Original article

The Impact of COVID-19 Crises on the Diet Quality and Physical Activity Among Saudi Adults

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Abstract. *Objectives:* The COVID-19 pandemic has affected day-to-day life and is changing how people eat and even how they exercise, as many individuals have developed a passive sedentary lifestyle. The aim of this study was to assess the impact of the COVID-19 crisis on dietary quality and physical activity among Saudi adults. *Methods:* A descriptive cross-sectional study was conducted among 738 adults in the Kingdom of Saudi Arabia (KSA). The modified Dietary Quality Score (DQS) and International Physical Activity Questionnaire (IPAQ) were used in this study. *Results:* In total, 76% of the participants had average dietary habits, while 16% of the participants were identified as having unhealthy dietary habits. The total average amount of time performing physical activity (PA) was 2079.08 ±2454.14 minutes/week, and the highest average was for vigorous PA (1372.47 ±1665.62 minutes/week). *Conclusion:* The COVID-19 crisis has rapidly affected people's daily lives, including their dietary quality and physical activity. This pandemic has had significant effects on the lifestyle, quality of life and wellbeing of individuals and societies, and it may continue to affect them in the future.

Key words: COVID-19, Diet Quality, Physical activity

Introduction

The COVID-19 pandemic is the defining global health crisis of our time and the greatest challenge we have faced thus far. The governments of many countries, such as the Kingdom of Saudi Arabia (KSA), have imposed a curfew since March 2020 (1,2). Therefore, many behavioral and physical health factors, such as dietary quality, and physical activity levels have changed (3–5). Many people are currently experiencing more angst and fear and are coping by either eating more or choosing unhealthy foods or beverages (3). Over the last few decades, the lifestyle factors of individuals have been proposed to predict current and future poor health statuses (6). Moreover, changes in dietary habits may lead to weight problems and other health-related problems (7). Failure to maintain a healthy weight, which is related to dietary quality and quantity, is a major problem. The Dietary Quality Score (DQS) is an accurate and validated tool that describes dietary quality and quantity and detects undernutrition in addition to risks for chronic diseases (8).

Concomitantly, all gyms and open spaces (1) have been closed during the COVID-19 crisis, which can result in increased risks for weight gain and mental health issues due to increasing stress and anxiety levels (3). Before COVID-19, physical inactivity had become a concern in the KSA, especially among adults, and 58.5% of the Saudi adult population was considered physically inactive (9). In 2015, Al-Zalabani and his colleague found that the prevalence of physical inactivity was 66.6% among the overall KSA population

(60.1% for men and 72.9% for women) (10). Furthermore, a nationwide study showed very low PA prevalence rates (6.1% for men and 1.9% for women) (11). Being physically active improves many individual health aspects, as it can prevent disease and affect mental and psychosocial statuses. PA reduces the risks of diabetes, stroke, ischemic heart disease, breast cancer and colon cancer; reduces blood pressure, heart rate, anxiety, depression, and stress; and improves mental health (12).

The objective of this study was to assess the impact of the COVID-19 crisis on dietary quality, and physical activity among adults during the curfew in 2020.

Materials and Methods

Study Population

A cross-sectional study was conducted in Madinah, KSA, during the spring semester of 2020. A total of 738 adults ranging from 18 and ≥50 years old agreed to participate in the study. The subjects were invited to participate in the study by completing a questionnaire via a link sent to their phones via WhatsApp messenger and the social networking company Twitter after they were informed of the study's purpose. All pregnant women, lactating women, and students with chronic diseases were excluded from the study. The study was approved by the committee of research ethics at Taibah University.

