



Changes in Nutritional Habits and lifestyles during the COVID-19 Lockdown period in Saudi Arabia: A Cross-Sectional Study

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Abstract

The World Health Organization (WHO) declared the coronavirus disease (COVID-19) to be a pandemic in March 2020 due to growing case notification rates worldwide. This study was designed to investigate nutritional habits and lifestyle changes among people living in the Kingdom of Saudi Arabia (KSA) during the COVID-19 lockdown. A cross-sectional study of 208 adults aged 18 to 56 years living in the KSA was conducted between March and May 2020. Participants were identified and invited to complete an online survey. Google forms were used by participants to self-report their nutritional habits, lifestyles, and physical activity levels during the lockdown. Of the 208 participants, 88.9% were female. More than half of the participants (58.1%) reported an increase in their food consumption during the lockdown, which included a higher intake of fast food (47.1%), sweets (48.5%), and fruits and vegetables (49%). 30.8% of participants reported an increase in body weight during the lockdown, while 32.2% reported a decrease. Staying at home or working from home was associated with decreased levels of physical activity in 39% of participants. This study provides the first data on changes in nutritional habits and lifestyles during the COVID-19 quarantine. Our findings suggest that people should decrease their intake of foods that are high in fat and sugar and increase their physical activity levels to maintain a healthy lifestyle.



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Introduction

The World Health Organization (WHO) declared the coronavirus disease (COVID-19) to be a pandemic in March 2020 due to growing case notification rates

worldwide.¹ The first case of COVID-19 was reported in Wuhan, China, in December 2019 and the virus then spread rapidly around the world.

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Up to date, the number of coronavirus cases confirmed worldwide reached 230,418,451 and deaths reached 4,724,876² on September 2021 and in the Kingdom of Saudi Arabia (KSA), 546,792 confirmed cases and 8,684 deaths have been reported in September 2021.³ Between a third and a half of the global population has been under quarantine since March 2020 in an effort to stop the spread of the virus.^{4,5}

In the KSA, the government acted quickly in their efforts to control the pandemic.⁴ The first case of COVID-19 in the KSA was confirmed on March 2, 2020.⁶ School and university closures were imposed on March 9, 2020. On March 16, workplace attendance was suspended, and restaurants, cafes, gyms, and shopping centers were closed. A lockdown was imposed from March 23 to June 21, 2020. Since March 23, 2020, the majority of Saudi people have worked from home and stayed at home to stop the spread of COVID-19.⁷ Studies have reported that lockdown can significantly control and delay the spread of the virus by 5–6 months, as opposed to 2.5 months without quarantine measures.^{8,9}

During the lockdown, many people changed their eating habits and levels of activity as they could only leave home for emergency propose. Several researchers have expressed concern about lifestyle changes during lockdowns, which can influence people's eating habits.^{10,11}

The WHO and public health guidance on nutrition have advised people to stay healthy during quarantine by following general health advice, which suggests eating a balanced diet rich in fresh foods, such as fruits and vegetables, and whole grains, and eating less high-fat foods, processed foods high in calories and salt, and sugary drinks.¹⁰ Moreover, it is recommended that people stay physically active, drink plenty of water, get enough sleep, and manage stress, as these actions can improve immune system functioning.^{12,13} The present cross-sectional study aimed to assess the impact of the COVID-19 lockdown on the nutritional habits and lifestyles of adults in the KSA by comparing aspects such as their food choices and level of physical activity before and during the pandemic.

Materials and Methods

Study Design and Participants

This cross-sectional study aimed to assess changes in nutritional habits and lifestyles during the COVID-19 lockdown in the KSA. The study was conducted in the KSA between March and May 2020, when the mandatory quarantine was first imposed. The study invited those aged 18 to 56 years living in the KSA to participate in the study by completing an online survey. Google forms of the questionnaire were sent to participants to complete via email and social media platforms, including Twitter, Telegrams, and WhatsApp. The questionnaire included a description of the study information and a consent form. Participants were excluded from the study if they were younger than 18 years, had a severe illness or chronic disease, or had been infected with COVID-19. Pregnant women, people who followed specific or strict weight-loss diets, and people who did not live in the KSA were excluded. This study was conducted according to the guidelines set by the Declaration of Helsinki (2000).

