

Assessment of the changes in nutritional and psychological behaviors of Saudi adults related to the impact of the coronavirus infectious disease-19 curfew: A cross-sectional study

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Background/aim

In response to the coronavirus infectious disease - 19 (COVID-19) spread, the Saudi government enforced a nationwide curfew, which in turn has influenced the dietary habits and psychological behaviors of the Saudi population. Data regarding the impact of curfew on Saudi adults are lacking. Thus, the study aims to assess the changes in nutritional and psychological behaviors of Saudi adults related to the impact of the coronavirus disease-19 curfew.

Patients and methods

This study is a cross-sectional online study among Saudi adults aged between 25 and 65. This study includes 1040 adults from different regions of Saudi Arabia. Data regarding nutritional behaviors, physical activity, weight changes, and psychological behaviors were collected via an online questionnaire. The psychological behaviors during the curfew were assessed by Depression, Anxiety, and Stress Scale-21. The Chi-square test was used to test for the presence of an association between the different categorical variables.

Results

Out of 1040 participants, 76.9% were female, and 36.4% were aged between 46 and 65 years. Our results showed an increase in intake in dessert by 54.2%, salty snacks by 52.1%, and appetite by 48.9%. Over 24.7% and 45% of participants reported eating more meals and snacking, respectively. Half of the participants gained weight, especially among male participants ($P=0.012$). Physical activity had also decreased among male participants ($P<0.001$). The prevalence of moderate to extremely severe anxiety, stress, and depression during the curfew was noted to be 13.8, 3.7, and 8.4%, respectively, without any gender difference.

Conclusion

Public health officials should focus on increasing awareness of healthy eating habits and provide psychological support and emphasizing physical activities during the curfew.

Keywords:

adults, coronavirus disease-19, curfew, nutritional behaviors, psychological behaviors

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Introduction

The coronavirus disease-19 (COVID-19) was first reported at the end of December 2019, with only a few cases in Wuhan, China [1]. Since COVID-19 has spread rapidly across the world within a relatively short time, the World Health Organization (WHO) declared COVID-19 as a global pandemic in March 2020 [2]. As a result of the outbreak, Saudi Arabia's government made massive efforts to prevent COVID-19 from spreading. The government enforced a curfew for all its residents, imposed social distancing rules, and banned attendance at workplaces, schools, restaurants, shops, and gyms [3].

While these precautions are essential for slowing the virus's spread, they may adversely affect people's daily routines and lifestyles [4]. This study focuses on adults

as they are considered the foundation of the family as well as playing a critical influence on shaping their children's nutritional and psychological behaviors. Despite the limited data on the impact of the COVID-19 curfew on adults' lives, previous studies have shown that the COVID-19 curfew has a negative impact on people's dietary habits, lifestyles, and psychological behaviors [5,6].

The curfew period has resulted in changes in people's meal patterns, including quantity, frequency, and food quality. Several studies in Poland, France, and the

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United States of America [7–9] have assessed people's food intake during the COVID-19 curfew. The findings revealed negative dietary trends such as increased caloric consumption, more frequent snacking, and a reduction in fresh fruit and vegetable consumption. Furthermore, the negative dietary habits during the COVID-19 curfew were consistent with a study conducted in Saudi Arabia, which found that over 40% and 45% of participants reported overeating and oversnacking, respectively [5]. The females were more inclined to increase in food amounts during the curfew according to a study conducted in Bavarian [10].

Information related to the impact of the COVID-19 curfew on food quality in Saudi Arabia is limited. However, in general, there was an increase in the consumption of sweets, including chocolate, cakes, and ice cream [5]. Similar findings in the United Arab Emirates show that sweet and salty snacks were reported among food items whose intake increased greatly during the curfew [11]. In addition, people in a negative mood may tend to eat energy-dense, palatable foods that are high in sugar content, which positively impacts mood levels. Therefore, the concerned authorities should increase nutrition awareness by suggesting healthy and nutritious food choices to limit the adoption of unhealthy dietary habits during pandemics, especially in curfew situations.

Since the curfew limits people from going to work, fitness centers, and even performing regular daily activities, several studies have shown that the COVID-19 curfew had an adverse impact on people's physical activity (PA) [5]. A study in Saudi Arabia examined the effect of the COVID-19 curfew on PA. The results indicated that 80.6% of participants were not meeting the WHO recommendations regarding PA during the curfew [12]. Additionally, sex differences in PA were observed in the United Arab Emirates, as they declared that 50% of male participants showed a reduction in their PA level during the curfew [13].

