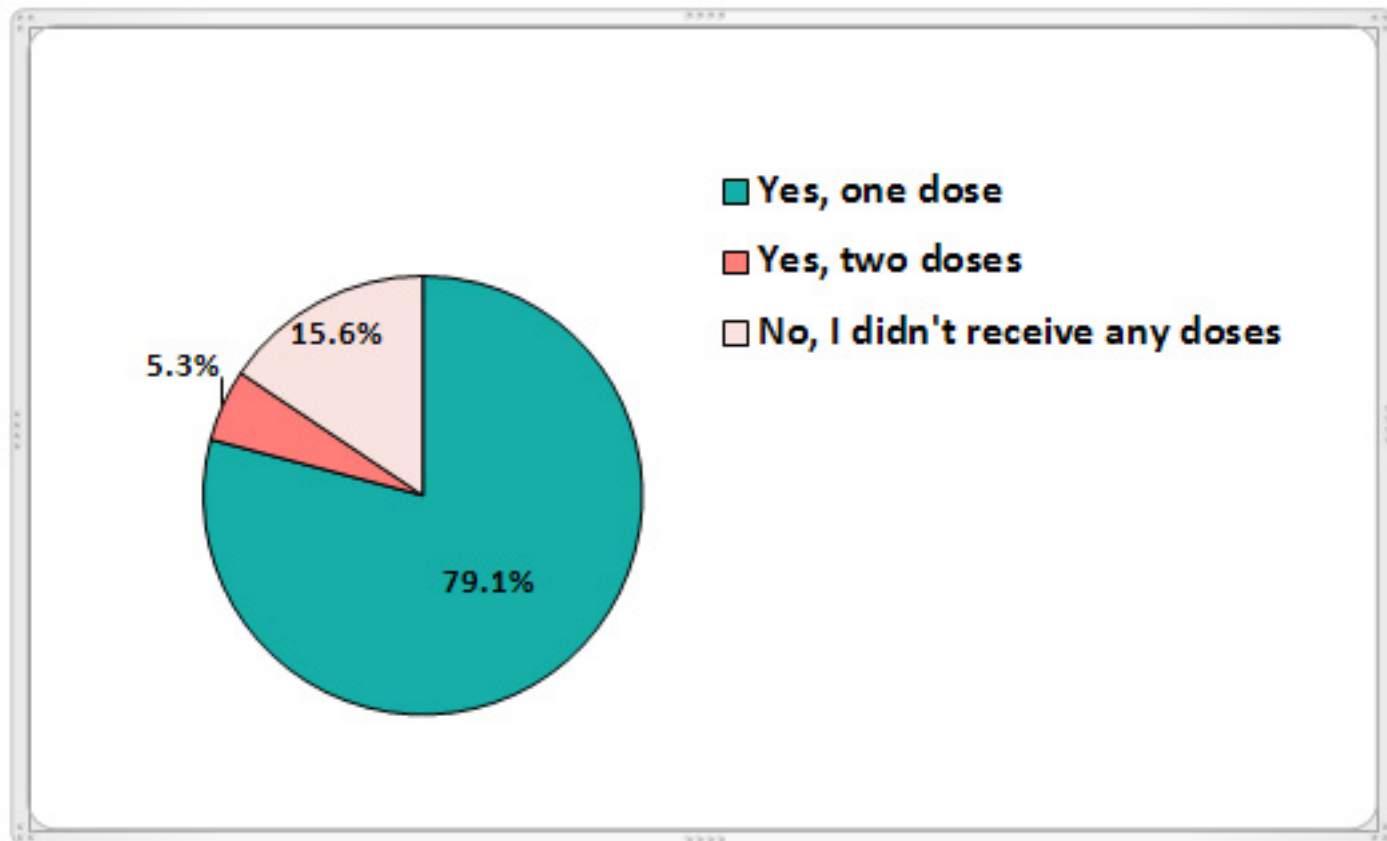
Finally, out of a total score of 12 points, the mean practice score was 7.9 ± 2.46. 36.2% of participants had good practice toward the COVID-19 virus, 50.3% had average practice, and 13.5% had poor practice (Figure 1).

