

## **COVID-19 Impact on Food Safety Perception among Saudi Women**

### **Abstract**

*Aims:* The spread of COVID-19 pandemic has increased the global public concern about food safety and hygiene. This study was conducted to assess the impact of COVID-19 on food safety knowledge, attitude, and practices among Saudi women.

*Study Design:* A cross-sectional study using self-administered online questionnaire.

*Place and Duration of Study:* Department of Clinical Nutrition, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia, between April 2021 and June 2021.

*Methodology:* Participants (426 Saudi adult females aged 18-60 years) were randomly recruited from the major cities of the Eastern Region of Saudi Arabia, including Dammam, Khobar and Qatif.

*Results:* Higher knowledge and practice of food safety measures were associated with COVID-19 pandemic, where 90% of participants acquired more food safety knowledge during the pandemic. Only 25% of participants, however, thought that the disease can be transmitted by food. Furthermore, more than 90% and 64% of participants presented high attitude and practices in hand washing and food cleaning, respectively.

*Conclusion:* Despite the lack of solid evidence that supports the transmission of COVID-19 virus through the food, applying appropriate precautionary safety measures throughout food production and servicing chain can reduce the transmission of the virus.

**Keywords:** Food Safety, COVID-19, Virus, Saudi Arabia, Women.

## 1. Introduction

In the year 2020, the new coronavirus-19 (COVID-19), originated in the Chinese city Wuhan in December 2019, has hit the world creating an unprecedented state of agony and uncertainty. Coronaviruses constitute a large family of viruses that cause ailments extending from mild symptoms to serious maladies like Middle East respiratory syndrome (MERS-CoV), severe acute respiratory syndrome (SARS-CoV) or pneumonia [1]. The most common symptoms of COVID-19 infection include high body temperature, dry cough, breath difficulties and tiredness. More than 80% of COVID-19 infected patients get well without specific treatments [2]. COVID-19 is not a foodborne disease, and it can spread through saliva sprays by coughing, mucus sprays by sneezing and by touching contaminated surfaces. No COVID-19 infections were identified in drinking water, as commercial water treatments have cycles of sterilizing before water is sent to homes [3]. Repeated hand washing, hand sanitizing, avoiding touching eyes or nose with unclean hands, practicing good respiratory manners, including covering cough and sneezing, avoiding the unnecessary gatherings, and staying home especially when feeling not well are recommended practices for controlling the spread of the virus [4].

Poor knowledge in safe food-handling and hygienic practices can lead to serious concerns and diseases. In a cross-sectional study, Saudi women showed a high awareness level regarding general safety, and food safety in particular. They tended to clean their hands after touching raw meat and wash the cutting boards upon every use. They were further aware of some storage strategies and cooking safety measures [5]. As the first hypothesis regarding COVID-19 infection transmission, they hypothesized that the transmission occurs upon eating infected animal meat. Specific consideration should be given to this circuitous pathway while thinking about the potential for the spread of an epidemic and the improvement of prevention standards [6]. In another study, the knowledge of food safety was found to improve in adolescents and adults after COVID-19 pandemic, however the awareness and knowledge of food safety was not significantly improved among elderly. The highest increase in knowledge was found among participants aged 15 to 40 years. This has been attributed to their ability to access the information resources, their skills to use technology, and their better reading and writing capabilities [7]. The lack of food safety knowledge, attitude and practices could be considered a potential factor for transferring infectious diseases including COVID-19. Thus,

understanding food safety measures and proper handling and hygienic practices is important for promoting health and improving life quality of the community. Therefore, **the objective of this study** is to explore the impact of COVID-19 on food safety knowledge, attitude, and practices among Saudi women. **The study digs deeper and thoroughly investigates their knowledge and perception towards food and eating during the pandemic, with more focus on the food safety measures.**

## **2. Methods and Participants**

### **2.1. Study Design**

A cross-sectional descriptive study was conducted on Saudi adult females ( $\geq 18$  years old) living in the Eastern Region of Saudi Arabia. Participants were recruited from the major cities in the Eastern Region including Dammam, Khobar, and Qatif.

### **2.2. Study Population and Sample Size**

The researchers did not find statistically proven evidence about the proportion of Saudi women who might have the proper knowledge towards food safety. Accordingly, they assumed that the percentage would be 50%, and the sample size was consequently calculate according to the procedure of [Bartlett et al. \[8\]](#) using the following equation: Sample size ( $n$ ) =  $[Z^2 \times P \times (1-P)]/d^2 = [1.96^2 \times 0.50 \times (1-0.50)]/0.05^2 = 384$ . Where:  $Z$  = standard normal random variable (at 5% type 1 error it is 1.96),  $p$ = expected proportion of population based on the assumed prevalence, and  $d$ = absolute error or precision, decided by the researchers. Considering any potential error that might happen during data collection or management, the researchers decided to increase the sample size by 10% making the final sample size to be 422 women. During the actual data collections, 426 women participated in this study.

