

ARTICLE

COVID-19 pandemic's impact on eating habits in Saudi Arabia

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Abstract

Background: COVID-19 virus has been reported as a pandemic in March 2020 by the WHO. Having a balanced and healthy diet routine can help boost the immune system, which is essential in fighting viruses. Public Health officials enforced lockdown for residents resulting in dietary habits change to combat sudden changes.

Design and Methods: A cross-sectional study was conducted through an online survey to describe the impact of the COVID-19 pandemic on the eating habits, quality and quantity of food intake among adults in Saudi Arabia. SPSS version 24 was used to analyze the data. Comparison between general dietary habits before and during COVID-19 for ordinal variables was performed by Wilcoxon Signed Rank test, while McNemar test was performed for nominal variables. The paired samples *t*-test was used to compare the total scores for food quality and quantity before and during COVID-19 periods.

Results: 2706 adults residing in Riyadh completed the survey. The majority (85.6%) of the respondents reported eating home-cooked meals on a daily basis during COVID-19 as compared to 35.6% before ($p < 0.001$). The mean score for the quality of food intake was slightly higher ($p = 0.002$) before the COVID-19 period (16.46 ± 2.84) as compared to the during period (16.39 ± 2.79). The quantity of food mean score was higher ($p < 0.001$) during the COVID-19 period (15.70 ± 2.66) as compared to the before period (14.62 ± 2.71).

Conclusion: Dietary habits have changed significantly during the COVID-19 pandemic among Riyadh residents. Although some good habits increased, the quality and the quantity of the food was compromised. Public Health officials must focus on increased awareness on healthy eating during pandemics to avoid negative consequences. Future research is recommended to better understand the change in dietary habits during pandemics using a detailed food frequency questionnaire.

Introduction

A novel coronavirus (COVID-19) outbreak was reported in

Wuhan, China, in December 2019.¹ The COVID-19 virus has spread rapidly globally and has been declared as a pandemic in March 2020 by the World Health Organization (WHO).² COVID-19 virus is considered an infectious disease affecting the respiratory system and can be fatal.³ Its signs and symptoms include fever, dry cough, fatigue or myalgias, headache, sore throat, abdominal pain, and diarrhea.⁴ Individuals with chronic medical conditions and the elderly are at higher risk and more likely to develop serious complications (⁵). The virus can be transmitted through droplets of saliva or nose discharges from an infected person, with an incubation period of 2-14 days.⁵ Therefore, primary prevention measures include hand hygiene, practicing respiratory etiquette, and social distancing, given that there is no treatment or vaccine for this virus so far.⁶

On March 2nd, 2020, Saudi Arabia reported the first case of COVID-19.⁷ The Ministry of Health and public health officials in Saudi Arabia put a lot of effort into controlling coronavirus spread. The Saudi government enforced lockdown and created curfew for all its residents by the end of March 2020 for about three months.⁸ Residents were not allowed in the streets except authorized professionals such as medical staff and police officers to combat the virus's spread. Violators of lockdown measures were subject to penalties and arrests. The entire community was affected because malls, restaurants, and shops were closed during the lockdown period from March till June of 2020. Only supermarkets and bakeries remained open, allowing selling goods online and in stores with banning serving food or beverages on their premises.⁸ The government also closed indoor and outdoor sports facilities, including gyms, public swimming pools, and parks.⁹

Saudi Arabia has experienced dietary transitions in the last decades, as the country has grown economically and became more influenced by the western culture. Since the 1960s, Saudi Arabia has shown a substantial economic growth from the oil revenue. Economic growth alongside globalization has led to linking the Saudi market to Western markets, affecting the food industry.¹⁰ As a result of the Western influences, eating habits in Saudi Arabia have undergone many transitions. Saudis have replaced traditional foods with fast foods over the past decade due to convenience, which compromised food quality and quantity and led to increased obesity levels, hence the obesity pandemic.¹¹

Significance for public health

Since pandemics come unannounced affecting public's safety, it is important to understand the changes that occur in a community. This study focuses on the dietary habits' changes during the COVID-19 pandemic. Coronavirus has been a threatening matter on a global level. It is tremendously crucial to consider various aspects of human health during pandemics including dietary habits, food quality and quantity as such factors play an important role in improving the immune system and overall health. Increasing the community's awareness on the importance of healthy food intake during COVID-19 pandemic is extremely necessary. Public health's role is to understand people's reactions during pandemics and establish guidelines to improve health and prevent diseases. Dietary habits change during COVID-19 is a major health threat that needs immediate Public Health Officials' attention. Maximizing awareness about healthy eating habits during quarantine requires attention to improve the overall health of the population.