**Figure 1: Knowledge, behavior, and practices about Novel Coronavirus (n=527)**

Regarding behavior toward the Novel Coronvirus (COVID-19), more than half of the participants (57.3%) did not go to crowded places, and 457 (86.7%) wore face masks when leaving the house. Also, 468 (88.8%) participants did not go out for an excursion during the lockdown, and a lower percentage (52%) never shook hands or hugged others recently. Participants were asked if they had received any doses of the COVID-19 vaccine; the majority of them (79.1%) received one dose, 28 (5.3%) received two doses, and 82 (15.6%) did not receive any doses (Figure 2).
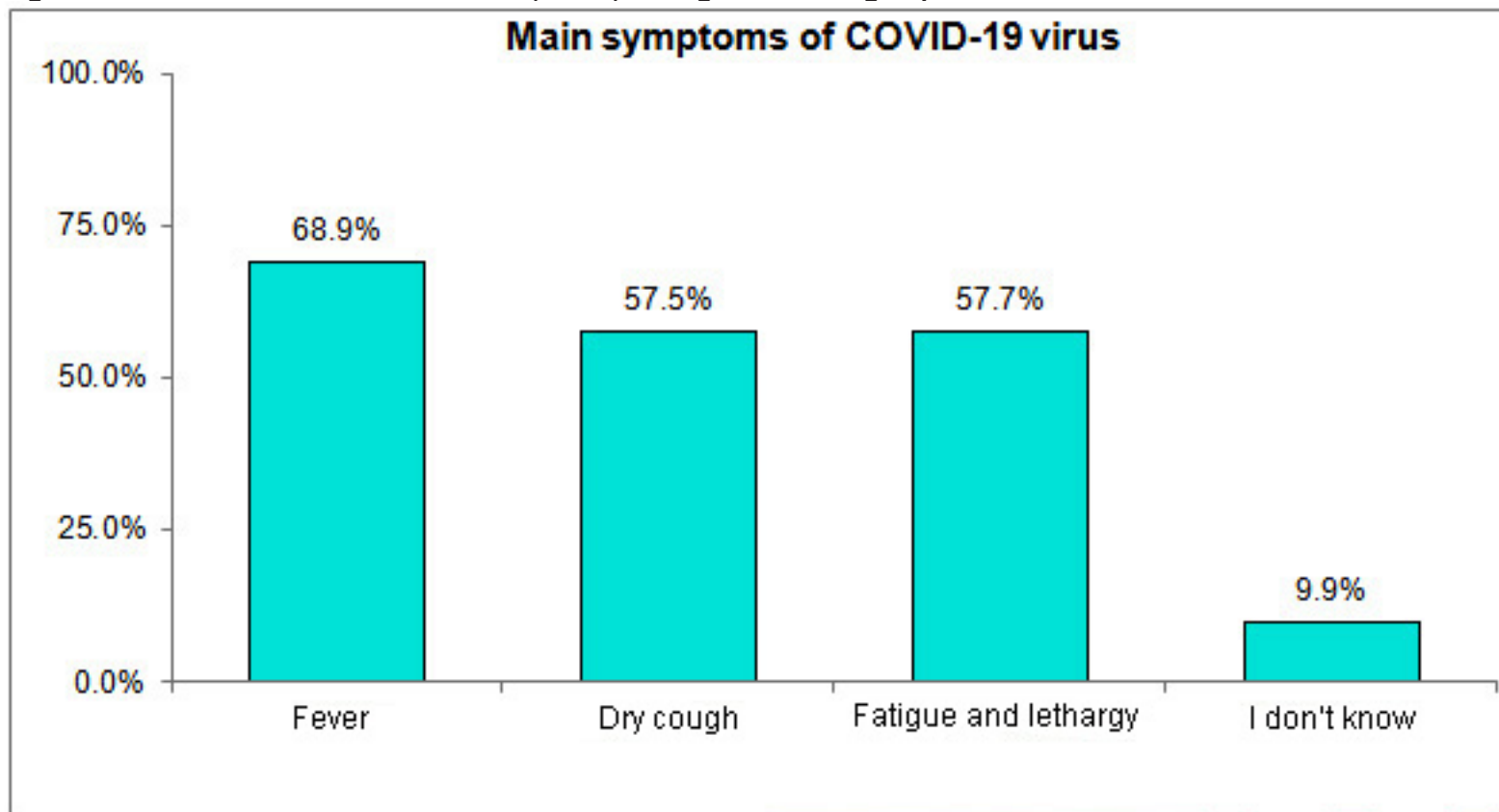
**Figure 2: Have you received any doses of the vaccine? (n=527)**

