ISSN: 2347-467X, Vol. 11, No. (1) 2023, Pg. 141-152

Current Research in Nutrition and Food Science

www.foodandnutritionjournal.org

Eating Habits and Diet Diversity of Saudi Arabia Residents during the COVID-19 locked-down

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Abstract

The COVID-19 pandemic has had a negative impact on overall health and well-being. Therefore, certain preventive measures may affect many lifestyle habits. This study aimed to explore the eating habits, food variety score (FVS), and diet diversity score (DDS) of adults residing in Saudi Arabia during the mandatory stay-at-home advisory for COVID-19. A cross sectional study was targeted adults living in Saudi Arabia during the COVID-19 lockdown (May – June 2020). An electronic self-reported survey was conducted through Research Electronic Data Capture (Redcap) distributed on social media platforms. The Arabic version of the questionnaire was previously evaluated for its reliability and validity. A total of 359 individuals who completed the food frequency questionnaire were included in the study. Diet diversity score (DDS) and food variety score (FVS) was calculated. The study found that the distribution of FVS ranged between 4-27 food items. The distribution of DDS ranged between 3-14 food items. Income, working status, and living status were factors associated with the FVS and/or DDS. The majority of the cohort (>67%) had at least one snack/day and < 3 meals/day. Diet diversity was acceptable among Saudi adults during the COVID-19 lockdown period. Age, sex, having children, marital status, education level, and income were factors associated with diet diversity and eating habits (having breakfast, skipping meals, and number of snacks).

Article History
Received: 19 December 2022
Accepted: 02 March 2023

Keywords
Adults;
COVID-19 Pandemic;
Dietary intake;
Dietary behavior;
Saudi Arabia.

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Doi: http://dx.doi.org/10.12944/CRNFSJ.11.1.9

Introduction

COVID-19 pandemic has had a negative impact on overall health and well-being. Governments have taken several preventive actions to contain the COVID-19 pandemic (such as social distancing, lockdowns, and border restrictions). Therefore, many lifestyle habits may have been affected by these preventive measures, including weight gain and physical inactivity.[1] Foods contain essential nutrients that plays significant role in the immune system maintenance and overall health. Specific nutrients (such as vitamins A, C, and D, and zinc) may play a role in preventing and treating COVID-19.[1] Consuming a diverse diet is crucial for maintaining an adequate intake of essential nutrients, and evidence shows that increased dietary diversity is associated with an increased overall nutritional status.[2]

Dietary diversity refers to a diet that contains a wide variety of food items and/or food groups measured at the household or individual level over a certain period of time.[3] Diet diversity is linked to dietary quality under the premise that consuming a variety of foods increases nutrient adequacy.[2] Diet diversity can be assessed based on the number of food items (food variety score [FVS]) or food groups (diet diversity score [DDS]).[4] FVS is defined as the number of food items consumed and DDS is defined as the number of food groups consumed.[4] Recently, low dietary diversity has been observed in developed and developing countries, especially during the COVID-19 pandemic.[5,6] Different factors may influence diet diversity, including lockdowns, food availability, accessibility, and security.[5-9]

Few studies have evaluated dietary intake, dietary behavior, and household diet diversity during the COVID-19 pandemic.[5-11] In the USA, there was an increase in high sugar, snacks and soda, as well as an increase in the intake of fruit and vegetables during the COVID-19 pandemic.[7,8] In India, 34% had reduced household dietary diversity.[12] In China, the overall household diet diversity was good during the COVID-19 pandemic.[5] Lower dietary diversity has been observed in cities with higher COVID-19 cases.[5] However, all studies have assessed dietary diversity in households, not at the individual level.

To our knowledge, no information is available concerning studies that have assessed individual dietary diversity during the COVID-19 pandemic in Middle Eastern countries. The aim of the current study was to descriptively assess the eating habits, FVS, and DDS of adults residing in Saudi Arabia during the mandatory stay-at-home advisory for COVID-19.