Data Collection

Self-reported electronic questionnaires were used for data collection. All participants were informed of the instructions before completing the questionnaire. The questionnaire contained four parts, including information about their demographic characteristics (such as anthropometric measurements, dietary quality, and physical inactivity). The first part of the questionnaire involved questions related to demographic features such as gender (male, female), age (years), marital status (married, single, divorced), income in Saudi Riyals (<5000, 5000-9999, ≥10,000), and educational level (high school, college and graduate). Anthropometric data were also collected by asking participants about their height and weight before and during the curfew to their calculate body mass index (BMI, ratio of weight in kilograms to height in meters squared). Based on guidelines from the National Institutes of Health (NIH), the BMIs of the participants were classified as underweight (BMI ≤ 18.0), normal (BMI = 18.5-24.9), overweight (BMI = 25.0-29.9), or obese (BMI ≥ 30.0) (13).

Diet Quality Assessment

The Healthy Food Palm (HFP) recommendation was used to assess dietary quality during the curfew. The HFP was developed based on the culture and eating habits of Saudi Arabians to preserve and enhance nutrient adequacy and improve health by emphasizing foods and food groups that attenuate the risk of chronic diseases (14). The DTS included 8 components, grains/breads, vegetables, fruits, dairy products, lean meats or meat alternatives, fats, sweets, and water, which were indicated based on the HFP as a guide for creating healthy and balanced meals per day.

A validated method for the DQS provided by Toft et al. was used and modified for the purpose of this study (15). Dietary quality accordance scores were computed by summing the ranked scores of each relevant food/group component. The scoring was based on those who met the guidelines (within the recommended range) and those who did not meet the guidelines (below and above the recommended range). The consumption of 6-11 servings of grains/breads per day corresponded to 2 points, fewer than 6 servings corresponded to 1 point, and no intake corresponded to 0 points. A total of 3-5 servings of vegetables corresponded to 2 points, fewer than 3 servings corresponded to 1 point, and no vegetables at all corresponded to 0 points. Additionally, the consumption of 2-4 servings of fruit per day corresponded to 2 points, fewer than 2 servings corresponded to 1 point, and no intake corresponded to 0 points. The consumption of 2-4 servings of dairy products per day corresponded to 2 points, below 2 servings corresponded to 1 point, and no consumption corresponded to 0 points. Moreover, the consumption of 2-3 servings of meats and beans corresponded to 2 points, fewer than 2 servings

corresponded to 1 point, and no servings corresponded to 0 points. The fat assessment was based on the recommended dietary reference intake (DRI) of fat in adults (20-35% of total calories from fat, which is equivalent to approximately 44-77 grams of fat per day based on a daily consumption of 2,000 calories) (16). A higher-than-normal portion corresponded to 2 points, a portion in the normal range corresponded to 1 point, and no fat corresponded to 0 points. Regarding sweets, the American Heart Association recommends that women consume no more than 6 teaspoons of added sugar per day and that men consume no more than 9 teaspoons of added sugar per day (17). The consumption of more than the normal range per day corresponded to 2 points, consumption in the normal range corresponded to 1 point, and no sweet intake corresponded to 0 points. Regarding water consumption, drinking 6 cups or more a day corresponded to 2 points, 2-5 cups a day corresponded to 1 point, and fewer than 2 cups or no intake corresponded to 0 points.

Participants were ranked according to their intake of each food/component, including grains/breads, vegetables, fruits, dairy products, lean meats or meat alternatives, fats, sweets, and water (the participant who consumed the highest amount in each food group received a score of 16, and the participant who consumed the lowest amount received a score of 0). To create dietary quality accordance scores, the respective food and nutrient component rank scores were summed. Subjects with scores of 11-16 points were identified as having healthy dietary habits, while lower consumption levels of these foods/products were characteristic of an average diet, and low consumption levels corresponded to 0-5 points, which identified subjects with unhealthy diets. More details on the proposed specifications for foods are found in Kałucka et al. (18).

