Food Consumption Behavior during COVID-19 Pandemic in Saudi Arabia

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ABSTRACT

The COVID-19 epidemic has had a tremendous influence on human health, creating abrupt lifestyle changes, social isolation and solitude at home, as well as societal and economic implications. Saudi Arabia's administration has also been working hard to guarantee that food is available to all inhabitants in order to mitigate the pandemic's impact. The main aim of the study is to explore and analyze the changes in frequency of nutritional supplements, frequency of eating snacks and frequency of consumption food items pre and during COVID-19 pandemic. The data were collected from 814 individuals. All of the participants were Saudis. An online questionnaire survey was used to collect data. Pre and during the COVID-19 pandemic, the north, middle, and south of Saudi Arabia had a population with a higher BMI than the west and east of the country. Participants from north Saudi tended to have the lowest food consumption, as compared to other Saudi regions pre and during COVID-19 pandemic. The percentage of people who did not use any nutritional supplements during the COVID-19 epidemic was lower than it was before the pandemic. The participants whom eat snacks have been increase from 56.8 to 74.9% pre and during COVID-19, respectively. It should be noted that, the percentage of participants whom consume often/sometimes snacks during pandemic were higher than pre pandemic. Cereal and bread consumption, as well as meat, poultry, egg, beans, and cooked vegetables, did not vary from before to after the curfew. During the curfew, the average food intake of dairy items, seafood, fresh vegetables, fruits, fast foods, packaged foods, and sweets and candies increased dramatically ($p< 0.001$). Finally, during the COVID-19 pandemic, Saudis suggested a trend toward a better diet. Fast meals, unhealthy snacks, chocolates, and candies were among the foods consumed less frequently.

Keywords: Saudi Arabia, Nutritional supplements, Snacks, Food consumption, Anthropometrics, Eating habits

INTRODUCTION

A healthy lifestyle, according to the World Health Organization (WHO), can aid in the prevention and treatment of the condition. Many countries have undertaken attempts to avoid agglomerations during lockdowns, which has resulted in modifications in lifestyle habits, particularly in the areas of food intake and physical activity[1]. The World Bank has cautioned that the COVID-19 pandemic could lead to an increase in food poverty among vulnerable people. As a result, several governments have made significant steps to improve their people's food security through supporting agriculture and the food market. Saudi Arabia's government, through the Ministry of Finance, has offered funding to assist the private sector and individuals who have lost income as a result of the crisis[2].

Saudi Arabia's administration has also been working hard to guarantee that food is available to all inhabitants in order to mitigate the pandemic's impact.During the curfew, the Ministry of Commerce has worked hard to keep food costs under control and to assist food stores in supplying food to clients[3]. When compared to normal living conditions, it has been claimed that the quarantine itself can be regarded

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a risk factor for the consumption of low-quality foods, such as ultra-processed meals. Impaired nutritional habits, when combined with the possibility of reduced physical activity levels, could result in a positive energy balance (i.e., weight gain)[4]. Furthermore, implementing online nutrition education treatments directed at behavioral change during this key time could be very beneficial; however, aspects peculiar to these online interventions should be carefully evaluated[5].

Changes in our lifestyle and eating patterns may put our health at risk. Eating a healthy diet is essential, particularly when the immune system may need to recuperate. In fact, people with significant obesity (BMI > 40 kg/m2) are among the people who are more likely to develop COVID-19 problems[6]. During the COVID-19 pandemic, changes in eating habits brought on by boredom, anxiety, stress, depression, or food insecurity may increase the risk of obesity and concomitant conditions including cardiovascular disease and type 2 diabetes, which may be more dangerous than COVID-19 itself[7].

From a diachronic standpoint, the study's major goal is to investigate and analyze variations in the frequency of nutritional supplements, snack consumption, and food intake. Measure the participants' weight, BMI, food consumption, and lifestyle before and during lockdown, based on the COVID-19 pandemic's regional distribution and age.

MATERIAL AND METHODS

Pre and during the implementation of the COVID-19 pandemic, data on the use of nutritional supplements, the use of snacks, weight, BMI, food intake, life style, and eating habits were obtained from 814 people in this retrospective analysis. Saudis made up the entire group. Data was gathered through an online questionnaire survey that ran on June and July 2020 during the lockdown period in all regions of the Kingdom. Several social media activists, including WhatsApp and Twitter users, as well as academic and medical personalities and university citations, were contacted to analyze the questionnaire's diffusion. Through a consent declaration on the questionnaire, all participants gave their informed consent. Institutional Review Board (IRB) approval was obtained from Princess Nourah bint Abdulrahman University (21-0355).