Materials and Methods

Study Setting and Population

A cross-sectional study was conducted in Saudi Arabia from May to June 2020, during the period in which the COVID-19 stay-at-home advisory was implemented. The study population was extracted from a larger study on the impact of COVID-19 on lifestyle and quality of life among people living in Saudi Arabia, which targeted adults living in Saudi Arabia during the COVID-19 lockdown.[13] The study followed the principles of the Declaration of Helsinki and obtained approval from the institutional review board (IRB #20-0142) at Princess Nourah Bint Abdulrahman University. All individuals who agreed to participate signed an electronic consent form and had clear knowledge about the study aim, they were notified that withdrawal from the study at any time without any penalty is permitted.

Eligible participants were residents of Saudi Arabia who were 18 years and older, except for individuals who were diagnosed with or suspected of having COVID-19. An electronic self-reported survey was conducted using Research Electronic Data Capture (Redcap). The survey was distributed on social media platforms such as Twitter and through personal contact with the research group members. The first page of the online questionnaire briefed participants about the study, explained that they had the right to participate, could drop out at any time, and did not have to answer all questions. In addition, electronic informed consent was obtained.

Sociodemographic and Anthropometric Variables

In a close-ended questionnaire, participants were asked about their sex, marital status, educational attainment, work status, work type, number of children, monthly income, chronic diseases, lives during the COVID-19 pandemic, region of residence, smoking status, and COVID-19 diagnosis. Moreover, the participants were asked to write their age in years, weight in kilograms (kg), and height in centimeters (cm).

Dietary Intake and Eating Habits

The Arabic version of the short food frequency questionnaire (FFQ), a self–administered questionnaire, was used to assess participants' food consumption.[14,15] The reliability and validity of the questionnaire have been evaluated previously.[14] The FFQ captured participants' number of meals and snacks using multiple-choice questions. Furthermore, the frequency of food item intake from different food groups was assessed using an 8-point Likert scale. The responses were categorized and recorded as never, 2-4 times / week, 5-6 times /week, one time/day, 2-3 times/ day, 4-5/day, and 6 times /day. One question was asked regarding eating habits: the number of meals and snacks consumed throughout the day during the COVID-19 quarantine.

DDS and FVS

The DDS of food groups and FVS of food items were measured using the FFQ data, as described in a previous study.[4,8] FVS was measured as the number of food items consumed using the FFQ.[4] Food items were classified into 14 groups according to FAO: grains and cereals, pulses and nuts, roots/tubers, fruits, green leafy vegetables, other vegetables, eggs, meat and poultry, seafood, dairy products, oils and fats, condiments, drinks, sugar, and miscellaneous.[16] DDS is measured as the number of food groups consumed.[4] Furthermore, DDS and FVS of food groups/items were presented using tertiles: 1st quartile, 2nd quartile/median (IQR), and 3rd quartile.[4,17]

Statistical Analysis

Statistical analyses were conducted using SPSS Statistics (IBM, version 26). Sociodemographic variables are presented as frequencies and percentages (for categorical variables) or mean ± standard deviation (SD) (for continuous variables). Levels of FVS and DDS for participants' scores were classified into low, medium, and high tertiles.[17] Anything less than the 1st quartile score = low, from 1st quartile to 2nd quartile/median = medium, and more than the 2nd quartile = high FVS and DDS. The chi-square test was used to investigate factors associated with food variety and diet diversity levels. An independent t-test was used to compare two means. Statistical significance was set at $P < 0.05$.

Results

Sociodemographic

Table 1 presents the sociodemographic characteristics of Saudi Arabia residents during the COVID-19 quarantine period. Overall, the study included 359 individuals: 83.3% were female, while 16.7% were male. The average of participants' age was 34.41 (SD = 11.4) years and the majority (71.0%) were 18-39 years old. The participants' mean body mass index (BMI) was 27.81 (SD = 20.0) kg/m2, where 37.5% had a normal BMI, 33.7% were overweight, and 24.4% were obese. Participants were mainly from the central area (70.2 %), followed by the western area (16.4%).

Eating Habits

During COVID-19 quarantine, the majority of participants reported eating two meals/day (n= 168, 46.8%), while 29.2% (n=105) consumed three meals/day. In addition, 67.7% (n=243) of participants consumed only one snack and 32.3% (n=116) consumed >1 snack /day. Regarding the daily eating pattern of participants, 67.4% (n=242) reported that they had breakfast, 61.8% (n=222) had lunch, and 71.0% (n=255) had dinner during the stay-at-home instructions.