### **2.3. Methods**

**A valid and reliable self-administered online questionnaire was used to collect the required information about participants knowledge and perception towards food safety measures. The questionnaire included different domains, demographic data (age, education level, income), questions related to COVID-19 pandemic, food buying habits, and food safety knowledge, attitude and practice. In the general COVID-19 related questions, the participants were asked if they have been infected with COVID-19, how do they usually sanitize their hands, do they think COVID-19 can be transmission by food, did COVID-19 pandemic change their eating habits,**

number of daily meals and home-made food consumption, and if they have learned from COVID-19 about food safety. Food buying, handling and preparation related questions were about how often and where they shop for food, do they sanitize hands during and after shopping, and what were they concerned about while preparing food at home during COVID 19. The food safety related questions were do they wash hands before and after eating, and after touching raw meat, chicken and fish, and what were the drives to change their food safety behavior during COVID-19.

#### **2.4. Statistical Analysis**

The data was analyzed using IBM SPSS Statistics 21. Descriptive statistics and frequencies were calculated for demographic variables. Knowledge, Attitude and Practice (KAP) items were presented as frequencies and percentages.

### **3. Results**

The study included a total of 426 participants ranging from 18 to 60 years old, with a mean age of  $30 \pm 9$  years. The education and income levels of the participants are presented in Table 1. Twenty six percent (26%) of participants reported that they have been previously infected with COVID-19 and 54% of the participants had one or more family members who were infected with COVID-19.

Different relevant questions were used to collect data on the knowledge, attitude, and practice of food safety. The participants' responses are presented in Tables 2, 3 and 4. Data showed that 25% of participants believed that coronavirus can be transmitted by food, and 90% of participants reported that they learnt more about food safety during COVID-19 pandemic. Among the participants, 74% thought that hand sanitizing is important as a food safety measure during COVID 19.

Almost half of participants (44%) were shopping for food once a week during the pandemic, and 64% of the participants were concerned about cleaning while preparing the food. Additionally, 64% of participants reported that they were eating outside less frequently. Almost all participants were practicing hand sanitizing during and after shopping (96%), and were washing their hands after touching raw meat, chicken, or fish (98%). Also, 83% and 90% of participants responded that they wash their hands before and after eating, respectively.

#### 4. Discussion

COVID-19 disease appeared at the end of 2019 and spread globally causing severe morbidity and mortality. As of March 6, 2022, there have been 440,807,756 confirmed cases of COVID-19, including 5,978,096 deaths, reported globally to the WHO. The corresponding numbers in Saudi Arabia were 746,473 and 9,004, respectively [9], where cough, fever, and sore throat were the most common signs and symptoms [10].

According to the present study, 90% of participants showed good knowledge about COVID-19 mode of transmission, hygiene, and food safety during the pandemic. Due to the lack of knowledge about COVID-19 mode of transmission, and the unavailability of vaccines at the first stage of outbreak, the Ministry of Health in Saudi Arabia launched a series of public awareness campaigns about the virus transmission, symptoms and recommended precautionary measures to avoid infection such as hand washing, healthy and safe food, hygienic practices, social distancing, face masks, etc. The public awareness had a great impact in limiting the spread of COVID-19. In a study conducted in Hong Kong, Hon et al. [11] stated that keeping food safety managed in all food workplaces can reduce the transmission of the virus. Once more, Duda-Chodak et al. [6] did not find solid evidence that supports the transmission of the virus through the food, but some animal sources were shown to be virus carriers which may lead to infectious diseases. Therefore, increasing the public knowledge regarding food safety is crucial especially during the time of pandemics.

Moreover, the pandemic was found to increase food safety knowledge and practice among Americans, where most quality standards were improved as most people were looking for healthy and safe food [12]. In a large study involving 3,000 participants from United States (US), United Kingdom (UK), India, and Ireland, Geldsetzer [13] used an online questionnaire to measure the knowledge about food safety and COVID-19. The results showed that during the pandemic most people believed that the safety of food may prevent viral infection. The majority of participants tended to rinse grocery staff to protect themselves. Additionally, 78% of the participants changed their eating habits and food safety behavior to be safer. Despite the lack of concrete evidence that COVID-19 infection might be transferred by food consumption, food safety and hygiene is crucially important during the pandemic. Safe and healthy food helps in preventing diseases and keeping health.

The present study found that Saudi women showed positive attitudes and good practices during the pandemic. The hygienic practices related to safe and healthy food were reported by the majority of participants. They tended to prepare home-made food and reduce eating outside home. They further assured to wash their hands before\after eating or touching raw meats. These findings are in line with those of [Desai and Aronoff \[14\]](#) who found that participants showed good safety practices during COVID-19, including hand sanitation, and rinsing off raw foods such as fruit and vegetable. The present study showed that most participants consumed one to two meals a day during the pandemic, which is less than the recommended number of meals. This might be due to the low physical activity and increased sedentary lifestyle. This finding is supported by [Marti et al. \[15\]](#) who found that Europeans reduced their food consumption during the pandemic.