Concerning practice toward the COVID-19 virus in the last two weeks, most participants did not use lemon and honey (72.1%) or incense with mastic (67.9%) to prevent infection with COVID-19. Regarding COVID-19 protective measures, 333 (63.2%) of the participants used a face mask and gloves when going out, 402 (76.3%) washed their hands after coming home, 352 (66.8%) kept a 1.5-meter distance between them and anyone else, and 260 (49.3%) changed their clothes after coming home.

Regarding knowledge about the Novel Corona virus (COVID-19), 363 (68.9%) of the participants identified fever as the main symptom of COVID-19 virus, followed by fatigue and lethargy (57.7%) and dry cough (57.5%) (Figure 3).

**Figure 3: Beliefs about COVID-19 vaccines (n=527) among the studied group**

About half of the participants knew there was no effective medication for COVID-19. When they were asked about their beliefs about COVID-19 vaccines, most of them (83.9%) supposed that it relieves symptoms of infection with the virus, 48 (9.1%) agreed that it protects against infection with the virus, the remaining think that it has no effect (3.6%) or has a harmful effect and can cause death (3.4%). Also, 438 (83.1%) of the participants correctly knew that COVID-19 could be transmitted through respiratory droplets, and 499 (94.7%) knew that infected people should be isolated and treated to reduce the spread of infection effectively. Finally, 487 (92.4%) correctly knew that it was useful to isolate people who had direct contact with people infected with COVID-19 (Table 3).

**Table 3: Knowledge, behavior, and practices about Novel Corona virus (n=527)**

| Knowledge | Yes | No | I do not know |
|---|---|---|---|
| - Is there an effective medication for COVID-19? | 96 (18.2%) | 270 (51.2%) | 161 (30.6%) |
| - Can COVID-19 be transmitted through respiratory droplets? | 438 (83.1%) | 19 (3.6%) | 70 (13.3%) |
| - Is isolating and treating infected people an effective way to reduce the spread of infection? | 499 (94.7%) | 12 (2.3%) | 16 (3%) |
| - Is it useful to isolate people who had direct contact with people infected with COVID-19? | 487 (92.4%) | 13 (2.5%) | 27 (5.1%) |
| **Behavior** | **Yes** | **No** | **I am not sure** |
| - In the past days, have you gone to crowded places? | 183 (34.7%) | 302 (57.3%) | 42 (8.0%) |
| - In the past days, did you wear a face mask when leaving the house? | 457 (86.7%) | 56 (10.6%) | 14 (2.7%) |
| - Did you go out for an excursion during lock-down? | 45 (8.5%) | 468 (88.8%) | 14 (2.7%) |
| - Have you shake hands or hugged others in recent days? | 205 (38.9%) | 274 (52%) | 48 (9.1%) |
| **Practice** | **Yes** | **No** | **I am not sure** |
| -Have you used lemon and honey to protect against COVID-19 in the past two weeks? | 128 (24.3%) | 380 (72.1%) | 19 (3.6%) |
| -Have you used incense with mastic to prevent infection with the COVID-19 in the past two weeks? | 144 (27.3%) | 358 (67.9%) | 25 (4.7%) |
| -Have you used a face mask and gloves when going out in the last two weeks? | 333 (63.2%) | 158 (30%) | 36 (6.8%) |
| -Do you wash your hands after coming home in the last two weeks? | 402 (76.3%) | 95 (18%) | 30 (5.7%) |
| -Do you keep a 1.5 meter distance between you and anyone in the two weeks? | 352 (66.8%) | 104 (19.7%) | 71 (13.5%) |
| -Have you changed your clothes after coming home in the past two weeks? | 260 (49.3%) | 214 (40.6%) | 53 (10.1%) |

**Factors associated with Knowledge, Behavior, and Practices about Novel Coronavirus**
A chi-square test was conducted to investigate the impact of the socio-demographic factors on the knowledge, behavior, and practice level of the studied population.