Before and after the lockdown, anthropometric data such as height in centimeters and weight in kilograms were obtained. Based on WHO cutoffs, body mass index was calculated to establish each participant's weight status. A questionnaire method for collect data about frequency of nutritional supplements pre and during the COVID-19 pandemic in Saudi Arabia. The researchers developed the questionnaire based on expert comments and a survey of the literature to ascertain how participant consumption changed before and during the COVID-19 epidemic. It consisted of a total of 4 main questions, eat supplemented, frequency using from participants whom using supplements, kind of supplemented and reasons of consumption supplemented. The researchers building up questioner, to ass the frequency of eating snacks pre and during COVID-19. The questionnaire has five section; eat snacks, frequency eating snacks, how many snacks, time of snacks and kind of snacks. The first section is eat snacks and includes 2 items assessing eat or none eating snacks.

The second section is assessing the frequency eating snacks and include two items sometimes or often consumption snakes pre and during pandemic. The third section is assessing the how many snacks and divided into four items don't eat, eat one meal per day, eat 2 meals per day and 3 meals per day. The fourth section is appear the time of eating snacks and divided into sex such as don't eat any snacks at any times, eat snacks at any time, eat snacks before breakfast, eat snacks after breakfast, eat snacks after lunch, eat snacks after dinner. The last section is assessing to know the kind of snacks which consumed by Saudis and include 12 items such as, tea, coffee, juices, chips and chocolate. The key food groups from the Saudi Dietary Guideline "The Healthy Diet Palm" (i.e., cereal and bread, fresh vegetables, cooked vegetables, fruits, milk and dairy products, meat and eggs) were included in a food frequency questionnaire[8]. Snacks and drinks were divided into additional food groups (i.e., sweets and candies). Participants were asked to record the frequency of consumption per week or day before and during the COVID-19 pandemic for each food group. Version 25.0 of the Statistical Package for Social Sciences (SPSS) was used to obtain and analyze the survey data. For descriptive data, mean, variation ratio, frequencies, and percentages were determined. Furthermore, statistical significance was predetermined at a 0.05 p-value.

RESULTS

Table 1 shows that there is a statistically significant variation in BMI between the five Saudi Arabian regions. When compared to west and east Saudi Arabia before and during the COVID-19 epidemic, the north, middle, and south had a population with a higher BMI. No difference was found for BMI for participants pre and during pandemic (P=0.129).

Table (2) shows changes in the prevalence of dietary supplements before and during the COVID-19 pandemic. It was reported that 82.4% of the Saudi participants had never utilized nutritional supplements prior to COVID-19 (table 2). On contrast, 17.6% of participants had used nutritional supplements before COVID-19 pandemic. Currently, 59.6% of people did not take any nutritional supplements during the COVID-19 pandemic.

The percentage of Saudi participants consuming nutritional supplement during the COVID-19 pandemic was higher than the percentage before the COVID-19 pandemic for the same research sample. It should be noted that, the percentage that used often nutritional supplement has been increase during COVID-19 pandemic, as compared with pre pandemic. Even, statistical significant was observed for frequency of participants whom using nutritional supplements pre and during COVID-19 pandemic. 18.2% tended to take some of all supplements pre COVID-19 pandemic. This percentage has been increase to 27.1% during this pandemic. 1.6%, 2.9%, 2.2and 0.1 had used vitamin D,

Table 1. Participants' general anthropometrics, food consumption and life style

	weight		BMI		Food consumption		Life style	
COVID-19	**pre**	**during**	**pre**	**during**	**pre**	**during**	**pre**	**during**
West	70.62[a]	70.35[a]	26.86[a]	27.09[a]	56.96[b]	53.15[b]	90.33[abc]	76.11[a]
East	71.75[a]	72.25[a]	27.41[ab]	27.34[ab]	53.81[b]	51.00[b]	138.48[c]	125.65[b]
North	71.84[a]	72.76[a]	28.01[abc]	27.97[abc]	47.85[a]	44.65[a]	115.27[bc]	78.81[a]
Middle	77.57[B]	77.46[B]	28.37[bc]	28.54[bc]	55.31[b]	52.94[b]	80.10[ab]	66.12[a]
South	80.91[B]	80.32[B]	29.10[c]	28.92[c]	53.57[b]	51.76[b]	43.99[a]	43.35[a]
p-value	0.210		0.129		0.041[*]		0.038[*]	

Table 2. Changes in the frequency of nutritional supplements pre and during the COVID-19 pandemic in Saudi participants.