Questionnaire

An online survey was designed in Arabic and English using Google forms The survey contained questions about personal eating habits and lifestyles before and during the COVID-19 lockdown. The survey was reviewed and evaluated by research teams. A pilot study was conducted with 12 participants in Al-Ahsa in the KSA to check the clarity and participant understanding of the questions, as well as the time needed to complete the questionnaire. After the pilot study, appropriate modifications were made in the questionnaire.

After providing and signing the consent form by electronic signature, the participants completed the online survey. The survey included questions about lifestyles before and during the lockdown, with many items related to changes in dietary habits and the potential impact of the lockdown on nutritional choices. The questionnaire contained 31 questions, which were divided into five parts. The first part consisted of seven questions about personal data, which included gender, age, nationality, marital status, education level, KSA region, and employment status. The second part consisted of four questions, which included dietary habits before

and during the COVID-19 quarantine. The third part contained 13 questions, which covered eating habits and lifestyle changes during the quarantine, including body weight changes, type of healthy lifestyle followed, number of meals and snacks consumed, number of meals cooked at home and ordered in, type of meals consumed, consumption of fruits and vegetables, consumption of herbal drinks, consumption of chicken and fish meals, consumption of cereals, consumption of soft and energy drinks, consumption of sweets, consumption of foods high in vitamin C, and consumption of vitamin C supplements. The fourth part contained five questions about participants' levels of physical activity before and during the COVID-19 outbreak. Participants were asked about their engagement in physical activity or sports before the pandemic, their gym attendance, whether they exercised at home during the lockdown, whether their time spent exercising increased during the quarantine, and how they obtained information and knowledge related to physical activity. The final part of the questionnaire contained two questions about the participants' sources of nutritional information and knowledge related to food and health during the COVID-19 pandemic.

The study protocol was approved by the Ethics Committee at the College of Agricultural and Food Sciences (58758). All participants were informed about the study requirements and gave their consent for data sharing and policy before completing the questionnaire. After the survey was completed on Google forms, the final data were downloaded into a Microsoft Excel sheet. For this study, "before the COVID-19 pandemic" was defined as the period before the COVID-19 outbreak, and "during the pandemic" was defined as the period during the lockdown quarantine in the KSA from March to June 2020.

Statistical Analyses

Statistical analysis was carried out using SPSS v.26 (IBM, Armonk, USA). Data were presented as numbers and percentages for categorical variables. The Shapiro–Wilk test was conducted to evaluate the variable distribution. A t-test was used to investigate the difference between the categorical variables of eating habits and lifestyle before and during the COVID-19 outbreak. A general linear model repeated measures ANOVA was used to evaluate eating

habits and lifestyle during the COVID-19 outbreak. Results of $p < 0.05$ were considered statistically significant.

Table 1: Participant characteristics (n=208)

Characteristics	All (n=208)	%
Gender		
Female	185	88.9%
Male	23	11.1%
Nationality		
Saudi	207	99.5%
Non-Saudi	1	0.5%
Age (Years)		
18-25	97	46.6%
26-35	68	32.7%
36-45	25	12.0%
46-55	13	6.3%
Above 55	5	2.4%
Distribution of participants according to Geographic area (Regions in the KSA)		
Central	33	15.9%
Northern	1	0.5%
Eastern	125	60.1%
Western	49	23.5%
Marital Status		
Married	104	50.0%
Single	91	43.7%
Divorces	13	6.3%
Educational Level		
Less than High school	--	--
High School	20	9.6%
Bachelor's degree	137	65.9%
Master's degree	38	18.3%
PhD degree	10	4.8%
Others	3	1.4%
Employment Status		
Full Time	58	27.9%
Part-Time	4	1.9%
Students	87	41.8%
Unemployed	50	24.0%
Retired	5	2.5%
Private works	4	1.9%