As a result of the prevalence of sedentary lifestyles and unhealthy dietary habits, weight gain during the curfew was anticipated. Several studies around the world examined the weight change during the curfew. In Saudi Arabia, a study reported weight gain of around 3–5 kg in 38% of the participants during the curfew, while 26% and 34% reported a decrease in weight and no change, respectively [5]. Besides, a study conducted in the United Arab Emirates showed that 36.1% of

male participants declared an increase in weight during the COVID-19 curfew. Consequently, more support and attention should be paid to obese and overweight individuals related to the positive effect of losing weight on health during the curfew.

The curfew during disease outbreaks raised many psychological issues, including loss of freedom, uncertainty over disease status, separation from loved ones, and boredom, which occasionally had pernicious effects. Various studies reported developing general psychological symptoms, traumatic stress, depression, insomnia, emotional disturbance, anger, and irritability in the adult population during the curfew [9,14].

A cross-sectional study among the public of Saudi Arabia declared that 23.6% of the participants showed moderate or severe psychological impact of the curfew. Additionally, 22.3, 24, and 28.3% of participants reported moderate-to-severe stress, anxiety, and depressive symptoms, respectively. The increased psychological impact triggered by the enforced curfew should encourage policymakers to implement public mental health strategies designed to mitigate the adverse effects associated with the curfew [15]. Thus, this study aims to assess the changes in the nutritional and psychological behaviors of adults related to the impact of the COVID-19 curfew in Saudi Arabia. Moreover, to investigate how adults' eating habits, PA, weight changes, and psychological behavior have been affected during the curfew in Saudi Arabia and the relationship between these changes with respect to sex.

Patients and methods

Participants and recruitment

A sample of 1040 adults from different regions of Saudi Arabia was recruited. The inclusion criteria were citizens and residents of Saudi adults aged between 25 and 65 years. Participants were requested to fill out an electronic questionnaire that was created via Google Forms and distributed on various platforms, such as WhatsApp, Twitter, and Snapchat groups. To reach all adults in society, data were collected using random convenience sampling and the snowball technique.

Ethical approval

Ethical approval for this study was obtained from the Ethical Committee of the College of Applied Medical Sciences at Taibah University, Al-Madinah Al-Munawara, Saudi Arabia, with approval number 2020/59/206 CLN. All participants provided informed consent through a statement on the questionnaire to be included in the study.

Sample size calculation

The representative target sample size needed to achieve 40% of expected changes in dietary habits, a confidence level of 95%, and a 3% margin of error, was calculated by Epi Info TM [16].

The questionnaire

This questionnaire was adapted from this study [5], however, some of the questions were modified to be answered sequentially and in accordance with the scenarios 'before' and 'during' the curfew. The self-reported questionnaire was translated from English to Arabic by the authors to be distributed. The questionnaire's reliability was tested through piloting before survey administration for clarity and logical flow of the questions.

On the first page of the online questionnaire, a proper explanation about the study objectives, the estimated time of completion, and the confidentiality of collected data has been made to the respondents. All participants provided informed consent through a statement on the questionnaire in order to be included in the study. The survey needed around 10–15 min and was made available online from October 15, 2020 to February 15, 2021.

This questionnaire comprises four main sections with 20 questions in total. The first section gathered information on respondents' sociodemographic characteristics, including age, sex, educational level, employment status, region of residence, family income, and whether there have been income changes during the pandemic or not. The second section assessed the change in the participants' dietary habits and nutritional intake during the curfew as compared with before. This section included 9 items on modes of the number of meals and snacks, change in portion size, food groups' intake, appetite, weight status, supplement use and consumption of immune-boosting food, and participation in cooking. The main food groups adapted from the Saudi Dietary Guideline 'The Healthy Food Palm' include cereal and bread, meat and eggs, milk and dairy products, vegetables, and fruits [17]. Additional food groups were added to categorize snacks and drinks such as desserts, salty snacks, juices and soft drinks, coffee, and tea.

The third section assessed the change in PA level using three questions: (1) change in PA during the curfew as compared with before, (2) average time spent actively during the week, and (3) average daily screen time spent during the curfew and before.

To describe the change, the respondents chose one of three categories: 'decreased,' 'increased,' or 'it has not changed.'

The fourth section assessed the participants' mental health status during the curfew as compared with before by using an Arabic version of the Depression, Anxiety, and Stress Scale-21 (DASS-21) [18]. DASS-21 is a self-report questionnaire consisting of 21 items concerning three subscales: depression, anxiety, and stress. Each subscale consists of seven items with four option scales ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). The final scores of each subscale were compared with DASS severity ratings, which were categorized into normal, mild, moderate, severe, and extremely severe.

Statistical analysis

Statistical analysis was performed using Statistical Packages for Software Sciences (SPSS) version 21, Armonk, New York, IBM Corporation. The normality of the data distribution was confirmed using the Shapiro–Wilk test as well as the Kolmogorov–Smirnov test. Frequency and percentages were used to display categorical variables. A Chi-square test was conducted to test for the presence of an association between categorical variables. Statistical significance was identified at P less than 0.05.