Nutrition is considered a public health priority at this time to build strong immunity and prevent the body from viruses.¹² Having a balanced and healthy diet routine can help boost the human body's immune system, which is essential in fighting viruses.¹³ Healthy diets can protect the community from an excessive inflammatory response to coronavirus.¹⁴ During the COVID-19 pandemic, physical activity among Saudis decreased since most sports facilities were forced to close by the government. The reduction in physical activity can lead to positive energy balance and increased body weight.⁹ However, during the pandemic, the sudden change has led to fear and anxiety about food security globally. People started to panic and overstock on food supplies in the markets.¹⁵ Individuals tend to exceed their needs, rush to buy and stock up on groceries as they fear food insecurity. Stress-eating became very common due to lockdown among many adults.¹²

Many countries have enforced lockdown measures and were under quarantine to limit the virus's spread during its peak. The government forced individuals to stay at home, resulting in boredom and increased stress and anxiety levels.¹⁶ Unfortunately, boredom and stress are associated with increased food intake, especially comfort foods high in sugar. Food craving is defined as the desire to consume a particular type of food. It is considered a multidimensional concept that includes emotional, behavioral, cognitive, and physiological processes.¹⁷ Women tend to have more food cravings than men. Carbohydrates craving increases serotonin levels, which positively impacts mood levels, and can be a way to combat stress. This unhealthy dietary routine could increase the risk of chronic medical conditions such as obesity, diabetes, and lung disease, which can increase complications of COVID-19 in a community.¹⁷

Since pandemics come unannounced, forcing individuals to change certain behaviors instantly, it is of great value to document the change in dietary habits during the COVID-19 pandemic, mostly that developing countries have encountered dietary transitions in the past.¹⁸ This study will help us better understand our community after enforcing the lockdown policies and direct public health to increase the focus and shed light on healthier and safer food options especially during quarantine in pandemics.

Design and Methods

A cross-sectional study was conducted on a sample of Riyadh residents in Saudi Arabia during the lockdown. The target population consists of adults residing in Riyadh-Saudi Arabia with an estimated population of 8.4 million adults. Convenience sampling was used; the required sample size was estimated to be 2401 based on a 95% confidence level and 2% margin of error based on an estimated 50% outcome response. The inclusion criteria are for the age category 18 years old or older and for participants Saudi Arabia participants during the COVID-19 pandemic. A questionnaire was distributed online via social media channels WhatsApp, LinkedIn, Snapchat, Facebook, and Twitter from 5-15 of May 2020, during the Holy month, Ramadan.

The questionnaire had four sections. Each section had the same questions for the periods pre and during coronavirus. The first section included demographic questions; the second section covered general dietary habits; while the third and fourth sections contained questions about dietary food in terms of quality and quantity of food, respectively. The questionnaire was taken from two previously published and validated surveys,^{19,20} and modified to fit the study's objectives. A clinical dietician from a local hospital in Riyadh reviewed the questionnaire and achieved the content validity. The survey was written originally in English and then translated

to Arabic by a translator who confirmed a match in both languages; hence, face validity was obtained. The questionnaire was sent in Arabic and English to target Arabic-speaking people and foreigners. The demographics included age groups, gender, nationality, education level, marital status, and monthly income in Saudi Riyal (SR). The five questions related to the quality of food were on a Likert scale of 1 to 5 (Strongly disagree to Strongly agree); the sum of these five questions was taken to represent the total quality of food score (max=25). The eight quantity of food questions were on a scale of 0 to 3 based on the frequency of food item use per week or day. The sum of these eight questions was taken to give the total quantity of food score (max=24). Respondents were asked the same question for pre and during COVID-19 periods. SPSS version 24 was used to analyze the data.