PA Assessment

To assess PA, the official Arabic short version of the International Physical Activity Questionnaire (IPAQ) was used (19). The assessments of the validity and reliability of the IPAQ have previously been studied as a measure of adult PA (20). The IPAQ has seven items and defines the total number of minutes over the previous seven days spent on vigorous activities, moderate activities, walking, and inactivity. Total PA over the previous seven consecutive days was converted to metabolic equivalent task minutes per week (MET minutes/week) (20) according to the IPAQ scoring protocol as follows: total minutes over the last seven days spent on vigorous activity, moderate-intensity activity, and walking were multiplied by 8 MET, 4 MET, and 3.3 MET, respectively. MET scores across the three subcomponents were summed to indicate total PA (MET minutes/week) (20). Total PA was classified into five categories:

1. Inactive: 0 MET minutes/week (those who reported no PA)
2. Insufficient: <600 MET minutes/week
3. Sufficient PA: 600-1600 MET minutes/week
4. Active: 1601-2999 MET minutes/week
5. Very active: ≥3000 MET minutes/week

This is no general consensus regarding cutoff levels based on the IPAQ. In this study, participants were considered to have met the recommendations of the Centers for Disease Control and Prevention, the American College of Sports Medicine (CDC/ACSM) (21), and the World Health Organization (WHO) (22) if they reported at least 150 minutes/week of walking or moderate- or vigorous-intensity PA (sufficient PA). Data were cleaned to ensure that the daily time spent on vigorous, moderate and walking activities ranged between 10 and 180 minutes for all participants according to the scoring system provided by the IPAQ (23).

Data Analysis

The Statistical Package for Social Sciences (SPSS Ins., Chicago, IL, USA) version 25 was used for data analysis. The chi-square test was used for categorical variables, and descriptive statistics such as the means and standard deviations were calculated for continuous variables. Mean group differences in physical activity (MET minutes/week) by gender were compared using Student's t-test and the Mann–Whitney U test for parametric and nonparametric data, respectively. All p-values were reported on the basis of two-tailed tests.

Results

Participant Characteristics

As indicated in Table 1, of the 738 respondents, 47% were male, and 53% were female. Nearly 69% of the participants were aged 25-36 years, and 59% were married males, which exceeded the proportion of married females by 14%. The majority of the participants (71%) had a college degree, and 43% were considered to have high incomes (i.e., total monthly income of 9999 SRs). Although almost 26% of the females had an income ≤4999, 27% of the males had an income of ≥10,000. Regarding BMI before the curfew, 34% had a normal BMI, 35% were overweight, and 26% were obese. Moreover, the BMIs of the participants during the curfew were distributed as follows: 32% had a normal BMI, 36% were overweight, and 27% were obese. Based on gender, BMI differences before and during the curfew appeared to be stronger among obese individuals.

Table 1. Characteristics of the participants (N= 738)

Number of participants	**Total N (%) 738 (100%)**	**Male n= 348 (47%)**	**Female n= 390 (53%)**	***p- value***
Age				
18-24	176 (24%)	41 (23%)	135 (77%)	0.001
25-35	238 (32%)	133 (56%)	105 (44%)	
36-49	271 (37%)	146 (54%)	125 (46%)	
≥50	53 (7%)	28 (52%)	25 (48%)	
Marital status				
Married	436 (59%)	247 (57%)	189 (43%)	0.001
Unmarried	272 (37%)	95 (35%)	177 (65%)	
Divorced	30 (4%)	6 (47%)	24 (53%)	
Education levels				
High school	120 (16%)	49 (41%)	71 (59%)	0.001
College	525 (71%)	249 (47%)	276 (53%)	
Undergraduate	93 (13%)	50 (54%)	43 (46%)	
Income[a]				
≤4999	273 (37%)	80 (29%)	193 (71%)	0.023
5000-999	144 (20%)	67 (46%)	77 (54%)	
≥10000	321 (43%)	201 (63%)	120 (37%)	
BMI before curfew				
Underweight	43 (6%)	19 (44%)	24 (56%)	0.001
Normal weight	247 (33%)	115 (47%)	132 (53%)	
Overweight	256 (35%)	128 (50%)	128 (50%)	
Obese	192 (26%)	86 (61.3)	106 (56%)	
BMI during curfew				
Underweight	44 (6%)	19 (45%)	23 (55%)	0.001
Normal weight	238 (32%)	113 (47%)	125 (53%)	
Overweight	264 (36%)	126 (46%)	138 (53%)	
Obese	194 (26%)	90 (47%)	104 (53%)	