Association Between Sociodemographic Variables and Eating Habits

Table 2 represents the association between the sociodemographic characteristics and eating habits of Saudi Arabia residents during the COVID-19 quarantine. No association was found between the number of meals and the sociodemographic variables (*P>0.05).

DDS and FVS

The distribution of the FVS ranged between 4-27 food items (Figure 1). The distribution of DDS ranged between 3-14 food items (Figure 2). The majority of participants (35.4%) had fewer than 10 food groups. Figure 3 shows the percentage of participants who consumed different food groups during quarantine.

Table 1: Sociodemographic characteristics of adults living in Saudi Arabia during COVID-19 quarantine (n=359)

Variable	n (%)	Mean (SD)
Sex		
Female	299 (83.3)	---
Male	60 (16.7)	---
Age (years)		34.41 (11.4)
18-39	255 (71.0)	---
40-64	98 (27.3)	---
65+	6 (1.7)	---
Educational level		
Secondary/Intermediate	39 (10.9)	---
Collage	230 (64.1)	---
Higher education	90 (25.1)	---
Height (m)[1]	---	1.62 (0.1)
Weight (kg)[1]	---	43.30 (9.3)
BMI (kg/m^2)[1]	---	27.81 (20.0)
Underweight	15 (4.4)	---
Normal	129 (37.5)	---
Overweight	116 (33.7)	---
Obese	84 (24.4)	---
Chronic Diseases		
Yes	335 (93.3)	---
No	24 (6.7)	---
Living Area		
Central	252 (70.2)	---
East	22 (6.1)	---
West	59 (16.4)	---
North	16 (4.5)	---
South	10 (2.8)	---
Marital Status		
Married	198 (55.2)	---
Non-married	161 (44.8)	---
Whom they live with		
Alone	11 (3.1)	---
With someone	348 (96.9)	---
Have children		
Yes	175 (48.7)	---
No	184 (51.3)	---
Work status		
Work	213 (59.3)	---
Do not work	146 (40.7)	---
Monthly Income in Saudi Riyals 2		
5,000 or less	74 (24.7)	---
5,001-10,000	49 (16.3)	---
10,001-15,000	72 (24.0)	---
15,001-20,000	49 (13.6)	---
20,001-25,000	22 (7.3)	---
More than 25,000	34 (11.3)	---

[1] n=344

Table 2: The association between sociodemographic characteristics and eating habits of adults during COVID-19 quarantine (n=359).

		Having breakfast			Meals number			Snacks number		
	N	**Yes (n=242)**	**No (n=117)**	**P-value**	**<3 (n=254)**	**≥3 (n=105)**	**P-value**	**>1 (n=116)**	**1 (n=243)**	**P-value**
Gender				0.365			0.122			<000.1
Female	299	198	101		216	83		84	215	
Male	60	44	16		38	22		32	28	
Age				0.059			0.616			0.008
18-39	255	164	91		184	71		71	184	
40-64	98	72	26		66	32		41	57	
65+	6	6	0		4	2		4	2	
Educational level				0.029			0.808			0.855
Secondary/Intermediate	39	22	17		30	9		13	26	
Collage	230	150	80		161	69		72	158	
Higher education	90	70	20		63	27		31	59	
BMI				0.028			0.772			0.486
Underweight	15	5	10		12	3		6	9	
Normal	129	90	39		91	38		35	94	
Overweight	116	81	35		85	31		41	75	
Obese	84	60	24		55	29		27	57	
Chronic disease				0.372			0.911			0.713
Yes	250	164	86		178	72		79	171	
No	109	78	31		76	33		37	72	
Area				0.544			0.920			0.274
Center	252	163	89		182	70		73	179	
East	22	16	6		13	9		10	12	
West	59	43	16		42	17		24	35	
South	10	8	2		6	4		3	7	
North	16	12	4		11	5		6	10	
Marital status				0.215			0.292			0.015