Results

About 1040 adults were enrolled to measure the effect of the COVID-19 pandemic on the nutritional and psychological behavior of adults before and during the curfew in Saudi Arabia. Table 1 presents the sociodemographic characteristics of 1040 adults. The most common age group was 46–65 years old 36.4%, the majority were female 76.9%, and most were university degree holders 61%. With respect to their monthly income, more than half 52% were earning above 10 000 SAR per month and 25.1% were earning 6,000–10 000 SAR/month. Furthermore, nearly half of them, 45.3%, were working in the government sector, while 30.4% were unemployed. With regard to the impact of the current pandemic on respondents' family income levels, approximately half of them, 49.8%, stated that their income did not change, while 38.6% stated it decreased and only 11.6% stated it increased. In addition, most of the respondents, 69.8%, were living in the Western region.

In Fig. 1, it can be noted that eating three meals per day was higher before the curfew 62.2% than during the

Table 1 Sociodemographic characteristics of all adults' participants

Study data	Overall [<i>n</i> (%)] (<i>N</i> =1040)	Male [<i>n</i> (%)] (<i>N</i> =240)	Female [<i>n</i> (%)] (<i>N</i> =800)
Age group in years			
25–35 years	295 (28.4)	50 (20.8)	245 (30.6)
36–45 years	366 (35.2)	80 (33.3)	286 (35.8)
46–65 years	379 (36.4)	110 (45.8)	269 (33.6)
Educational level			
Below high school	61 (5.9)	3 (1.3)	58 (7.3)
High school/diploma	249 (23.9)	88 (36.7)	161 (20.1)
University	634 (61.0)	106 (44.1)	528 (66.0)
Master/PhD degree	96 (9.2)	43 (17.9)	53 (6.6)
Monthly income (SAR)			
<4,000	93 (8.9)	11 (4.6)	82 (10.3)
4,000–6,000	145 (13.9)	22 (9.2)	123 (15.4)
6,000–10,000	261 (25.1)	47 (19.6)	214 (26.8)
>10,000	541 (52.0)	160 (66.7)	381 (47.6)
Occupation			
Governmental sector	471 (45.3)	151 (62.9)	320 (40.0)
Private sector	71 (6.8)	29 (12.1)	42 (5.3)
Freelance	29 (2.8)	07 (2.9)	22 (2.8)
Retired	153 (14.7)	44 (18.3)	109 (13.6)
Unemployed	316 (30.4)	09 (3.8)	307 (38.4)
Impact of family income			
Increased	121 (11.6)	34 (14.2)	87 (10.9)
Decreased	401 (38.6)	94 (39.2)	307 (38.4)
No change	518 (49.8)	112 (46.7)	406 (50.7)
Area of residency			
Northern	106 (10.2)	29 (12.1)	77 (9.6)
Southern	37 (3.6)	11 (4.6)	26 (3.3)
Central	122 (11.7)	26 (10.8)	96 (12.0)
Eastern	49 (4.7)	11 (4.6)	38 (4.8)
Western	726 (69.8)	163 (67.9)	563 (70.4)

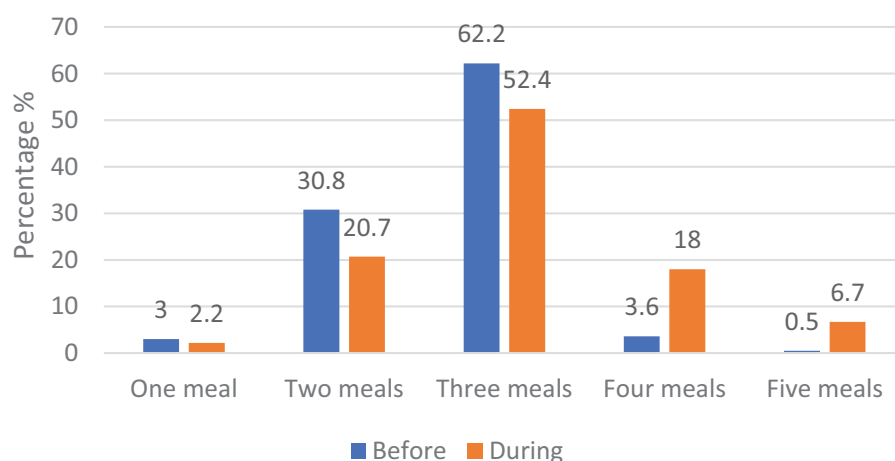
All data are represented as number and percentage.

curfew 52.4%, while 24.7% of the participants reported eating more than three meals.