Results

Participant Characteristics

The characteristics of the participants are presented in Table 1. We received 219 responses, but 11 had to be excluded, as they were not eligible to

participate: six were out of the age range, and five had not completed the questionnaires. The final sample of 208 participants completed the survey. The study was a cross-sectional study of the 208 participants 88.9% were female and 46.6% were in the 18- 25 years age group. Participants were from eastern KSA (60.1%), western KSA (23.5%), and central KSA (15.9%). The majority of the participants

were Saudi (99.5%). Half (50%) of the participants were married, 43.7% were single, and 6.3% were divorced. Over three-quarters of the participants were highly educated, and 65.9% had bachelor degrees. In terms of employment status, 41.8% of the participants were students, and 27.9% had full-time jobs (Table 1).

Table 2: Eating habits of participants before and during COVID-19 pandemic (n=208)

No	Questions	Before COVID-19 All (n=208)	During COVID-19 All (n=208)	p-value (t-test)
1-	The average body weight (Kg±SD)	65.19±15.38	66.26±17.08	0.52
2-	Have you skip breakfast? (%)			
	- Yes	97 (46.6%)	107 (51.5%)	0.64
	- No	111 (53.4%)	101 (48.5%)	
3-	Have you taken food supplementation? (%)			
	- Yes	54 (25.9%)	58 (27.8%)	0.41
	- No	154 (74.1%)	150 (72.2%)	
	4- Your food intake is considered to be :(%)			
	- Very Health	12 (5.8%)	22 (10.5%)	0.05
	- Healthy	131 (63.0%)	134 (64.4%)	0.06
	- Unhealthy	49 (23.5%)	37 (17.8%)	0.31
	- Never unhealthy	9 (4.3%)	12 (5.8%)	0.21
	- I do not know	7 (3.4%)	3 (1.5%)	0.36

Eating Habits and Lifestyle Before and During the Quarantine

Table 2 shows the eating habits of the participants before and during the pandemic lockdown. The average body weight (kg) of the participants before the lockdown was 65.19 ± 15.38 kg; during the lockdown, it increased to 66.26 ± 17.08 kg ($p = 0.52$). The results showed that there were no significant changes in the number of participants who skipped breakfast ($p = 0.647$) before and during the COVID-19 pandemic. More than half of the participants (51.5%) reported skipping breakfast during the lockdown. No significant differences were reported regarding the intake of food supplements ($p = 0.412$). Before the lockdown, 25.9% of the participants had used supplements, and 27.8% used them during the lockdown. We also asked the participants about their food intake before and during the COVID-19 pandemic lockdown. The results showed that 63% of participants considered their food intake to have been healthy before the

pandemic, and 64.4% felt their intake was healthy during the lockdown ($p = 0.06$).

Food Consumption and Lifestyle During the Quarantine Period

The food consumption and lifestyle of participants during the COVID-19 pandemic are presented in Table 3. There were no significant differences in weight changes among the participants (self-reported) during the lockdown. However, 30.8% of participants reported an increase in body weight during quarantine, and 32.2% reported a decrease.

Our results showed that during the pandemic, 80.2% of the participants did not follow a healthy lifestyle ($p < 0.001$), whereas 19.8% reported that they followed a healthy lifestyle. No significant differences were reported regarding increased consumption of foods containing high levels of vitamin C during the COVID-19 pandemic ($p > 0.05$). However, 71.2% of

the participants did not take vitamin C supplements during the COVID-19 pandemic ($p = 0.02$).

On average, during the lockdown period, more than half of the participants (58.1%) reported a significant increase in food consumption compared to before the lockdown ($p < 0.05$). In comparison, 18.8% of the participants reported minimal or no changes

during the lockdown. The most frequent number of meals and snacks per day during the lockdown was two of each per day (52.8%), three meals and two snacks per day (24%), and one meal and two snacks per day (15%) ($p = 0.04$). In addition, 56.1% of participants reported that they cooked all meals at home during the lockdown ($p = 0.03$), and 17.8% cooked two meals at home per day.