Data are represented as frequency and percentage for categorical variables. A comparison between general dietary habits before and during COVID-19 for ordinal variables was made by Wilcoxon Signed Rank test, while McNemar test was performed for nominal variables. The paired samples *t*-test was used to compare the total scores for the quality and quantity of food before and during COVID-19 periods. A *p*-value <0.05 was considered to show a statistically significant difference for all the statistical tests.

Results

There was a total of 2706 completed questionnaires received online, and the demographics of the respondents are shown in Table 1. The majority of the respondents *i.e.*, 1899 (70%), were from the younger age group of 18-35 years, and there 1466 (54%) were females. Almost all *i.e.*, 2494 (92%) were Saudi, and more than half, 1724 (64%) had a bachelor's degree or higher, and more than half, 1551 (57%) were single. Monthly income was reported by 1680 of respondents and of these the highest response was for the lower income category of less than SR 10,000 (US\$ 2667) per month, 729 (43%).

Table 2 shows the comparison of the dietary habits before and during the COVID-19 outbreak. The responses were compared using the Wilcoxon Signed Rank test or the McNemar test before and after the comparison of ordinal and nominal variables respectively. A significant difference was found for all the six questions for the dietary habits. There was an increase in the respondents rating of their eating healthy food as very good/excellent from 22.3% to 29.5% during the COVID-19 period ($p < 0.001$). The majority (85.6%) of the respondents reported eating home cooked-meals daily during the COVID-19 compared to 35.6% before ($p < 0.001$). The proportion of ordering food from outside per week was 0 in 74.7% of the respondents during the COVID-19 period as compared to 15% in the before period ($p < 0.001$).

There was a slight increase in the proportion of respondents who bought groceries three or more times per week from 35.9% before the COVID-19 to 38.9% during the COVID-19 period ($p = 0.02$). The proportion of buying groceries online increased to 28.6% during the COVID-19 period as compared to 3% before; the majority of the respondents (93%) used to buy groceries from the market before, but this decreased to 66.7% during the COVID-19 period ($p < 0.001$). There was a marked increase in the respondents reporting anxiety about food hygiene from outside from 17.3% before to 72.9% during the COVID-19 period ($p < 0.001$), as shown in Table 2.

Sections 3 and 4 of the survey asked about the quality and quantity of food before and during the COVID-19 period. These questions were on a Likert scale from 1 to 5 for the food quality (five questions) and 0 to 3 for the food quantity (eight questions).

The scores were totaled for the respective sections, and the mean total scores were compared for before and during COVID-19 period (Figure 1). The mean score for the quality of food intake was slightly higher ($p=0.002$) for before COVID-19 period (16.46 ± 2.84) as compared to during COVID-19 period (16.39 ± 2.79). On the other hand, the quantity of food mean score was higher ($p<0.001$) during the COVID-19 period (15.70 ± 2.66) as compared to the before period (14.62 ± 2.71).

The mean scores for the quality and quantity of food were compared by the subcategories of the different demographic variables (age group, gender, nationality, education level, marital status, and monthly income category), as shown in Table 3. It was seen that the quantity of food scores was significantly higher across all the subcategories. The significance level was $p<0.001$ for all the categories except for age-group >55 years ($p=0.003$) and being divorced/widowed ($p=0.02$). Regarding food's quality, it was found that there was only one subcategory in each demographic variable that was showing a significant difference. The oldest age group of more than 55 years showed a higher score during COVID-19 ($p=0.01$) in the age-groups. When comparing gender, there was no difference between the males, but the females had a slightly higher mean score for the before COVID-19 period. The Saudi respondents had a slightly higher score in the before COVID-19 period compared to the during period ($p=0.04$), but no significant difference was found for the non-Saudi respondents. Regarding the marital status, the married respondents had a slightly higher score during the COVID-19 period ($p<0.001$). The respondents in the higher income group of Saudi Riyals 20,000+ (US\$ 5333) per month were found to have a higher score ($p<0.001$) for the quality of food score.