First, the age and level of education were significantly associated ($p < 0.01$) with knowledge about the COVID-19 virus. Generally, those aged 20 to 40 had the highest level of knowledge compared to other age groups. Likewise, the level of knowledge improves with educational level, as depicted by the highest level of knowledge observed in participants with a master's degree or above, while the lowest level of knowledge was observed in illiterate participants (Table 4).

Second, age and Occupation have been significantly associated ($p < 0.01$) with behavior toward the COVID-19 virus. The results showed that good behavior is associated with higher age, as depicted by the highest level of good behavior observed in participants older than 40, while the lowest level of good behavior was observed in participants aged 15 to 20. Also, it was found that retired participants had the highest level of good behavior compared to other occupational groups (Table 5).

Finally, Occupation was the only factor significantly associated ($p < 0.05$) with practice toward the COVID-19 virus. The results showed that private sector employees had the highest level of good practice compared to other occupational groups, followed by governmental sector employees, while retired participants had the lowest level of good practice (Table 6).

**Table 4: Factors associated with Knowledge about Novel Coronavirus**

| Variable | Knowledge about COVID-19 | | | P value |
| --- | --- | --- | --- | --- |
| | Poor N (%) | Average N (%) | Good N (%) | |
| **Age (Years)** | | | | |
| 15 – 20 | 12 (15.6) | 31 (40.3) | 34 (44.1) | |
| 20 – 40 | 19 (4.8) | 157 (39.4) | 222 (55.8) | **0.000** |
| More than 40 | 1 (1.9) | 31 (59.6) | 20 (38.5) | |
| **Gender** | | | | |
| Male | 10 (5.8) | 61 (35.7) | 100 (58.5) | 0.140 |
| Female | 22 (6.2) | 158 (44.4) | 176 (49.4) | |
| **Educational level** | | | | |
| Illiterate | 0 (0) | 4 (100) | 0 (0) | |
| Intermediate or less | 4 (14.3) | 14 (50) | 10 (35.7) | |
| Secondary or diploma | 15 (10.3) | 76 (52.1) | 55 (37.7) | **0.000** |
| Bachelor | 13 (3.9) | 123 (37) | 196 (59) | |
| Master degree or above | 0 (0) | 2 (11.8) | 15 (88.2) | |
| **Occupation** | | | | |
| Student | 15 (6.7) | 77 (34.4) | 132 (58.9) | |
| Housewife | 6 (7.8) | 40 (51.9) | 31 (40.3) | |
| Government sector | 4 (4.2) | 39 (41.1) | 52 (54.7) | |
| Private sector | 1 (2.5) | 17 (42.5) | 22 (55) | 0.088 |
| Unemployed | 6 (7.4) | 39 (48.1) | 36 (44.4) | |
| Retired | 0 (0) | 7 (70) | 3 (30) | |
| **Residence** | | | | |
| Village | 16 (5.6) | 125 (44) | 143 (50.4) | 0.456 |
| City | 16 (6.6) | 94 (38.7) | 133 (54.7) | |
| **Monthly income (SAR)** | | | | |
| Less than 5,000 | 12 (8.2) | 59 (40.1) | 76 (51.7) | |
| More than 5,000 | 8 (4.1) | 71 (36.8) | 114 (59.1) | 0.086 |
| Not Found | 12 (6.4) | 89 (47.6) | 86 (46) | |