Table 3: Eating habits and lifestyle changes of participants during the lockdown COVID-19 pandemic period (n=208)

Questions	All (n=208)	%	P value
1- During the quarantine period, have your weight changed?			
- Increased body weight	64	30.8%	0.07
- Decreased body weight	67	32.2%	
- Maintained body weight	60	28.8%	
- Do not know	17	8.2%	
2- During the quarantine period, have you followed a healthy lifestyle?			
- Yes	41	19.8%	<0.001
- No	167	80.2%	
3- During the quarantine period, have your dietary habits changes?			
- No/minimal changes	39	18.8%	0.03
- Increased eating	121	58.1%	
- Decreased eating	48	23.1%	
4- During the quarantine period do you consumed:			
- 3 meals and 2 snacks/day	50	24.0%	0.04
- 2 meals and 2 snacks/day	110	52.8%	
- One meal and 2 snacks/day	31	15.0%	
- >3 meals/day	17	8.2%	
5- During the quarantine period, have you cooked meals or used food delivery services? *			
- Cooked all meals at home	151	56.1%	0.03
- Cooked two meals at home	48	17.8%	
- Cooked one meal only at home	14	5.20%	
- Order all meals from fast food restaurants to deliver at home	4	1.48%	
- Order two meals from fast food restaurants to deliver at home	2	0.74%	
- Order one meal from fast food restaurants to deliver at home	50	18.5%	
6- During the quarantine period, have you taken a vitamin C supplementation during the COVID-19 pandemic?			
- Yes	60	28.8%	0.02
- No	148	71.2%	
7- During the quarantine period, have you drinking herbals drink such as ginger, turmeric and others more than usual to boost your immune system?			
- Yes	57	27.5%	0.01
- No	151	72.5%	
8- During the quarantine period, your consumption of fruit and vegetables were:			
- Less than before the quarantine	21	10.1%	0.01

- The same as before the quarantine	75	36.1%	
- More than before the quarantine	102	49.0%	
- I do not eat these foods.	10	4.8%	
9- During the quarantine period, your consumption of meats, chicken and fish were:			
- Less than before the quarantine	12	5.8%	>0.05
- The same as before the quarantine	75	36.1%	
- More than before the quarantine	71	34.1%	
- I do not eat these food	50	24.0%	
10- During the quarantine period, your consumption of cereals such as pasta, rice and other were:			
- Less than before the quarantine	23	11.1%	>0.05
- The same as before the quarantine	98	47.1%	
- More than before the quarantine	82	39.4%	
- I do not eat these food	5	2.4%	
11- During the quarantine period, your consumption of soft drinks and Energy Drink were:			
- Less than before the quarantine	23	11.1%	>0.05
- The same as before the quarantine	116	55.8%	
- More than before the quarantine	44	21.1%	
- I do not drink these beverages	25	12.0%	
12- During the quarantine period, your consumption of fast food was:			
- Less than before the quarantine	34	16.3%	0.03
- The same as before the quarantine	59	28.4%	
- More than before the quarantine	98	47.1%	
- I do not eat these food	17	8.2%	
13- During the quarantine period, your consumption of sweets was:			
- Less than before the quarantine	11	5.3%	0.05
- The same as before the quarantine	82	39.4%	
- More than before the quarantine	101	48.5%	
- I do not eat these food	14	6.8%	

In terms of food intake during quarantine, there was a significant increase in fruit and vegetable intake (49%), with participants eating more than before quarantine during the lockdown ($p = 0.01$). However, there were no significant differences in meat, chicken, and fish intake: 36.1% of participants reported that their intake was the same as before the quarantine. Similarly, 47.1% of participants reported the same intake of cereals, such as pasta and rice, as before the quarantine. A significantly high intake of fast food (47.1%; $p = 0.03$) and sweets (48.5%; $p = 0.05$) during the quarantine was reported. Additionally, 55.8% reported the same soft drink and energy drink intake as before the quarantine. Twelve percent reported that they did not consume any soft drinks or energy drinks.

Physical Activity Level Before and During the Quarantine Period

Table 4 shows participants' responses to questions about their physical activity levels before and during the COVID-19 pandemic. One hundred and twenty-three participants (59.1%) reported engaging in physical activity before the COVID-19 pandemic; 28.8% of participants went to the gym before the pandemic started. However, only 39% of individuals reported exercising at home during the lockdown period; 36.5% did not exercise during the quarantine period.