In Fig. 2, it can be noted that having one snack and two snacks were higher before the curfew at 42% and 39.1%, respectively, than during the curfew at 21.9%

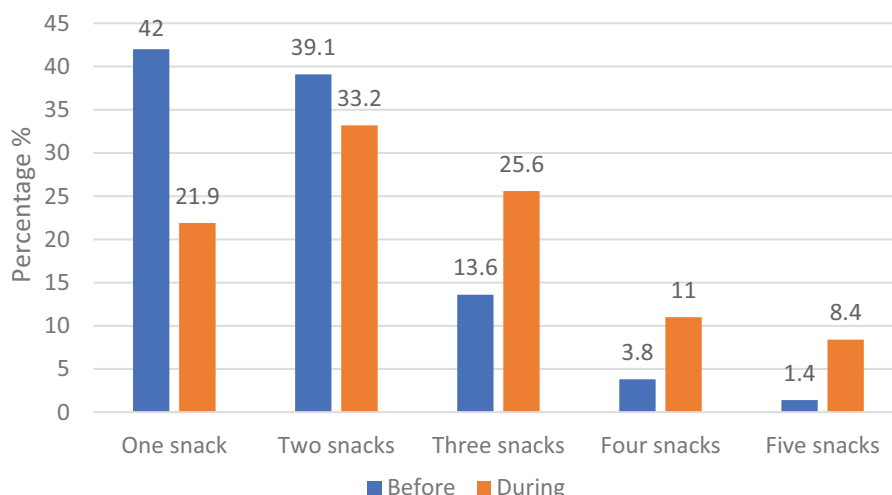
and 33.2%, respectively, whereas, having more than two snacks was higher during the curfew with 45% than before the curfew with 18.8%.

The following results in Table 2 showed the top nutritional factors where adults increased their

Figure 1

Number of meals before and during coronavirus disease-19 curfew.

Figure 2



Number of snacks before and during coronavirus disease-19 curfew.

behaviors were cooking participation 65%, drinking coffee 57.3%, eating salty snacks 52.1%, eating dessert 54.2%, and appetite 48.9%, while a decrease in the nutritional habit mainly was noted in eating fast food 37.4%, followed by drinking juices and soft drinks 22.4% and eating legumes 20.5%, respectively.

In Table 3, a significant difference between males and females was observed in the change of the following nutritional behaviors during the COVID-19 curfew as compared with before the curfew: grain ($P=0.008$), meat ($P=0.010$), tea ($P=0.006$), weight changes ($P=0.012$), and cooking participation ($P=0.002$).

In Table 4, it was observed that 43.9% of the respondents stated that their PA increased during the curfew, while 29.7% showed a reduction in their PA. When measuring the PA in accordance with gender, it was found that change in PA was significantly associated with gender ($P<0.001$). Male participants reported a decrease in their PA by 44.2%, while female participants reported a decrease in their PA by 25.4%. It was also observed that 55.6% of the respondents reported an increase in their weight as well. Weight changes were significantly associated with gender ($P=0.012$). Male participants reported an increase in their weight by 63.8%, while female

Table 2 Change in parents' nutritional behavior during the COVID-19 curfew compared to before the COVID-19 curfew (n=1040)

Variables	Increased N (%)	Decreased N (%)	No changed N (%)	I don't eat N (%)
Cooking participation	676 (65.0%)	55 (5.3%)	309 (29.7%)	–
Coffee	596 (57.3%)	67 (6.4%)	341 (32.8%)	36 (3.5%)
Dessert	564 (54.2%)	174 (16.7%)	266 (25.6%)	36 (3.5%)
Salty snacks	542 (52.1%)	156 (15.0%)	308 (29.6%)	34 (3.3%)
Appetite	509 (48.9%)	138 (13.3%)	393 (37.8%)	–
Water	504 (48.5%)	88 (8.5%)	432 (41.5%)	16 (1.5%)
Tea	493 (47.4%)	86 (8.3%)	416 (40.0%)	45 (4.3%)
Grain	491 (47.2%)	109 (10.5%)	430 (41.3%)	10 (1.0%)
Vegetables	372 (35.8%)	158 (15.2%)	490 (47.1%)	20 (1.9%)
Meal portion	360 (34.6%)	117 (11.3%)	563 (54.1%)	–
Fruit	360 (34.6%)	202 (19.4%)	446 (42.9%)	32 (3.1%)
Meat	340 (32.7%)	166 (16.0%)	522 (50.2%)	12 (1.2%)
Milk products	294 (28.3%)	148 (14.2%)	563 (54.1%)	35 (3.4%)
Juices and soft drinks	277 (26.6%)	233 (22.4%)	352 (33.8%)	178 (17.1%)
Fats	244 (23.5%)	185 (17.8%)	575 (55.3%)	36 (3.5%)
Fast food	244 (23.5%)	389 (37.4%)	240 (23.1%)	167 (16.1%)
Legumes	201 (19.3%)	213 (20.5%)	570 (54.8%)	56 (5.4%)