Table 1. Demographics of online respondents.

n=2706	n	%
Age group (years)		
18-35	1899	70.2
36-55	658	24.3
>55	149	5.5
Gender		
Male	1240	45.8
Female	1466	54.2
Nationality		
Saudi	2494	92.2
Non-Saudi	212	7.8
Education level		
High school	982	36.3
Bachelors	1312	48.5
Graduate	412	15.2
Marital status		
Single	1551	57.3
Married	1028	38.0
Divorced / widowed	127	4.7
Monthly income (SR)		
9,999 or less	729	43.4
10,000-19,999	578	34.4
20,000 or more	373	22.2
Total	1680	100.0
No answer	1026	

Table 2. Comparison of dietary habits before and during COVID-19.

Dietary habits		Before COVID-19 (n=2706)		During COVID-19 (n=2706)		p
		n	(%)	n	(%)	
How would you rate your overall habits of eating healthy foods?	Poor	616	22.8	509	18.8	<0.001 ^a
	Fair	808	29.9	718	26.5	
	Good	677	25.0	680	25.1	
	Very good	442	16.3	587	21.7	
	Excellent	163	6.0	212	7.8	
How often do you eat home-cooked meals per week?	0	90	3.3	98	3.6	<0.001 ^a
	1-2 times/week	491	18.1	78	2.9	
	3-6 times/week	1162	42.9	215	7.9	
	Daily	963	35.6	2315	85.6	
How often do you order from a restaurant, take away, and delivery per week?	0	406	15.0	2021	74.7	<0.001 ^a
	1-2 times/week	1369	50.6	474	17.5	
	3-6 times/week	698	25.8	118	4.4	
	Daily	233	8.6	93	3.4	
How often do you buy groceries per week?	0	181	6.7	175	6.5	0.02 ^a
	1-2 times/week	1555	57.5	1478	54.6	
	3-6 times/week	641	23.7	701	25.9	
	Daily	329	12.2	352	13.0	
How do you mostly buy groceries?	Online	81	3.0	774	28.6	<0.001 ^b
	Market	2515	92.9	1804	66.7	
	I Don't	110	4.1	128	4.7	
Do you have any anxiety about food hygiene when you buy food from markets, online, restaurants, take away, or delivery?	Yes	467	17.3	1974	72.9	<0.001 ^a
	Sometimes	1149	42.5	511	18.9	
	No	1090	40.3	221	8.2	

^aWilcoxon Signed Rank test; ^bMcNemar test.

Discussion

Dietary habits

Since coronavirus is still in its infancy stages, this is the first study, to our knowledge, that focuses on eating habits and dietary change during the COVID-19 pandemic in Saudi Arabia. The main objective of this study is to describe the change in dietary habits, quality and, quantity of food intake during the COVID-19 pandemic. Eating habits are impacted during quarantine by reducing available goods, lack of the accessibility of food, grocery store limited opening hours, and consuming unhealthy food.¹⁷ Our results in the dietary habits section showed a significant increase in healthy food rating from 23.3% before COVID-19 to 29.5% during COVID-19 ($p < 0.001$). During COVID-19, 85.6% of the participants reported eating home-cooked meals every day during the COVID-19 compared to only 35.6% before the pandemic ($p < 0.001$). Interventions that encourage home-cooked meals can help households to incorporate nutritious food items into their diets,²¹ but this does not necessarily be true as some individuals increase carbohydrates and sugar intake. Respondents might have rated their habits of eating healthy food as better because they shifted to homecooked meals and reduced ordering from restaurants. However, the quality and quantity play a significant role of eating healthy. Therefore, the concept of eating healthy varies and can be misleading to some individuals depending on their backgrounds and educational level.²² Another Italian study conducted during COVID-19 matches our findings as it reported an increase of homemade recipes consumption during the lockdown,

and 37.4% declared to eat more healthy food options.²³ Besides, another Canadian study found that respondents' eating habits have changed since COVID-19 started as they ate more snacks and increased cooking meals at home.²⁴ The lockdown in Saudi forced restaurants, malls, and delivery applications to work during limited hours only, which may have affected the eating habits as the lockdown and public safety measures interfered with regular eating habits.⁸ This factor may have impacted many individuals to shift to home-cooked meals since there are no other options. Another significant factor for dietary habits change was Ramadan, as many people change their dietary routine to enable Islamic fasting practices.²⁵