[a]Saudi Riyal

Diet Quality Assessment

Table 2 presents the frequency of food consumption based on the HFP. Eighty-eight of the presented population consumed fewer than six servings of grains. Among those, 4% of males reported no intake of grains, and 4% of females consumed 6-11 servings per day. Seventy-six percent of the participants reported more than three servings of vegetables per week, and 66% consumed fewer than two pieces of fruit per week. Males and females exhibited the same vegetable and fruit consumption trends; 12% of the female participants reported no intake, and 6% of males consumed the these food groups in the normal range. More than half of the participants consumed fewer than 2 servings of dairy products, and a high percentage of females consumed either zero servings (10%) or 2-4 servings (15%). Almost all the subjects (60%) ate fewer than 2 servings from the meats and beans group, and only 5% of the participants reported no consumption. In the study, the proportion of respondents consuming fats, sweets, and water fell to

Table 2. Consumption frequencies of the most important foods in the study cohort

Food	Frequency	Total (%)	Male n= 348 (47%)	Female n= 390 (53%)	*p-value*
Grains	No intake	42 (6%)	27 (64%)	15 (36%)	0.015
	fewer than 6 servings	699 (88%)	305 (49%)	394 (51%)	
	6-11 servings	42 (6%)	16 (38%)	26 (62%)	
Vegetables	No intake	111 (15%)	30 (27%)	81 (73%)	0.001
	fewer than 3 servings	558 (76%)	273 (49%)	285 (51%)	
	3-5 servings	69 (9%)	45 (38%)	24 (62%)	
Fruits	No intake	160 (22%)	73 (45%)	87 (55%)	0.001
	fewer than 2 servings	485 (66%)	234 (48%)	251 (52%)	
	2-4 servings	93 (12%)	41 (44%)	52 (56%)	
Dairy products	No intake	124 (17%)	54 (43%)	70 (57%)	0.004
	fewer than 2 servings	421 (57%)	209 (50%)	212 (50%)	
	2-4 servings	193 (26%)	85 (44%)	108 (56%)	
Meat and beans	No intake	33 (5%)	12 (36%)	21 (64%)	0.002
	fewer than 2 servings	449 (60%)	211 (47%)	239 (53%)	
	2-3 servings	256 (35%)	125 (49%)	131 (51%)	
Fat[a]	No intake	26 (4%)	17 (65%)	9 (35%)	0.018
	Normal range	640 (86%)	292 (46%)	348 (54%)	
	Higher than normal range	72 (10%)	39 (54%)	33 (46%)	
Sweets[b]	No intake	117 (16%)	72 (62%)	45 (38%)	0.001
	Normal range	353 (48%)	178 (50%)	175 (50%)	
	Higher than normal range	268 (36%)	98 (37%)	170 (63%)	
Water	Fewer than 2 cups[c] or no intake	94 (13%)	29 (31%)	65 (69%)	0.003
	2-5 cups	297 (40%)	137 (46%)	160 (54%)	
	≥6 cups	347 (47%)	182 (52%)	165 (48%)	

[a]The dietary reference intake (DRI) for fat in adults is 20-5% of total calories from fat, which is approximately equal to 44-77 grams of fat per day based on 2,000 calories per day.
[b]The American Heart Association recommends that women consume no more than 6 teaspoons of added sugar per day and that men consume no more than 9 teaspoons of added sugar per day.
[c]Cup is equal to 240 milliliters.

within the normal ranges of 86%, 48%, and 47%, respectively. Regarding the consumption of sweets, 16% of the male participants reported no sweet consumption, while 63% of the female participants reported a higher-than-normal amount of sweet consumption. When we compared water consumption between males and females, 69% of the females reported no water consumption, and 52% of males reported consuming 6 cups or more of water.