Non-married	161	103	58		115	46		42	119	
Married	198	139	59		139	59		74	124	
Whom they live with				0.754			0.406			0.104
Alone	11	7	4		6	5		6	5	
With someone	348	235	113		248	100		110	238	
Have children				0.117			0.735			0.002
No	184	117	67		124	52		45	139	
Yes	175	125	50		122	53		71	104	
Work status				0.039			0.654			0.819
Work	213	153	60		147	66		70	143	
Do not work	146	98	57		107	39		46	100	
Monthly income				0.001			0.471			0.088
5,000 or less	74	43	31		53	21		24	50	
5,001-10,000	49	33	16		37	12		15	34	
10,001-15,000	72	45	27		51	21		20	52	
15,001-20,000	49	36	13		35	14		11	38	
20,001-25,000	22	21	1		10	12		7	15	
More than 25,000	34	31	3		24	10		18	16	

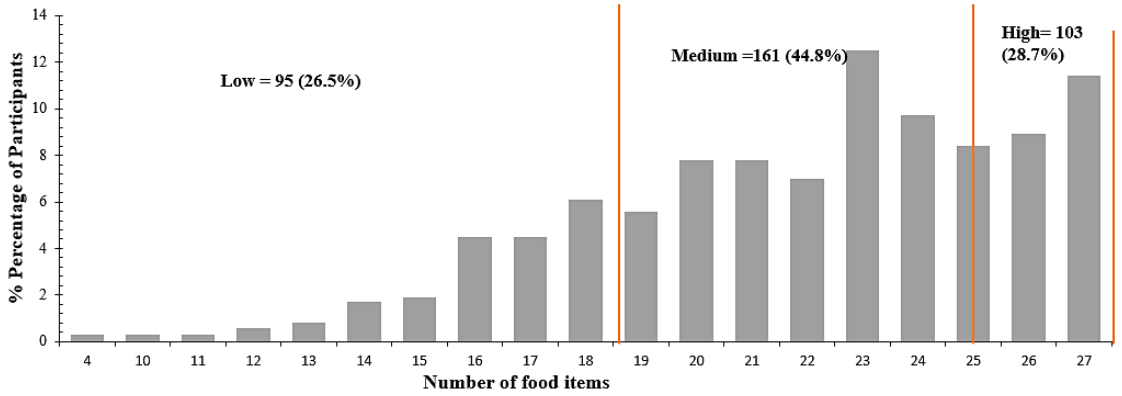

Fig. 1: Distribution of food variety scores (FVS) of food items daily consumption during COVID-19 quarantine among adults (N=359) living in Saudi Arabia.

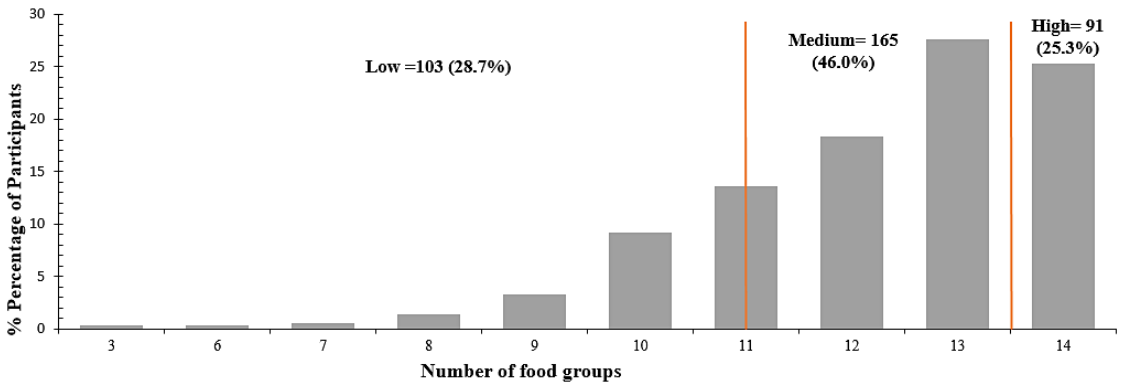

Fig. 2: Distribution of diet diversity scores (DDS) of food items daily consumption among adults (N=359) living in Saudi Arabia.