**Table 5: Factors associated with behavior toward Novel coronavirus**

| Variable | Behavior toward COVID-19 | | | P value |
|---|---|---|---|---|
| | Poor N (%) | Average N (%) | Good N (%) | |
| **Age (Years)** | | | | |
| 15 – 20 | 9 (11.7) | 40 (51.9) | 28 (36.4) | |
| 20 – 40 | 8 (2) | 138 (34.7) | 252 (63.3) | **0.000** |
| More than 40 | 0 (0) | 11 (21.2) | 41 (78.8) | |
| **Gender** | | | | |
| Male | 5 (2.9) | 66 (38.6) | 100 (58.5) | |
| Female | 12 (3.4) | 123 (34.6) | 221 (62.1) | 0.656 |
| **Educational level** | | | | |
| Illiterate | 0 (0) | 0 (0) | 4 (100) | |
| Intermediate or less | 1 (3.6) | 9 (32.1) | 18 (64.3) | |
| Secondary or diploma | 7 (4.8) | 55 (37.7) | 84 (57.5) | 0.698 |
| Bachelor | 9 (2.7) | 120 (36.1) | 203 (61.1) | |
| Master degree or above | 0 (0) | 5 (29.4) | 12 (70.6) | |
| **Occupation** | | | | |
| Student | 13 (5.8) | 104 (46.4) | 107 (47.8) | |
| Housewife | 2 (2.6) | 29 (37.7) | 46 (59.7) | |
| Government sector | 1 (1.1) | 22 (23.2) | 72 (75.8) | |
| Private sector | 0 (0) | 13 (32.5) | 27 (67.5) | 0.000 |
| Unemployed | 1 (1.2) | 19 (23.5) | 61 (75.3) | |
| Retired | 0 (0) | 2 (20) | 8 (80) | |
| **Residence** | | | | |
| Village | 12 (4.2) | 91 (32) | 181 (63.7) | |
| City | 5 (2.1) | 98 (40.3) | 140 (57.6) | 0.074 |
| **Monthly income (SAR)** | | | | |
| Less than 5,000 | 7 (4.8) | 58 (39.5) | 82 (55.8) | |
| More than 5,000 | 6 (3.1) | 61 (31.6) | 126 (65.3) | 0.325 |
| Not found | 4 (2.1) | 70 (37.4) | 113 (60.4) | |

**Table 6: Factors associated with practices toward Novel Coronavirus**

| Variable | Practice toward CVID-19 | | | P value |
|---|---|---|---|---|
| | Poor N (%) | Average N (%) | Good N (%) | |
| **Age (Years)** | | | | |
| 15 – 20 | 15 (19.5) | 42 (54.5) | 20 (26) | |
| 20 – 40 | 53 (13.3) | 194 (48.7) | 151 (37.9) | 0.101 |
| More than 40 | 3 (5.8) | 29 (55.8) | 20 (38.5) | |
| **Gender** | | | | |
| Male | 28 (16.4) | 88 (51.5) | 55 (32.2) | 0.245 |
| Female | 43 (12.1) | 177 (49.7) | 136 (38.2) | |
| **Educational level** | | | | |
| Illiterate | 0 (0) | 1 (25) | 3 (75) | |
| Intermediate or less | 4 (14.3) | 13 (46.4) | 11 (39.3) | |
| Secondary or diploma | 22 (15.1) | 74 (50.7) | 50 (34.2) | 0.744 |
| Bachelor | 42 (12.7) | 171 (51.5) | 119 (35.8) | |
| Master degree or above | 3 (17.6) | 6 (35.3) | 8 (47.1) | |
| **Occupation** | | | | |
| Student | 40 (17.9) | 116 (51.8) | 68 (30.4) | |
| Housewife | 12 (15.6) | 35 (45.5) | 30 (39) | |
| Government sector | 4 (4.2) | 49 (51.6) | 42 (44.2) | 0.036 |
| Private sector | 4 (10) | 18 (45) | 18 (45) | |
| Unemployed | 11 (13.6) | 39 (48.1) | 31 (38.3) | |
| Retired | 0 (0) | 8 (80) | 2 (20) | |
| **Residence** | | | | |
| Village | 47 (16.5) | 142 (50) | 95 (33.5) | 0.059 |
| City | 24 (9.9) | 123 (50.6) | 96 (39.5) | |
| **Monthly income (SAR)** | | | | |
| Less than 5,000 | 21 (14.3) | 82 (55.8) | 44 (29.9) | |
| More than 5,000 | 19 (9.8) | 95 (49.2) | 79 (40.9) | 0.116 |
| Not Found | 31 (16.6) | 88 (47.1) | 68 (36.4) | |

## Discussion

This cross-sectional survey aimed to assess the knowledge, behavior, and practice of COVID-19 among Jizan region residents. The novelty and uncertainty of this disease make it essential for health authorities to devise appropriate strategies for preparing and managing the public. Therefore, studying the population's knowledge, behavior, and practices is important to guide this effort.