Table 3 Gender difference of change in nutritional behavior during the COVID-19 curfew compared to before the COVID-19 curfew (n=1040)

Variables	Increased [n (%)]	Male decreased [n (%)]	No change [n (%)]	Increased [n (%)]	Female decreased [n (%)]	No change [n (%)]	P value
Meal portion	95 (39.6)	30 (12.5)	115 (47.9)	265 (33.1)	87 (10.9)	448 (56.0)	0.087
Grain	133 (56.4)	23 (9.7)	80 (33.9)	358 (45.1)	86 (10.8)	350 (44.1)	0.008 **
Milk products	75 (32.3)	37 (15.9)	120 (51.7)	219 (28.3)	111 (14.4)	443 (57.3)	0.321
Meat	98 (40.8)	38 (15.8)	104 (43.3)	242 (30.7)	128 (16.2)	418 (53.0)	0.010 **
Legumes	45 (19.5)	62 (26.8)	124 (53.7)	156 (20.7)	151 (20.1)	446 (59.2)	0.089
Fruit	91 (38.6)	56 (23.7)	89 (37.7)	269 (34.8)	146 (18.9)	357 (46.2)	0.056
Vegetables	86 (36.6)	42 (17.9)	107 (45.5)	286 (36.4)	116 (14.8)	383 (48.8)	0.468
Fats	67 (28.8)	46 (19.7)	120 (51.5)	177 (23.0)	139 (18.0)	455 (59.0)	0.104
Dessert	125 (54.6)	38 (16.6)	66 (28.8)	439 (56.6)	136 (17.5)	200 (25.8)	0.659
Salty snacks	123 (53.0)	37 (15.9)	72 (31.0)	419 (54.1)	119 (15.4)	236 (30.5)	0.953
Fast food	57 (27.1)	96 (45.7)	57 (27.1)	187 (28.2)	293 (44.2)	183 (27.6)	0.923
Tea	134 (57.8)	22 (9.5)	76 (32.8)	359 (47.1)	64 (8.4)	340 (44.6)	0.006 **
Coffee	138 (59.7)	15 (6.5)	78 (33.8)	458 (59.2)	52 (6.7)	263 (34.0)	0.987
Juices and soft drinks	61 (30.2)	65 (32.2)	76 (37.6)	216 (32.7)	168 (25.5)	276 (41.8)	0.169
Water	128 (54.2)	20 (8.5)	88 (37.3)	376 (47.7)	68 (8.6)	344 (43.7)	0.190
Appetite	113 (47.1)	33 (13.8)	94 (39.2)	396 (49.5)	105 (13.1)	299 (37.4)	0.806
Weight changes	153 (63.8)	25 (10.4)	62 (25.8)	425 (53.1)	122 (15.3)	253 (31.6)	0.012 **
Cooking participation	140 (58.3)	08 (3.3)	92 (38.3)	536 (67.0)	47 (5.9)	217 (27.1)	0.002 **

All data are represented as number and percentage. P value has been calculated using χ^2 , Chi-square test. ** Significant at P less than 0.05 level, using χ^2 , Chi-square test.

participants reported an increase in their weight by 53.1%.

Figure 3 depicts the PA before and during the COVID-19 curfew. It can be noticed that PA for less than 6 h/week was higher before the curfew 30.7% than during the curfew 11.1%. On the other hand, physical inactivity was higher during the curfew 22.1% as compared with before the curfew 0.8%.

In Fig. 4, it was observed that the most-taken supplement during the curfew was vitamin C 43.8%, followed by vitamin D 24.8%, and vitamin B 13.8%, while folic acid was the least 0.7%.

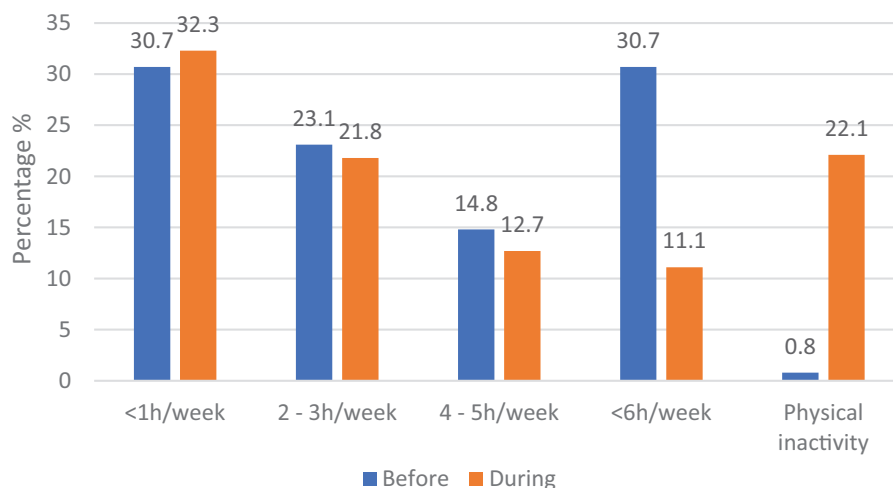
In Fig. 5, it was observed that the most-taken food items that boosted the immune system were honey 59.2%, followed by citrus 53.9% and ginger 46.8%, while onion was the least taken 35.8%.