For the purpose of the study, participants were categorized based on their gender to determine the dietary quality components and DQSs. Among a 0-16 range, the highest DQS among all participants was 15, and the lowest score was 3. As shown in Table 3, the majority of the participants were identified as having average dietary habits, 8% had healthy dietary habits, and 16% had unhealthy dietary habits. Based on gender, 75% of the females were categorized as having healthy dietary habits, whereas 60% of males were categorized as having unhealthy dietary habits.

PA Assessment

The mean MET minutes/week for total PA was 2079.08 ±2454. Participants engaging in vigorous PA had the highest MET minutes/week at 1372.47 ±1665.62. Those engaging in moderate PA and walking had means of 701.53 ± 796.76 and 766.56 ± 869.16 MET minutes/week, respectively. Although the relationship between MET minutes/week for all variables was not significant based on gender, males had a higher MET minutes/week than females. Regarding the time spent sitting (in hours/day and minutes/day), the average time was 7.28 ± 4.08 hours/day (or 436.82 ± 245.39 minutes/day), and the differences were significant between males and females (Table 4).

As shown in Table 5, among males, 27% and 24% were identified as having insufficient and sufficient PA, respectively. Among females, 29% and 25% were identified as having insufficient and sufficient PA, respectively. Furthermore, more females than males were

Table 3. Dietary Quality Scores

Category	Score Range	Total (%)	Male n = 348 (47%)	Female n = 390 (53%)
Healthy dietary habits	11-16	58 (8%)	14 (25%)	44 (75%)
Average dietary habits	6-10	529 (76%)	243 (46%)	286 (54%)
Unhealthy dietary habits	0-5	151 (16%)	91 (60%)	60 (40%)

Table 4. PA Assessment

Variable[a,b]	Total (N = 738)	Male (N = 348)	Female (N = 390)	*t*-test	*P-value*
Vigorous PA (MET min/w)	1372.47 ± 1665.62	1427.22 ± 1583.86	1313.63 ± 1751.30	0.695	0.487
Moderate PA (MET min/w)	701.53 ± 796.76	731.35 ± 858.41	673.08 ± 733.81	0.791	0.429
Walking (MET min/w)	766.56 ± 869.16	777.42 ± 866.60	756.08 ± 873.02	0.290	0.772
Total PA (MET min/w)	2079.08 ± 2454.14	2196.02 ± 2545.18	1966.45 ± 2361.58	1.183	0.237
Time spent sitting (h/d)	7.28 ± 4.08	7.97 ± 4.12	6.65 ± 3.95	4.425	0.000
Time spent sitting (min/d)	436.82 ± 245.39	478.62 ± 247.75	399.53 ± 237.44	4.425	0.000

[a]M ± SD.
[b]h/d= hours/day, min/d= minutes/day, MET min/w: metabolic equivalent task minutes per week.

Table 5. PA Categories

PA category[a] (%)	Total (N= 738)	Male (N= 348)	Female (N= 390)
Inactive	13.3	9.8	16.4
Insufficient	26.8	28.7	25.1
Sufficient	24.3	23.3	25.1
Active	15.0	14.9	15.1
Very active	20.6	23.3	18.2

[a]Inactive: 0 MET min/w (those who reported no PA); insufficient <600 MET min/w; sufficient PA: 600-1600 MET min/w; active 1601-2999 MET min/w; very active ≥3000 MET min/w.

inactive (16% vs. 10%). For both males and females, 15% were categorized as active. Only 20% of the participants were very active, and males comprised a higher percentage of this subgroup than females.

Discussion

The COVID-19 global pandemic has resulted in new challenges for individuals, communities, and the world in regards to the maintenance of healthy habits. This study has described patterns of dietary quality and PA during the COVID-19 curfew of 2020 among a representative sample of Saudi adults.