	Pre COVID-19		during COVID-19		*P-value*
	Frequency	**percent**	**Frequency**	**percent**	
Eat supplemented					
Yes used	143	17.6	329	40.4	0.032
Not used	671	82.4	485	59.6	
Frequency using from participants whom using supplements					
Sometimes	134 (n 143)	93.7	263 (n 329)	79.9	0.013
Often	9(n 143)	6.3	66 (n 329)	20.1	
Kind of supplemented					
some or all	148	18.2	221	27.1	0. 012*
i don't take supplemented	671	82.4	485	59.6	
vit A	1	0.1	58	7.1	
vit B complex	16	2.0	15	1.8	
Vit.C	18	2,2	102	12.5	
Vit. D	33	4.1	136	16.7	
Iron	15	1.8	14	0.7	
Zn	24	2.9	101	12.5	
multi vit. and minerals	72	8.8	5	0.6	
Omega	10	1.2	9	1.1	
amino acids and proteins	1	0.1	5	0.6	
Herbals	39	5.0	85	7.1	
Reasons of consumption supplemented					
i don't take supplemented	671	82.4	485	59.6	0.022*
Prescription	53	6.5	156	19.2	
health support	154	18.9	117	14.4	
immunity support	15	1.8	142	17.4	
other reasons	63	7.7	85	10.4	

zinc, vitamin Cand vitamin A pre COVID-19 pandemic, respectively. During pandemic this percentage was sharply increase and achieve 16.7%, 12.5%, 12.5% and 1.7% for vitamin D, zinc, vitamin C and vitamin A during COVID-19 pandemic, respectively (Table 1). Fortunately, vitamin D, zinc, vitamin C and vitamin A were the most predient supplements intake during COVID-19 pandemic. Vitamin C helps to restore healthy lung function by regulating the angiotensin converting enzyme-2 receptor (ACE2) and modulating the rennin-angiotensin system.

Changes in the frequency of eat snacks pre and during the COVID-19 pandemic in Saudi Arabia were present in table (3). With regard to the eating of eating snacks, 43.2% of the Saudis participants declared that they had never used them before COVID-19 (table 3). On contrast, 56.8% of participants had eaten snacks before COVID-19 pandemic. Currently, 26.1% of people did not take any snacks during the COVID-19 pandemic.

The participants whom eat snacks have been increase from 56.8 to 74.9% pre and during COVID-19, respectively. Even, significant differences was observed between them at ($p<0.05$). It should be noted that, the percentage of participants whom consume often/sometimes snacks during pandemic were higher than pre pandemic.

During the curfew, the mean food intake of dairy items, seafood, fresh vegetables, fruits, fast foods, packaged foods, and sweets and candies increased significantly (p.001) (Table 4). Cereal and bread consumption, as well as meat, poultry, egg, beans, and cooked vegetables, did not vary from before to after the curfew. Participants believed that eating more dairy products (11%), fish (30%), fresh vegetables (13.9%), cooked vegetables (8.7%), and fruits (16.6%) would help them fend against the virus during the COVID-19 pandemic (Table 4). On contrast, the consumption of some foods items has been slightly decreased during COVID-19 as compared to pre pandemic such as, meat (1.3%), poultry (1%) and egg (0.8%). While, other food items has been sharply decreased during COVID-19 pandemic such as, packaged products (35.5%), fast foods (25.9%) and sweet (5.6%).

DISCUSSION

This result was agreed with Italian survey that confirmed no difference was found for BMI pre and during corona pandemic[9]. With comparing the BMI for Saudis participants with different international classifications of BMI, it's clear that, all participants in different Saudi regions were classified as overweight or obesity class I according to international WHO and Asian and Korean criteria-based adults' classification, respectively. Accordingly, risk of co-morbidities has been increased between Saudis participants pre and during COVID-19 pandemic. It should be noted that, To enhance a patient's short- and long-term prognosis, clinicians should consider the patient's body mass index (BMI) while assessing risk and choosing a treatment plan for COVID-19[10].When compared to other Saudi regions prior to and during the COVID-19 pandemic, participants from north Saudi Arabia had the lowest food consumption. Furthermore, food intake during the COVID-19 pandemic was lower in all locations than before the pandemic. Even, significant difference was observed between them. The reduction of food consumption observed during COVID-19 in Saudi Arabia was within with that found in French and USA by about 35% and 50%, respectively[11]. Food intake may have decreased as a result of a change toward a healthier diet during the COVID-19 pandemic[12]. This result are in general agree with the recent study which confirmed that, 81.9% of the 11.2% of individuals from Turkey reported using vitamin D, while others said they had never used it before to COVID-19. Currently, 90.3% of people did not take any

Table 3. Changes in the frequency of snacks consumption pre and during the COVID-19 pandemic in Saudi participants.