Sources of Information and Knowledge

Participants were asked about their sources of nutritional information related to food and health

during the COVID-19 pandemic (Table 5). One hundred and forty-eight participants (71.1%) reported having increased their awareness and knowledge of healthy eating and immune systems during the pandemic. Moreover, the most common sources of information on nutrition and health were

taken from the Saudi Ministry of Health and the Saudi Food and Drug Authority (39.2%), followed by specialists, health professionals, and nutritionists on social media (33.8%), the internet (20.6%), and celebrities on social media (6.4%).

Table 4: Physical activity level before and during the lockdown of the COVID-19 pandemic (n=208)

Physical activity level	n	%
1-Did you engage in physical activity or any sport before the COVID-19 pandemic		
- Yes	123	59.1%
- No	85	40.9%
2-I used to go the gym before the COVID-19 pandemic		
- Yes	60	28.8%
- No	148	71.2%
3-During the quarantine period, the exercise that you have practiced:		
- I never practice exercise	76	36.5%
- I practice every day at home	30	14.4%
- I practice 1-3 times/ week at home.	81	39.0%
- I practice 4-6 times/week at home	21	10.1%
4-During the quarantine period, I have increased the time of exercise at home:		
- Strongly agree	57	27.5%
- Agree	53	25.5%
- Neutral	62	29.8%
- Disagree	26	12.5%
- Strongly disagree	10	4.8%
5-During the quarantine period, I get the information and knowledge of physical activity and exercise from: *		
- Social Media	99	27.9%
- Application in Smartphones	63	17.7%
- YouTube	128	36.0%
- By myself	65	18.4%

*Multiple responses were allowed

Table 5: Sources of Information and knowledge of participant (n=208)

Questions	n	%
1-Did your awareness and knowledge about healthy eating and healthy immunity systems increased during the COVID-19 pandemic?		
- Yes	148	71.1%
- No	60	28.9%
2-Source of nutritional information related to food and health during the COVID-19 pandemic*		
- Celebrities at social Media	27	6.4%
- Specialists, health professional and nutritionist in social media	143	33.8%
- Internets	87	20.6%
- The Saudi Ministry of Health & Saudi Food and Drug Authority	166	39.2%

*Multiple responses were allowed

Discussion

This study presents information about the nutritional habits and lifestyles of during the COVID-19 lockdown period in Saudi Arabia. These results are very important, as they reflect the level of serious public health issues during the lockdown. The WHO suggested that during the quarantine, the public should maintain a healthy lifestyle and balanced eating, including increasing their fruits and vegetables intake, and should engage in physical activity to help boost their immune systems.^{14,15} Changes in eating habits and lifestyle have been observed in many countries around the world, where the pandemic has affected public lifestyles.¹⁶ The results of this study show changes in eating habits and lifestyle during the lockdown of the COVID-19 pandemic among adults living in the KSA. This is similar to several studies in different countries that have reported changes in dietary choices and habits,¹⁷ behavioral changes,¹⁸ and changes in lifestyles and physical activity levels.¹⁹

In this study, 51.5% of participants reported skipping breakfast during the lockdown, a habit that can lead to eating more foods later and affect subsequent energy intake.²⁰ There is evidence that skipping breakfast can lead to an increased risk for diseases, such as type 2 diabetes,^{21, 22} obesity,²² and coronary artery disease.²³ Possible reasons for skipping breakfast are waking up late, lack of appetite, and going to sleep late, which can lead to increased snacking during the day.²⁴ There is strong association between late dinner and snacks and skipping breakfast in both children and adults.^{25, 26}

We also examined changes in the participants' eating habits during the lockdown. Greater consumption of fast food and sweets during the lockdown was reported, and 58.1% of participants reported eating more in general during the lockdown. Previous studies have reported that high amounts of fat, sugar, and salt can lead to increased weight and other health problems.^{19, 27} Another study done during the pandemic addressed the type and quality of food consumption among healthy young Saudi women (age 18–39, n = 638) who reported high fat intake, increased number of meals, sugary food consumption, and more frequent fast food intake during the quarantine.²⁸ This may have been due to emotional eating and negative moods during the lockdown, which can increase unhealthy food

consumption and consumption of high energy and sugar meals.^{28, 29} During the lockdown, the number of people with anxiety and depression also increased; these conditions are strongly associated with increased body weight and consumption of unhealthy food.^{30, 31}