In this current study, most respondents (41.6%) and (52.4%) had moderate and good knowledge about COVID-19, respectively, with an average score of 8.8 ± 2.34 points out of 12. (68.9%) of the participants identified fever as the main symptom of COVID-19, and about half of the participants knew there is no effective medication for COVID-19, similar to a previous study in Bangladesh (8). These findings were in agreement with several studies in Uganda, China as well as Saudi Arabia (9) (10) (11). Due to the differences between measurement and evaluation systems, comparing these studies' knowledge levels is impossible. The characteristics of the sample may explain this relatively good knowledge of our participants about COVID-19; most (63%) completed their Bachelor's degree and were aged 20 to 40 years (75.5%). The positive association between knowledge, education, and age supports our assertion. This finding was consistent with a previous study in Saudi Arabia (11).

In the present study, (60.9%) of the participants had good behavior towards the COVID-19 pandemic, with an average score of 7.4 ± 2.19 points out of 10. This finding was lower than the results of another study in Malaysia (83.1%). In addition, a study in China reported that most respondents had a positive attitude toward COVID-19 (10). However, these results are higher than other studies in Ethiopia (12) and Thailand (13). Most participants reported taking precautions such as wearing facemasks when leaving the house and taking the first dose of the vaccine. In addition, more than half of the participants avoided crowded places. These results conflicted with another study in China which stated that nearly all participants avoided crowded places (96.4%) and wore masks when leaving home (98.0%) during the rapid rise period of the COVID-19 outbreak (10). This finding shows the general willingness of the participants to implement behavioral changes in the face of the COVID-19 pandemic.

Furthermore, there was a significant association between behavior toward COVID-19 and socio-demographic factors such as age and occupation. Participants aged more than 40 years and the retired population showed better behavior toward COVID-19. This result may be due to the fear of getting infected and the high education level of that population. On the other hand, students and the younger population represented the worst behavior towards COVID-19. These results help public health policymakers and healthcare professionals identify target populations for COVID-19 prevention and health education.

Moreover, regarding participants' practices toward COVID-19, it was found that (36.2%) of participants had a good practices. The overall average score was 7.9 ± 2.46 points out of 12. (63.2%) of the participants who used a facemask and gloves when going out, these findings are higher than the study done in Malaysia (14) and lower than in China (10). Moreover, the present study revealed that 76.3% washed their hands after coming home, and 66.8% kept a 1.5-meter distance between them and anyone. This finding was consistent with previous studies in Saudi Arabia (11). The different socio-demographic samples and periods can explain the differences between many studies. Also, it was found that occupation is a significant factor associated with practice towards COVID-19. Participants in the private sector associated with better practices followed by the government sector. This finding may be due to that sector's strict work regulations and rules.

**Strengths and limitations**
This study has several strengths and weaknesses. One of its assets includes the data collected through the online self-administered approach of the participants, such as those with low educational levels. This data collection enabled the provision of a more realistic estimate in comparison to other surveys utilizing personal interviews.

On the contrary, this study has some limitations. First, this study followed a cross-sectional study design. Therefore, it is impossible to conclude a causal relationship. Second, self-disclosure has limitations compared to face-to-face interviews, including multiple biases. Third, the survey is limited to those with internet access, so it can hardly reflect the entire population of Saudi Arabia. Therefore, an additional assessment that includes all aspects of KBP related to COVID-19 is important to determine the true extent of KBP in the general population. In particular, KSA is uniquely positioned to manage two outbreaks of viral origin from related viruses successfully.

## Conclusion

The present study suggested that the participants have a piece of good knowledge, behavior, and average to good practice towards COVID-19.

## Recommendations

These results underscore the importance of improving residents' knowledge of COVID-19 through health education, which may also lead to improved attitudes and practices toward COVID-19.

Current research shows the need for a broader education program focusing on consistent information from governments and related agencies. Educational efforts on COVID-19 should take a proactive approach and focus on dispelling false information through contradictory opinions and false information.

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