	Pre COVID-19		during COVID-19		*P-value*
	Frequency	percent	Frequency	percent	
Eat snacks					
yes	462	56.8	602	73.9	0.029*
no	352	43.2	212	26.1	
Frequency eating snacks					
sometimes	348	42.8	442	54.3	0.019*
often	114	14.0	160	19.7	
How many snacks					
don't eat	352	43.2	212	26.1	0.025*
one meal	235	28.9	378	46.4	
2 meals	137	16.8	129	15.8	
3 meals	90	11.1	95	11.7	
Time of snacks					
don't eat	352	43.2	212	26.1	0.106
Any time	106	13.0	151	18.9	
before breakfast	39	4.8	23	2.8	
after breakfast	90	11.1	85	10.4	
after lunch	164	20.1	244	30.0	
after dinner	63	7.7	99	12.2	
Kind of snacks					
i don't eat	352	43.2	212	26.1	0.327
soft drinks	18	2.2	10	1.2	
tea	121	14.9	113	13.9	
coffee	80	9.8	79	9.7	
juices	2	0.2	11	1.4	
fruits	11	1.4	11	1.4	
cooked deserts	3	0.4	4	.5	
pies	2	0.2	3	.4	
chipsy	9	1.1	9	1.1	
chocolate	6	0.7	6	0.7	
sandwich	2	0.2	7	0.9	
nuts	14	1.7	13	1.6	
some or all	457	56.1	487	59.8	

Table 4. Participants' dietary changes during the COVID-19 epidemic

Items	never	once daily	/ more than once	once / week	2-3 / week	once / month	rare	Mean	F	*p*	% of change
Cereal and bread											
pre	3.7	50.1	6.9	33.0	4.7	1.0	.6	483.8	0.13	.932	0.37%
during	3.7	51.1	5.9	34.0	3.7	1.2	.4	482			
Dairy product											
pre	10.2	48.3	12.2	13.1	6.9	5.6	3.7	438.8	21.7	< .001*	11.0%
during	8.8	59.3	14.6	10.7	3.4	2.2	0.9	487.2			
Meat											
pre	8.0	33.0	4.4	28.1	13.9	7.9	4.7	394.6	0.53	.623	1.3%
during	10.3	31.0	4.2	33.5	11.3	4.7	5.0	389.3			

Poultry											
pre	3.7	50.1	6.9	33.0	4.7	1.0	.6	483.8	0.50	.702	1.0%
during	5.9	49.8	5.9	31.0	4.1	2.6	.9	478.8			
Fish											
pre	21.7	9.5	0.7	11.1	12.7	17.3	27.0	204.6	30.6	< .001*	30%
during	21.8	17.3	8.2	12.4	11.5	8.4	20.3	266.0			
Egg											
Pre	6.5	38.3	2.9	33.3	12.4	4.4	2.1	425.6	0.41	.520	0.8%
during	8.6	38.9	3.4	32.9	9.7	4.8	1.6	422.3			
Beans											
pre	12.8	22.1	1.5	27.9	15.4	10.6	9.8	328.6	0.31	0.854	0.2%
during	16.2	23.2	3.1	26.2	14.7	9.1	7.5	329.3			
Fresh vegetables											
Pre	8.7	42.0	8.9	18.4	6.9	9.6	5.5	415.5	23.2	< .001*	13.9%
during	6.3	51.8	12.0	19.0	5.7	4.1	1.1	473.2			
Cooked vegetables											
Pre	13.8	39.6	9.0	24.8	6.3	4.2	2.5	411.6	18.2	< .06*	8.7%
during	12.3	45.7	20.7	12.6	3.6	3.4	1.7	447.4			
Fruits											
pre	8.6	39.0	10.8	15.0	11.4	8.3	7.0	405.8	25.9	< .001*	16.6%
during	5.5	48.5	15.2	20.5	5.1	3.4	1.8	472.9			
Sweets and candies											
pre	26.5	23.8	6.5	21.7	10.0	5.5	5.9	309	15.9	< .007*	5.6%
during	31.7	24.2	5.7	19.0	8.7	5.0	5.7	291.5			
Fast foods											
Pre	32.8	14.1	5.5	15.4	10.8	8.4	13.0	235.9	29.9	< .001*	25.9%
during	48.9	12.0	3.4	11.3	5.8	6.6	11.9	176.7			
Packaged products											
pre	32.8	34.3	6.2	8.2	6.2	4.1	8.2	304.6	42.2	< .001*	35.5%
during	50.3	16.6	4.8	8.5	6.6	5.1	8.1	195.7			