The prevalence of anxiety, depression, and stress has been described in Table 5. Based on the results, the prevalence of anxiety was mild, moderate, severe, and extremely severe among the participants with 5.9, 9.6, 2.9, and 1.3%, respectively. With regard to depression, the prevalence of depression was found to be mild, moderate, and severe among 9.2, 6.8, and 1.6% of the participants, respectively. Finally, the prevalence of stress was mild and moderate among 5.7% and 3.7%

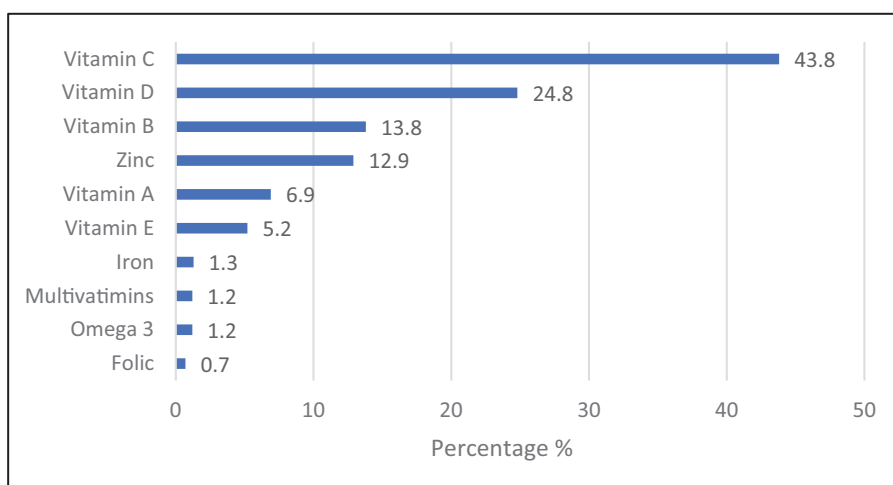
Table 4 Physical activity and weight change during COVID-19 curfew in relation to gender (n=1040)

Variables	Overall [n (%)] (N=1040)	Male [n (%)] (N=240)	Female [n (%)] (N=800)	P value
Physical activity change				
Increased	457 (43.9)	82 (34.2)	375 (46.9)	<0.001**
Decreased	309 (29.7)	106 (44.2)	203 (25.4)	
No change	274 (26.3)	52 (21.7)	222 (27.8)	
Weight change				0.012**
Increased	578 (55.6)	153 (63.8)	425 (53.1)	
Decreased	147 (14.1)	25 (10.4)	122 (15.3)	
No change	315 (30.3)	62 (25.8)	253 (31.6)	

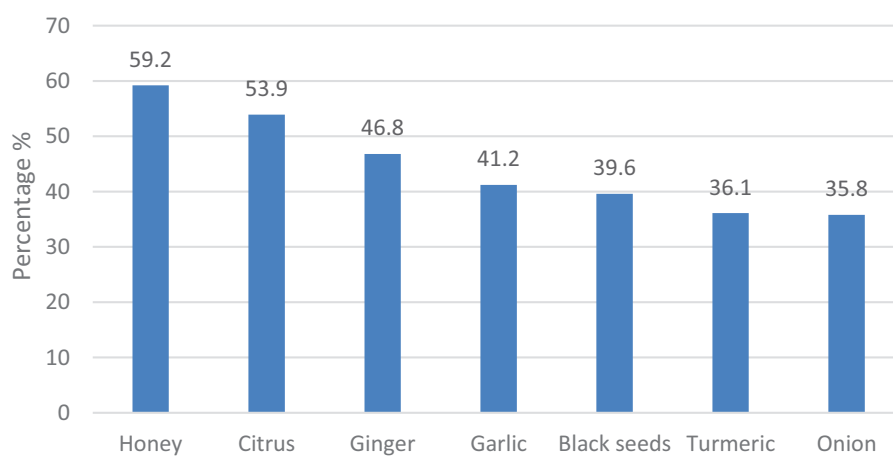
All data are represented as number and percentage. P -value has been calculated using the Chi-square test. **Significant at $p < 0.05$ level.