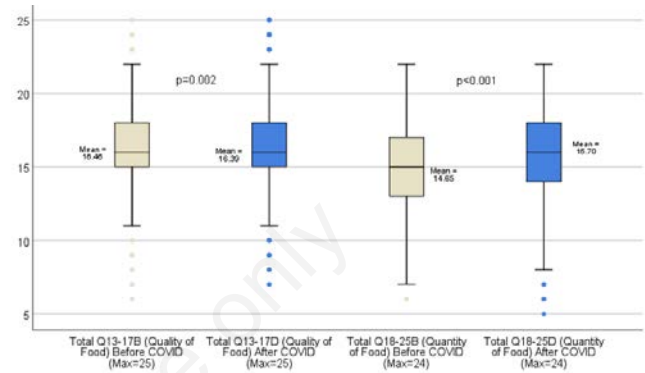


Figure 1. Before and during total scores for quality and quantity of food questions (n=2706).

Table 3. Comparison of before and during total scores for quality and quantity of food by demographic variables.

	n	Quality of food (max=25)			Quantity of food (Max=24)		
		Before COVID-19	During COVID-19	p	Before COVID-19	During COVID-19	p
Age group (years)							
18-35	1899	16.1+2.8	16.0+2.8	0.17	14.1+2.7	15.3+2.7	<0.001
36-55	658	17.2+2.7	17.1+2.6	0.15	15.8+2.3	16.5+2.4	<0.001
>55	149	18.0+2.8	17.7+2.8	0.01	16.5+2.2	16.9+2.5	0.003
Gender							
Male	1240	16.4+2.7	16.4+2.7	0.55	14.7+2.8	15.7+2.7	<0.001
Female	1466	16.5+2.9	16.4+2.8	0.009	14.6+2.6	15.7+2.6	<0.001
Nationality							
Saudi	2494	16.4+2.9	16.3+2.8	0.04	14.6+2.7	15.7+2.7	<0.001
Non-Saudi	212	17.0+2.5	16.9+2.6	0.21	14.8+2.8	15.8+2.6	<0.001
Education level							
High school	982	15.9+2.8	15.9+2.7	0.94	14.1+2.8	15.3+2.8	<0.001
Bachelors	1312	16.4+2.8	16.4+2.7	0.16	14.8+2.7	15.8+2.6	<0.001
Graduate	412	17.9+2.8	17.9+2.9	<0.001	15.6+2.3	16.3+2.4	<0.001
Marital status							
Single	1551	15.9+2.9	16.0+2.8	0.89	14.0+2.8	15.3+2.7	<0.001
Married	1028	17.1+2.7	17.0+2.6	<0.001	15.5+2.4	16.3+2.4	<0.001
Divorced / widowed	127	17.3+2.5	17.1+2.6	0.20	15.6+2.4	16.1+2.5	0.02
Monthly income (SR)							
9,999 or less	729	16.0+2.7	16.0+2.6	0.27	14.4+2.7	15.6+2.6	<0.001
10,000-19,999	578	16.9+2.7	16.8+2.7	0.7	15.2+2.5	16.0+2.6	<0.001
20,000 or more	373	17.6+2.9	17.3+3.0	<0.001	15.6+2.4	16.2+2.5	<0.001

Nevertheless, studies focused on dietary intake during Ramadan concluded that Ramadan fasting has no impact on feelings, dietary intake, and short-term maximal performance.^{25,26} Also, our study used a self-administered questionnaire; individuals ranked their eating habit as healthier since they shifted to home-cooked meals, regardless of the quality and quantity of food.