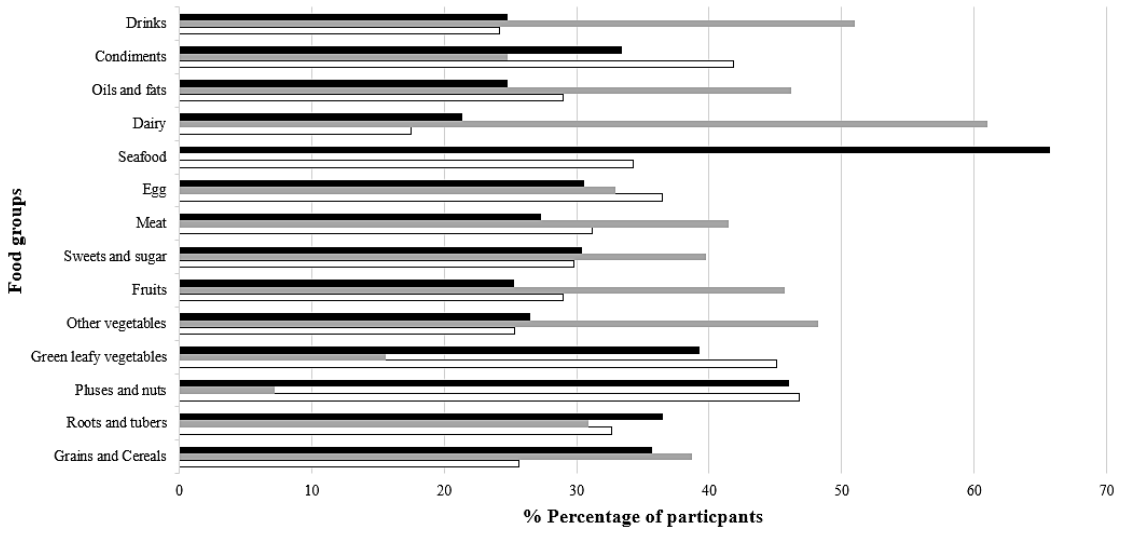

Fig. 3: Percentage of participants consuming each food group of adults living in Saudi Arabia during COVID-19 quarantine (n=359). The Y-line presents the food groups, while the X-line presents the percentage of individuals with low DDS (white), medium DDS (grey) and high DDS (black) consumption.

Table 3: The association between sociodemographic characteristics and Food Variety Scores and Diet Diversity Scores (n=359).