Figure 3

Physical activity before and during coronavirus disease-19 curfew.

Figure 4

Specific supplement taken during coronavirus disease-19 curfew.

Figure 5

Food items that boosted the immune system taken during the coronavirus disease-19 curfew.

Table 5 Prevalence of anxiety, depression, and stress using DASS-21 in relation to gender (n=1040)

Domains	Overall [<i>n</i> (%)] (<i>N</i> =1040)	Male [<i>n</i> (%)] (<i>N</i> =240)	Female [<i>n</i> (%)] (<i>N</i> =800)	<i>P</i> value
Anxiety level				
Anxious	204 (19.6)	49 (20.4)	155 (19.4)	0.722
Not anxious	836 (80.4)	191 (79.6)	645 (80.6)	
Severity of anxiety				
Normal	836 (80.4)	191 (79.6)	645 (80.6)	0.669
Mild	61 (5.9)	12 (5.0)	49 (6.1)	
Moderate	100 (9.6)	25 (10.4)	75 (9.4)	
Severe	30 (2.9)	07 (2.9)	23 (2.9)	
Extremely severe	13 (1.3)	05 (2.1)	08 (1.0)	
Depression level				
Depressed	184 (17.7)	43 (17.9)	141 (17.6)	0.917
Not depressed	856 (82.3)	197 (82.1)	659 (82.4)	
Severity of depression				
Normal	856 (82.3)	197 (82.1)	659 (82.4)	0.259
Mild	96 (9.2)	17 (7.1)	79 (9.9)	
Moderate	71 (6.8)	20 (8.3)	51 (6.4)	
Severe	17 (1.6)	06 (2.5)	11 (1.4)	
Extremely severe	0	0	0	
Stress level				
Stressed	97 (9.3)	27 (11.3)	70 (8.8)	0.243
Not stressed	943 (90.7)	213 (88.8)	730 (91.3)	
Severity of stress				
Normal	943 (90.7)	213 (88.8)	730 (91.3)	0.485
Mild	59 (5.7)	17 (7.1)	42 (5.3)	
Moderate	38 (3.7)	10 (4.2)	28 (3.5)	
Severe	0	0	0	
Extremely severe	0	0	0	

All data are represented as number and percentage. Significant *P*-value has been calculated using Chi-square test.

of the participants, respectively, however, the results revealed that there was no significant relationship with gender in anxiety ($P=0.669$), depression ($P=0.259$), and stress ($P=0.485$).

Discussion

The current study focused on describing the change in adults' nutritional and psychological behaviors during the COVID-19 curfew as compared with before the curfew in Saudi Arabia. In general, this study has found that the curfew has negatively affected nutritional behavior, psychological behavior, PA level, and weight status among Saudi adults [19].

The current findings showed that the participants reported an increase in the number of meals, snacks, and portion sizes during the COVID-19 curfew than before, supporting the results as they declared that the amount of food consumption and the frequency of snacking increased, and the participants who eat five meals per day increased from 19.9% to 31.1%. This may be due to boredom or the impact of the COVID-19 curfew on the psychological status as it makes people feel mentally stressed and anxious; thus, food

consumption becomes a way to escape from negative emotions [19].

Considering WHO recommendations on eating at home will reduce contact with other people and lower the chance of being exposed to COVID-19 [20]. Therefore, during the curfew, most of the participants engaged in cooking more than before and reduced their fast-food consumption [5], which agreed with this study. Previous studies indicated that limited accessibility of food, limited opening hours of the grocery store, and having more time for meal preparation promoted cooking at home prominently. In addition, this study showed cooking participation was more evident among female participants by 67.0%. This may be due to the cultural norms in the Saudi population, as cooking chores are associated more with females. However, people might believe they consume a healthy diet as they shifted to home-cooked meals and reduced fast foods, but this does not always prove to be true because certain home-cooked meals are high in sugar and fat [19].

Regarding the changes in food groups, the results showed an increase in grain intake among the

participants. People tend to eat carbohydrates during the curfew since it increases serotonin production, which can work as antidepressive to positively influence mood status [21]. The increase was especially among male participants by 56.4%. A study in Italy agreed with this finding; however, the increase was evident in female participants [22]. While regarding meat intake during the curfew, the participants reported a significant difference between the sexes. Male participants reported a change of 56.6% with an increased intake of 40.8%, while female participants reported a total change of 46.9% and an increase of 30.7%. This could be explained as males naturally tend to consume meat more than females [23]. However, studies conducted in the Saudi population reported no change in meat intake among their participants [5,24].