Our results also showed that 74.7% of the population has reported that they never ordered food from outside per week compared to prior COVID-19, as only 15% reported ordering food from outside ($p < 0.001$). Likewise, a study in Kuwait confirmed that the percentage of people who had their main meal from restaurants reduced from 14.7% before COVID-19 to 2.2% during COVID-19.²⁷ In addition, an Indian study concluded that the majority (97%) of participants did not order food from outside during coronavirus lockdown.²⁸ These countries have enforced similar lockdown measures, which explains the reduced percentages. Instead, our results show a slight increase in the proportion of respondents who bought groceries three or more times per week from 35.9% before the pandemic to 38.9% during the pandemic period ($p = 0.02$). The proportion of buying groceries online increased to 28.6% during the COVID-19 period compared to only 3% before. This study is in concordance with ours as the percentage of online grocery shopping increased from 3.9% before COVID-19 to 9.2% during COVID-19.²⁷ Another Canadian study found growth in the online food industry during the COVID-19 pandemic.²⁹ Another study showed that 75.8% of respondents purchase food at the supermarket, 26% at the grocery shops, 14.8% at farmers or local markets, and 9.0% use online delivery.²³ On the other hand, our results indicate that most of the respondents 93% used to buy groceries from the market before the pandemic, but this decreased to 66.7% during the COVID-19 period ($p < 0.001$). This can be justified as 72.9% of the respondents reported anxiety about food hygiene from outside during COVID-19, whereas only 17.3% had anxiety prior ($p < 0.001$). Moreover, nutritional habits are impacted during quarantine by reducing available goods, lack of food accessibility, and grocery store limited opening hours.¹²

Quality of food

The quality of food was slightly higher ($p = 0.002$) before COVID-19 as the mean score was (16.46±2.84) before the pandemic and (16.39±2.79) during the pandemic. This study mirrors our findings as the food intake quality has changed negatively during COVID-19 pandemic, as consumption of carbohydrates and fat increased by 21% and 13%, respectively. However, fruit consumption increased by 7%.²⁸ During the COVID-19 pandemic, people tend to be anxious and stressed regarding a shortage of food in the future. This fear resulted in purchasing packaged and long-life food instead of fresh food, which impacted the quality and led to gaining weight and increased the intake of oxidants.³⁰ A study conducted in Europe and Latin American concluded notable decreased physical activity levels and increased processed food intake during COVID-19 pandemic.³¹ A study concluded that food quality was compromised because (31.5%) increased sugary beverages intake during COVID-19 and 36.7% increased fried food consumption.³² However, the increase in fruit and vegetable intake was 33.2% and 39.5%, respectively.³² Another study concluded that 43.9% of participants mentioned that the quality of food sold in their areas in Zimbabwe has decreased, and the prices have increased. Therefore, food security was an issue as the quality of available food was compromised during the pandemic.³³ An Italian study found an increased intake of sweets, snacks, and cereals, yielding an increase in weight and Body Mass Index during the lockdown, especially among those who reported less exercise levels.³⁴ Regarding Ramadan's timing, a study indicated that people tend to consume more carbohydrates during Ramadan and that is related to the culturally distinct traditional foods prepared during Ramadan time.³⁵

Quantity of food

On the other hand, the quantity of food mean score was higher during the COVID-19 period (15.70±2.66) than prior COVID-19 (14.62±2.71). Lippi *et al.* support our results as they concluded that unhealthy dietary habits are more common during the lockdown as there is a reduction of fruits and vegetables intake and an increase in snacking and coffee consumption.³⁶ An Italian study concluded that 52.9% were eating more during the lockdown. The study also stated that there had been an increase in comfort food consumption, including chocolate, ice-cream, desserts, and salty snacks.³⁷ Another Polish study concluded an increase in food and snack consumption 43% and 52%, respectively, during COVID-19 pandemic.³⁸ Since most recreational centers closed during the lockdown, physical activity was limited and replaced with extra screening time and increased food intake.⁹ In addition, a study in Zimbabwe indicated that 57.8% of participants reported a decrease in the consumption of fruits and vegetables rich in vitamin A, 45% stated a reduction in nuts and seeds intake during the lockdown. However, 33.7% indicated increase in dark green leafy vegetable consumption.³³ Moreover, a study found that adolescents increased intake of fried food, sweets, and legumes during COVID-19.³⁹ Conversely, a Chinese study found a generally improved quality of food during the COVID-19 period among Chinese people.⁴⁰ Since the survey was distributed in Ramadan, food quantity may have been impacted not only by the COVID-19 but also by practicing the Islamic fasting measures. A study conducted in Ghana indicated that fasting during Ramadan causes a reduction in consumption of foods from roots and tubers, legumes and nuts, and dark green leafy vegetables, resulting in increased dietary diversity and change in usual food routines.⁴¹ However, some studies show that people do not reduce the number of calories in their food during Ramadan's month.³⁵