These data indicated that average dietary habits appeared to be prevalent among the participants. Because the DQS assessed various aspects of diet with a strict set of standards, especially for all main food groups, the DQS scores indicated that the level of adherence to the HFP was average among more than half of the participants, while a few participants had either healthy or unhealthy dietary habits. This trend was observed in adults before the implementation of the curfew in the KSA and other foreign countries. In 2019, a study of 612 Saudi males and females reported that Saudi's overall level of adherence to the HFP was 26%, which is considered low (14). Similar results were found in a cross-sectional population-based study of 6542 participants from Copenhagen County, Glostrup, Denmark (15). The less healthy dietary habits among the participants during the COVID-19 pandemic can potentially be explained by both psychological and physiological responses to stress and heightened emotional states such as fear and anxiety, which lead to changes in food intake (24,25). In April 2020, Farah Naja and Rena Hamadeh listed recommendations to cope with the influence of this pandemic on nutrition and dietary intake, and these recommendations have already been extended beyond individuals and communities to national and global levels (26).

Despite that all sports activities in the KSA are currently suspended and that private sports halls and centers are closed during the COVID-19 pandemic, the current data demonstrate that the mean total PA in this study was 2079 minutes/week and that 59% of the subjects engaged in sufficient PA, active PA, or very active PA, performing over 600 MET minutes/week. To our knowledge, only one study conducted among 2176 adult Saudis found that the median total physical activity was 2304 MET minutes/week, and 52% were sufficiently active (27). Males were likely to be more active than females, which is not consistent with the results of similar target populations in the KSA (28). In this study, physical activity among adults was higher than the estimate presented in a 2018 systematic review, which reported that Saudi children, youth and adults were not sufficiently active to meet the recommended guidelines for moderate to vigorous PA (29). Despite reports that the majority of Saudis are unaware of these PA recommendations (30), our results indicated that the participants that met the WHO recommendations for being physically active enjoyed health benefits. The observed difference can be explained by one of two factors. First, the Ministry of Sports encourages Saudis to exercise more based on different challenges with prizes, such as running a marathon from home and showing their efforts on their social media accounts (31). (40). Second, many gyms and social media influencers (32) share videos of circuits or exercises to encourage PA. Being physically active improves many individual health aspects, as it can prevent diseases and improve mental and psychosocial statuses. The estimated increase in life expectancy as a result of eliminating physical inactivity is 1.51 years (33). PA reduces the risks of diabetes, stroke, ischemic heart disease, breast cancer and colon cancer (34) as well as blood pressure and heart rate values (35). PA also reduces anxiety, depression, and stress and improves mental health (12).

The present study has several strengths, including the large sample size with different characteristics, thereby making the study population unique and appropriate for investigation. The HFP and DQS methods were used to assess dietary quality and have been shown to be reliable methods of assessment due to the detailed items assessed; they have also been tested among individuals of different nationalities (14,15). The IPAQ method has become extensively accepted methods to assess physical activity levels have been widely studied among adults. However, several limitations need to be acknowledged. Due to the curfew, self-reporting was the only method of data collection, which may have caused bias and affected the results. The cross-sectional design did not allow the gain of information regarding the cause-and-effect relationships between COVID-19 and the other variables; thus, a longitudinal design is needed. Further research is needed to strengthen, validate and extend these results.

Conclusion

This study assessed the impact of COVID-19 on the dietary quality and physical activity of KSA individuals during the curfew implemented in 2020. We found that COVID-19 affected the dietary quality of the participants by decreasing their healthy dietary habits and increasing their unhealthy dietary habits. Overall, the IPAQ results indicated that females were less likely to be physically active than males. Our findings indicated the need to increase awareness of the importance of consuming diversified, balanced and healthy diets that provide energy and all essential nutrients for a healthy and active life. Our adults should be encouraged to become more physically active to promote a healthy lifestyle and to facilitate the secondary prevention of chronic diseases by noting strategies and coordinating efforts at all levels (family, university, community, and government).

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