Scale: never = 0; rare= 1; once / month = 2; 2-3 / week = 3; once / week = 4; more than once = 5; once / daily = 6.The data in this table was analyzed using repeated measures analysis of variance.* After a Bonferroni adjustment, the difference is significant at the.006 level.

nutritional supplements throughout the COVID-19 pandemic, while only 5.2% of people took vitamin D[13].Additionally, the immune system is made up of cells that fight illness, but in order for them to operate properly during infections, they also need the right amount of vitamin C[14]. Vitamin D helps to prevent many of the difficulties that come with pneumonia, as well as cytokine storms. Furthermore, vitamin D is also being evaluated as a potential treatment for influenza virus-induced lung damage[15]. Additionally, zinc can control respiratory virus entrance, fusion, replication, viral protein translation, and virus budding[16].

Compared to before the COVID-19 epidemic, over three times as many people reported using nutritional supplements as advised by their physicians. Moreover, the participants whom used nutritional supplements for improvingimmunity system has been increased from 1.8% to 17.4% pre and during COVID-19 pandemic, respectively. 10.4% used them for other reason such as, on their own judgment, and the remainder used them on the advice of close friends or family (data not shown). The current findings were consistent with prior research showing that 32.4% of respondents used nutritional supplements based on their own judgment, while nearly 60% said they did so on their doctors' advice[13].

Most of participants consume snacks one meal per day for pre and during COVID-19. This result was within with Polish study which reported that, in case of snacks, it 28.3 % was consume snacks one time per day and 36.1% consumed snacks two time per day[17]. Fortunately, 20.1% of Saudis participate in this study tended to have snacks after lunch pre corona pandemic. This percentage has been increase to 30% during COVID-19 pandemic. Because prior studies have demonstrated that people who weigh more typically snack considerably more frequently in the evening, which is more harmful to maintaining a healthy weight than snacking at other times of the day[18]. While, the latest consume snacks was before breakfast pre and during COVID-19 pandemic. More than half of participants consume different types of snacks pre and during COVID-19 pandemic. They reported an increase in “beverage” consumption, especially tea (14.9 percent) and coffee (9.8 percent). Long periods of time spent at home during a lockdown may have contributed to the rise in snacking, eating appetizing meals, and drinking alcohol[7]. Furthermore, it has been indicated that eating more meals and/or snacks between main meals is a bad diet habit[4].

This findings was consistent with other studies that showed no changes in cereal and bread consumption, vegetables, milk and dairy products consumption, or meat and egg consumption[7]. Participants in this study reported eating more of certain foods as a result of the curfew. However, some food consumption items were unaffected by the ban. High-income countries and countries with a high level of food security may face similar challenges. The current food consumption frequency finding was consistent with another Saudi study, which found that the frequency of specific foods was not significantly different before and after the curfew[19].

The consumption of fast foods has been sharply decreased during pandemic. It's possible that it's because participants said they've changed their eating habits as a result of having more time to cook[20]. The frequency consumption of sweet and candies and fast foods decreased during curfew. During the COVID-19 curfew, these outcomes were observed and aligned with WHO recommendations to limit the intake of sweets and high-calorie items. Consumption of unhealthy items such as fast food, unhealthy snacks, sweets, and cookies was reduced. Simultaneously, they are eating a healthier diet that includes more fresh fruits and vegetables. Because poor eating habits raise the risk of diabetes, heart disease, and cancer[21].

CONCLUSION

Changes in eating patterns, weight, and BMI were widely recorded across severely Saudi regions, according to this study. During the COVID-19 pandemic, the data revealed a trend toward a healthier diet. Consumption of unhealthy foods such as fast food, unhealthy snacks, sweets, and candies was reduced. Simultaneously, they are eating a healthier diet that includes more fresh fruits and vegetables. This population-based study offers a glimpse into the lifestyle and eating patterns of Saudi citizens who took part in the survey. The use of BMI value is a key tool to define the nutritional status in infected COVID-19 patients. Inelastic food intakes, such as cereals and bread, as well as meat and eggs, are unlikely to vary because these foods are ingested mostly during the day's main meals. National and international health organizations must emphasize the importance of reducing unhealthy snack consumption, promoting positive dietary behaviors and attitudes, and increasing physical activity to maintain good health and avoid weight gain by sending simplified messages to the public via social media.

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