Demographics

The quantity of food scores was significantly higher across all the subcategories during COVID-19. The significance level was $p < 0.001$ for all the categories except for the age group > 55 years ($p = 0.003$) and being divorced/widowed ($p = 0.02$). A study conducted during quarantine found that most participants were less active, consumed comfort foods and gained weight during the pandemic in Africa. The lockdown and elevated anxiety levels increased food intake, which can worsen overweight and obesity levels.³³ Regarding the quality of food, the oldest age group of more than 55 years showed a higher significant score during COVID-19 ($p = 0.01$). Older populations are at a higher risk of contracting COVID-19 complications compared to younger populations. Therefore, they could have improved food intake quality during the pandemic to improve their immune system.⁴² When comparing by gender, a study in China concluded that females were associated with a higher score of willingness to adopt healthy diet than males during COVID-19 pandemic.⁴⁰ Yet, our study showed that females had a slightly higher mean score for the quality of food before the COVID-19 period. A study reported that females showed significantly higher psychological distress than males ($p < 0.001$) amid COVID-19,⁴³ which can result in increased food craving and comfort food consumption.¹⁷ With regard to marital status, our findings show that married respondents have a slightly higher score of food quality during the COVID-19 period ($p < 0.001$). Another study shared the same results, concluding that married participants were significantly associated with higher dietary improvement score during the COVID-19 pandemic.⁴⁰ Although a study indicated that higher income was associated with lower quality of food,⁴⁴ studies concluded that individuals with lower household income are more likely to consume poor food quality compared to those with higher household income.^{45,46} Our results also showed that respondents in the higher income group of SR 20,000+ per month had a

higher quality of food score ($p < 0.001$). Higher income can impact the quality of food consumed and purchased as it facilitates accessibility to healthier, nutritious and fresh food items.⁴⁷

Conclusions

Dietary habits have changed significantly during the COVID-19 pandemic among Riyadh residents. Although some good habits increased, such as consuming home-cooked meals, the quality and the quantity of the food was compromised. Food quality and quantity became worse during the COVID-19 pandemic. Therefore, public health officials must increase their focus on nutrition awareness by suggesting healthy food choices and nutritious alternatives during pandemics, especially in lockdown situations. Future research is highly needed to better understand the change in nutrition habits during pandemics using a detailed food frequency questionnaire. Some of the limitations of this study are recall bias of food intake or misreporting data. Since it is an online survey, selection bias can occur, given that only people with internet access were included in the study. Moreover, the questionnaire was distributed during Ramadan, the holy month, which may have affected dietary habits due to fasting. The questionnaire lacks information about physical activity, which could have added a lot of value to the study. No causal inferences can be drawn due to the nature of cross-sectional studies. Since coronavirus is still in its infancy stages, this is the first study to our knowledge that focuses on eating habits and dietary change during the COVID-19 pandemic on a local level. There is no peer-review data about the impact of COVID-19 pandemic on the dietary habits in Saudi Arabia. This study is novel as it will add new information to the current literature about dietary habits during a pandemic. A high response rate was achieved most probably because people were in lockdown.

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Key words: COVID-19; dietary habits; food quality; food quantity; pandemic.

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Conflict of interest: The authors declare that they have no competing interests, and all authors confirm accuracy.

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