		FVS				DDS			
	N	Low N (%)	Medium N (%)	High N (%)	(P)	Low N (%)	Medium N (%)	High N (%)	(P)
Gender									
Female	299	80 (26.8)	137 (45.8)	82 (27.4)	0.488	88 (29.4)	141 (47.2)	70 (23.4)	0.170
Male	60	15 (25.0)	24 (40.0)	21 (35.0)		15 (25.0)	24 (40.0)	21 (35.0)	
Age									
18-39	225	71 (27.8)	112 (43.9)	72 (28.2)	0.332	77 (30.2)	112 (43.9)	66 (25.9)	0.351
40-64	98	21 (21.4)	46 (46.9)	31 (31.6)		23 (23.5)	50 (51.0)	25 (25.5)	
65+	6	3 (50.0)	3 (50.0)	0(0)		3 (50.0)	3 (50.0)	0(0)	
Educational level									
Secondary/Intermediate	39	6 (15.4)	22 (56.4)	11 (28.2)	0.411	9 (23.1)	17 (43.6)	13 (33.3)	0.271
Collage	230	63 (27.4)	98 (42.6)	69 (30.0)		68 (29.6)	100 (43.5)	62 (27.0)	
Higher education	90	26 (28.9)	41 (45.6)	23 (25.6)		26 (28.9)	48 (53.3)	16 (17.8)	
BMI									
Underweight	15	5 (33.3)	10 (66.7)	0(0)	0.142	5 (33.3)	8 (53.3)	2 (13.3)	0.422
Normal	129	39 (30.2)	50 (38.8)	40 (31.0)		40 (31.0)	52 (40.3)	37 (28.7)	
Overweight	116	28 (24.1)	54 (46.6)	34 (29.3)		33 (28.4)	58 (50.0)	37 (28.7)	
Obese	84	18 (21.4)	41 (48.8)	25 (29.8)		18 (21.4)	42 (50.0)	24 (28.6)	
Chronic disease									
Yes	109	30 (27.5)	43 (39.4)	36 (33.0)	0.348	72 (28.8)	120 (48.0)	58 (23.2)	0.325
No	250	65 (26.0)	118 (47.2)	67 (26.8)		31 (28.4)	45 (41.3)	33 (30.3)	
Area									
Center	252	62 (24.6)	117 (46.4)	73 (29.0)	0.524	69 (27.4)	125 (49.6)	58 (23.0)	0.458
East	22	8 (17.3)	11 (32.6)	3 (20.3)		9 (40.9)	8 (36.4)	5 (22.7)	
West	59	18 (30.5)	25 (42.4)	16 (27.1)		18 (30.5)	21 (35.6)	20 (33.9)	
South	10	2 (20.0)	4 (40.0)	4 (40.0)		3 (30.0)	3 (30.0)	4 (40.0)	
North	16	5 (31.3)	4 (25.0)	7 (43.8)		4 (25.0)	8 (50.0)	4 (25.0)	
Marital status									
Non-married	161	49 (30.4)	65 (40.4)	47 (29.2)	0.216	51 (31.7)	73 (45.3)	37 (23.0)	0.455
Married	198	46 (23.2)	96 (48.5)	56 (28.3)		52 (26.3)	92 (46.5)	54 (27.3)	

Whom they live with									
Alone	11	6 (54.5)	5 (45.5)	0(0)	0.036	6 (54.5)	5 (45.5)	0(0)	0.063
With someone	348	89 (25.6)	156 (44.8)	103 (26.9)		97 (27.9)	160 (46.0)	91 (26.1)	
Have children									
No	184	53 (28.8)	74 (40.2)	57 (31.0)	0.195	56 (30.4)	82 (44.6)	46 (25.0)	0.749
Yes	175	42 (24.0)	87 (49.7)	46 (26.3)		47 (26.9)	83 (47.4)	45 (25.7)	
Work status									
Work	213	55 (25.8)	90 (42.3)	68 (31.9)	0.250	53 (24.9)	97 (45.5)	63 (29.6)	0.042
Do not work	146	40 (27.4)	71 (48.6)	35 (24.0)		50 (34.2)	68 (46.6)	28 (19.2)	
Income (SAR/month)									
<5,000	74	26 (35.1)	33 (44.6)	15 (20.3)	0.121	33 (44.6)	25 (33.8)	16 (21.6)	0.008
5,001-10,000	49	11 (22.4)	19 (38.8)	19 (38.8)		10 (20.4)	21 (42.9)	18 (36.7)	
10,001-15,000	72	12 (16.7)	38 (52.8)	22 (30.6)		12 (16.7)	42 (58.3)	18 (25.0)	
15,001-20,000	49	13 (26.5)	23 (46.9)	13 (26.5)		14 (28.6)	22 (44.9)	13 (26.5)	
20,001-25,000	22	7 (31.8)	12 (54.5)	3 (13.6)		6 (27.3)	14 (63.6)	2 (9.1)	
> 25,000	34	13 (38.2)	11 (32.4)	10 (29.4)		12 (35.3)	13 (38.2)	9 (26.5)	

Association Between Sociodemographic Characteristics and DDS and FVS

Table 3 shows the association between sociodemographic factors, the FVS, and the DDS. Individuals who lived with their families and/or partners had a high FVS. Income and work status were also associated with DDS.

Discussion

This study aimed to explore the eating habits, FVS, and DDS of adults residing in Saudi Arabia during their mandatory stay-at-home advisory for COVID-19. The study found that the distribution of FVS ranged from to 4-27 food items. The distribution of DDS ranged between 3-14 food items. Income, working status, and living status were factors associated with the FVS and/or DDS. Approximately 30% of the participants skipped breakfast, and the majority (>67%) had at least one snack/day and <3 meals/day. Education level, BMI, working status, and income were factors influencing breakfast consumption. Sex, age, marital status, and having children were factors influencing the number of snacks consumed.