In addition, the results showed a change in caffeinated drink consumption. The participants reported an increase in coffee and tea consumption during the curfew. A study from China agreed with these findings [25]. The change in tea consumption among male participants was higher than females by 10% when the differences in accordance with gender were measured. Major tea components such as polyphenols showed antiviral properties by inhibiting virus replication and adsorption [26].

People looked for alternative options to enhance their immune system and prevent the infection's progression as well [27]. The belief in the importance of nutritional supplements in fighting infections significantly increased during the pandemic [28]. This study's findings showed that almost half of the participants who were taking nutritional supplements reported an intake of vitamin-C supplement, followed by the intake of vitamin D in a quarter of the participants, similar to the results [5]. In fact, vitamins C and D have a vital role in supporting different immune cellular functions, antioxidant, and antiviral properties [29]. Although some vitamins and minerals have positive effects related to COVID-19 [30,31]; there is no substantial evidence suggesting any single supplement treating or preventing viral infections [5].

Regarding immune-boosting foods, the current study indicated an increase in the use of honey, citrus fruits, ginger, and garlic with 59.2, 53.9, 46.8, and 41.2%, respectively among the participants. Our results are in line with [27–32]. Several pieces of evidence showed that some fruits, vegetables, spices, and herbs could lower the risk or severity of a wide range of viral infections due to their antiviral and antioxidant

functions [33]. Thus, maintaining an adequate intake of micronutrients, a balanced diet, and a healthy lifestyle are useful strategies in guaranteeing a strong immune system and avoiding infection complications [11,33].

Isolation and curfew have led to changes in daily lifestyle habits, including PA. Recent studies from various countries showed a reduction in PA levels in male and female participants during the curfew [4,13,34]. The current study found a significant difference in PA patterns among male and female participants, and a significant decrease was noticed among males than females by 18.8%. In addition, males reported a decrease in their PA level by 44.2%, while females by 25.4%. In agreement with the present results, a study from the United Arab Emirates indicated a decrease in PA during the curfew was observed more in the male group than the female group [13]. Moreover, it was observed that during the curfew, 54.4% of the participants did not meet WHO recommendations regarding PA as compared with 31.5% before the curfew. A study conducted in Saudi Arabia showed similar results [12]. This could be because the closure of fitness centers, outdoor activities and parks, and overall movement limitation has decreased the ability to engage in PA accompanied by an increase in sedentary habits related to curfew, including telework and distance learning.

Due to insufficient PA and negative alterations in dietary habits, weight gain was observed during the curfew. This study's findings declared an increase in weight gain among the participants, especially among males by 63.8%. Data from the United Arab Emirates showed an agreement with the current result [11]. The reasons for weight gain might be limited PA along with increased consumption of coffee, dessert, salty snacks, and grain during the curfew. The increasing consumption of comfort food was evident in this study as well. Lippi and others [35] supported these results by declaring that unhealthy dietary habits were expected during the curfew, including an increase in snacking and coffee consumption and a reduction in fruits and vegetable intake.

Regarding psychological status during the curfew, in the current study, the prevalence of moderate to extremely severe anxiety, stress, and depression during the curfew was noted to be 13.8, 3.7, and 8.4%, respectively. The respondents reported experiencing less anxiety and stress compared with other studies [15,36]. The differences may result

from the following explanations: first, as the psychological effect of the pandemic became obvious, the National Center for Mental Health Promotion recognized the importance of early intervention and raising awareness to deal with emerging issues, for example, providing free counseling through hotlines or (qariboon) application, live streams on social media about the mental health issues related to the pandemic [37]. Second, this study was conducted after the curfew period when new COVID-19 cases dropped, which relieved psychological stress and decreased anxiety and depression symptoms in return. Although the prevalence of psychological symptoms is still small in the many studies, existing literature suggests greater symptoms requiring intervention and support, especially in the vulnerable population [38].

In addition, this study presents no significant relationship between psychological status and gender. This finding is inconsistent with numerous studies, which show a relationship between gender and psychological status [15,39,40]. Being female is a risk factor for experiencing psychological stress. In self-reported stress, sex differences are further reflected in the perceived need for psychological support services, which are often most evident in females [40].

Conclusion and future direction

This study revealed that the COVID-19 curfew negatively affected the nutritional behaviors, psychological behaviors, PA, and weight status among Saudi adults. However, maintaining a balanced diet, ensuring adequate PA, and good mental health are effective strategies to guarantee good health. Therefore, public health officials should focus on increasing awareness of healthy eating and emphasizing the message 'to be physically active' to avoid negative consequences of the curfew and prevent weight gain. Moreover, public health interventions are needed to address parenting-specific stressors, develop useful strategies for coping with parenting difficulties to reduce the effect of this pandemic on adults' mental health.

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Conflicts of interest

There are no conflicts of interest.

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