The results of this study revealed that more than half of the participants cooked all their meals at home during the COVID-19 pandemic lockdown. This may be due to increased time spent at home, as most people have been working from home during the pandemic. These results are similar to a study done in Kuwait, which reported a rise in home cooking during the COVID-19 pandemic.¹⁹ Participants in the present study reported trying to eat more fruits and vegetables during the pandemic to boost their immune systems. Fruits and vegetables contain high amounts of vitamins, minerals, and fiber, which help to improve immune systems. Previous studies have suggested that eating five or more portions of fruits and vegetables per day can lead to a significantly improved antibody response in older people, which can help boost immune function.³² Furthermore, fruits and vegetables contain bioactive compounds and antioxidants, which can lower one's risk of cancer, diabetes,³³ cardiovascular diseases,³⁴ and neurodegenerative diseases,³⁵ and improve immune function.³⁶

In the present study, 36.5% of participants reported that they did not engage in any physical activity during the lockdown. However, about 39% reported exercising one to three times per week at home using YouTube videos, as gyms were not open during the lockdown. Lockdown during the pandemic has affected people's lifestyles, as it has prevented people from engaging in many physical activities, such as walking or going to the gym. This can lead to weight gain and an increased risk of chronic diseases, such as CVD and type 2 diabetes.^{37, 38} Similar to our findings, studies done in the United Arab Emirates and Kuwait have indicated that lockdowns have negatively affected people's lifestyles and caused them to become physically inactive.^{19, 27} The present study shows that during the COVID-19 lockdown, individuals who stayed at home to control the spread of infection developed unhealthy eating habits with a high intake of foods containing fat and sugar and became physically

inactive, putting them at increased risk of weight gain and developing diseases in the future.

The results of the current survey indicated that 71.1% of participants increased their awareness and knowledge about nutrition information and eating habits during the COVID-19 pandemic, and about 39.2% of participants received this information from the Saudi Ministry of Health and the Saudi Food and Drug Authority. This may be because of the high educational attainment of the participants. Similarly, study has showed that 55.3% of surveyed nurses obtained information on COVID-19 from the WHO and Ministry of Health websites.³⁹ Misinformation about the COVID-19 pandemic was frequently spread on social media, which was found to raise people's anxiety and depression during the lockdown.^{40,41} For these reasons, the Saudi Ministry of Health advised people to increase their awareness by following updates and information posted in the media and on government websites.

This study had several limitations. First, there was a small sample size and few male participants compared to female participants. In addition, participants were recruited through social media platforms, such as Twitter, Telegrams and WhatsApp. Second, because of the lockdown timing, we used an online survey through which participants self-reported their eating habits, physical activity levels, and weight changes. The self-reported nature of the survey may have decreased the quality of information. Third, individuals who did not use personal computers or smartphones were excluded from this study, thus creating a potential bias toward people with internet access. Moreover, in this study,

we did not collect daily or weekly frequency of food consumption or serving size. Also, in this study, we did not ask participants about BMI, obesity level, eating disorders, or COVID-19 infections.

In conclusion, results of this study showed evidence on the effect of lockdown on people's nutritional habits and lifestyles in the KSA. During the quarantine, individuals ate more generally, ate foods high in fat and sugar, experienced changes in their weight, and were less active. Future research is important to understanding the effects of long-term COVID-19 infection-related lockdowns on eating habits and eating disorders, which can affect physical and mental health.

Ethical approval

The study protocol was approved by the Ethics Committee at the College of Agricultural and Food Sciences at King Faisal University (Reference No. 58758). The study was conducted in accordance with the Declaration of Helsinki (2000). Informed consent was obtained from the participants after the aims of the study were explained.

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Conflict of Interest

The author has no conflict of interest to declare.

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