Diet diversity is a proxy measure of diet quality because it is associated with nutrient adequacy.[18] One study showed that reduced diet diversity can be associated with reduced dietary adequacy and may lead to various adverse health outcomes, such as poor nutritional status.[19] Adequate diet diversity is associated with positive health outcomes such as an increase in the level of antioxidants in the blood.[3,20] Strong evidence has shown the influence of nutritional status or dietary supplements on enhancing the immune system and preventing and/or treating respiratory infections or COVID-19.[21-25] Furthermore, recent evidence has shown a positive influence of vitamins C and D in patients with COVID-19.[23,25]

Data regarding dietary diversity in Saudi Arabia are limited.[16, 26] A study conducted among 1700 Saudi mothers found that more than 50% of the sample consumed at least five out of 14 food groups.[16] During the COVID-19 era, few studies have assessed diet diversity at the household level.[5, 6, 9-11] Household diet diversity were found to be altered in Iran, France, Bangladesh, Burkina Faso, Nigeria, and Ethiopia during the COVID-19 outbreak.[5, 6, 9-11] Unfortunately, limited data are available to assess diet diversity

in Saudi Arabia during COVID-19. Therefore, we could not compare the results of the current study with those of a cohort study. In addition, we were unable to compare the diet diversity results to other studies that compared diet diversity per, during, and after the COVID-19 outbreak.[5, 6, 9-11] This is because we assessed dietary diversity at the individual level, not at the household level.

Several sociodemographic factors may influence diet diversity, including level of education, occupation, income, and marital status.[5,6,27] Two studies assessed the potential predictors of diet diversity during COVID-19.[5,6] In China, low diet diversity has been observed in areas with a high number of COVID-19 positive cases.[5] In Bangladeshi, income and occupation are major determinants of diet diversity during COVID-19, which is similar to the results of the current study.

In the current study, around 30% of the participants had skipped breakfast during COVID-19 quarantine. In Kuwait, skipping breakfast was observed in 42% of Kuwaitis during the COVID-19 lockdown compared to 39% before lockdown.[28] The current study found that skipping breakfast was associated with obesity, educational level, income, and not working. It has been demonstrated that skipping breakfast maybe related to lifestyle behaviors such as oversleeping or sleeping late, which were reported to be common during COVID-19 lockdown.[28-30] In addition, skipping meals was also observed among young Saudi women during the COVID-19 lockdown.[31] The current study showed that the majority of participants had less <3 meals and one snack per day. Having children, BMI, age, and marital status are potential predictors of the number of snacks, these factors were reported previously.[32]

Although we found that food and diet diversity in Saudi Arabia during COVID-19 was limited, the current study had several limitations. First, the majority of the study population was female and from the central region owing to the snowball sampling technique. This poses challenges in generalizing the results to the Saudi Arabian population. Furthermore, the current study did not compare diet diversity to before the COVID-19 quarantine. However, recent studies have assessed food intake and changes in dietary habits using a subjective perception of changing dietary habits or intake or household purchasing questions as a marker of changes in dietary intake.[5,7,8,31,33]

Conclusion

In conclusion, the majority of the participants in the cohort had more than one snack per day but skipped meals. Diet diversity was acceptable among Saudi adults during the COVID-19 lockdown period. Age, sex, having children, marital status, education level, and income were factors associated with diet diversity and eating habits (having breakfast, skipping meals, and number of snacks). Further cohort studies are needed to assess other factors that may influence dietary diversity. In addition, assessing eating habits and diet diversity in the post-COVID-19 era is essential for measuring the long-term influence of COVID-19 on eating habits and diet diversity in Saudi Arabia.

Acknowledgements

The authors extend their appreciation to all participants who contributed to our research project during the pandemic.

Funding

This research was funded by Princess Nourah bint Abdulrahman University Researchers Supporting Project number (PNURSP2023R207), Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia.

Conflict of Interests

The authors declare that they have no competing interests.

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