The findings of the present study would help increase the public awareness about the proper and safe handling of food especially during the time of pandemics and viral infections. Public health authorities may benefit from these findings in shaping education programs about food safety and hygienic practices, as well as developing policies that ensure the best and safest food handling and preparing, including safety measures in food production establishments and staff personal hygiene. The current study, however, has some limitations, represented in the self-reported online questionnaire which might have led to a sort of data losing or biasing, and the shortage in supporting studies related to food safety and COVID-19. Hence, further research is needed in this area.

## **5. Conclusion**

Regardless of the lack of evidence that supports the transmission of COVID-19 virus through the food, most participants believe that appropriate food safety and hygienic practices may prevent the virus transmission and reduce the spread of the pandemic. Thus, they adopted positive attitudes and improved behaviors towards food safety and hygienic practices since COVID-19 has popped out. More in-depth investigation and larger studies are needed to consolidate the relationship between food safety and hygiene and COVID-19 and other viral infections.

### ***Ethical Approval and Consent***

The study was approved by the Institutional Review Board of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia (IRB: 2021-03-109). Prior to their consent to participate in

the study, the participants were briefed about the research objective, their role and confidentiality rights, and any potential risks.

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### **Author Contribution**

This work was carried out in collaboration among all authors. WA contributed to data collection and drafting the initial version of the manuscript. TP conducted the statistical analysis of data. Both AG and RK evaluated the output and prepared the final version of the manuscript. All authors approved the final version sharing the responsibility for ensuring the manuscript complies with the journal style requirements and terms of consideration.

### **Transparency Declaration**

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported. The reporting of this work is compliant with STROBE guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

### **Competing Interests Disclaimer**

The choice of the topic and the views expressed are solely those of the authors. Authors have declared that no competing interests exist. 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.

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**Table 1. Demographic Variable Distribution of the Study Participants**

<b>Variables</b>	<b>Categories</b>	<b>Number (n)</b>	<b>Percent (%)</b>
Education	Primary	9	2
	Elementary	25	6
	Secondary	144	34
	University	248	58
Income	≤5,000	103	24
	5,000-10,000	103	24
	10,000-15,000	44	10
	>15,000	67	16
	Not responded	109	26

**Table 2. Knowledge of Food Safety during COVID-19**

	<b>Number (n)</b>	<b>Percent (%)</b>
Do you think COVID-19 can be transmitted by food?		
Yes	107	25
No	190	45
Neither	129	30
Have you learned from COVID-19 pandemic about food safety?		
Yes	382	90
No	44	10
Mode of hygiene or safety during COVID-19:		
Hygiene practices	320	87
Social distancing	33	9
Wearing mask	13	4
Reasons for changing food safety behavior during COVID-19:		
Severity of disease	221	52
Media	14	3
Precautionary measures	191	45

**Table 3. Attitude towards Food Safety during COVID-19**

	<b>Number (n)</b>	<b>Percent (%)</b>
How often do you shop for food, either for yourself or others in your household?		
Everyday	36	9
Weekly	188	44
Monthly	131	31
less than monthly	55	13
Never	16	4
Where do you mainly shop for food?		
Supermarket	370	87
Specialist retailers	12	3
Market	31	7
Restaurant	13	3
What were you most concerned about regarding food during COVID 19?		
Food must be always clean	271	64
Prepare food at home	57	13
Use hot food serving	5	1
Use cold food serving	3	1
Individual food serving	19	4.5
Group family eating	71	17

**Table 4. Practice of Food Safety during COVID-19**

	Number (n)	Percent (%)
During COVID 19 pandemic, how do you usually sanitize your hand?		
Water with soap	236	56
Hand sanitizer	186	44
During COVID-19 pandemic was there any changes towards eating outside home?		
Yes	244	57
No	182	43
What is your current behaviour?		
Eating outside less frequency	272	64
Eating outside more frequency	14	3
No change	140	33
The number of daily meals you usually take during COVID-19 pandemic:		
1-2 meals/day	270	63
3-5 meals/day	150	35
6 or more meals/day	6	2
Do you often eat home-made foods during COVID-19?		
Yes	262	62
No	49	11
Sometimes	115	27
Do you sanitize your hand during and after shopping?		
Yes	411	96
No	15	4
How often do you wash your hands after touching raw meat, chicken, or fish?		
Always	400	94
Most of the times	17	4
Sometimes	2	5
Rarely	2	5
Never	5	1
How often do you wash your hands before eating?		
Always	352	82.6
Most of the times	40	9.4
Sometimes	29	6.8
Rarely	3	7
Never	2	5
How often do you wash your hand after eating?		
Always	384	90
Most of the times	24	6
Sometimes	14	3
Rarely	2	5
Never	2	5