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Original article

Effect of quarantine on eating behaviors and weight change among King Saud University students in Riyadh

Nora O. Alafif [a,*], Ezz H. Abdelfattah [b], Rasil A. Al hadi [a], Seham B. Alanazi [a], Raghad I. Alkabaa [a], Fadwa A. Alsalem [a], Taeef M. Aljeldah [a], Kadia K. Aldriweesh [a], Aljohara A. Albati [a]

[a] Department of Community Health Sciences, College of Applied Medical Sciences, King Saud University, Riyadh 11433, Saudi Arabia
[b] Department of Statistics, Faculty of Sciences, King Abdulaziz University, Jeddah 21589, Saudi Arabia

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ABSTRACT

Background: To determine the effect of quarantine on eating habits and weight change, as well as the primary changes in weight and eating habits among King Saud University students.
Aim: This study aims to identify the effects of quarantine on eating behaviours and weight changes. Also, it determines the main changes in eating behaviours and weight among KSU students in Riyadh from March 23 to June 21, 2020.
Methods: This is a cross-sectional study of a random sample of KSU students. Saudi male and female (non-pregnant females) bachelor's degree students at KSU in the Riyadh region, who had not tested positive for COVID-19, satisfied the selection criteria. The total number of responses to the questionnaire was 1053; after the elimination of 320 responses that met the exclusion criteria, 733 students were included in the study.
Results: The current study results confirmed as 52.4% of students ate more of snacks. Among students' most consumed food items during the quarantine were starches, coffee, dairy, and poultry. Contrastingly, the least consumed food items were energy drinks, fish, and soft drinks. Further, 53.7% of the students gained weight, which was associated with anxiety, boredom, and consumption of red meat and eggs. However, weight loss among students was associated with concerns regarding weight gain, changes in food quantity, changes in appetite, and the consumption of vegetables.
Conclusion: Although lockdowns are an important safety measure to protect public health, the findings of this study show that quarantine affects eating and Emotional Eating (EE) behavior such as consuming more starch, dairy, and poultry among students at KSU. Furthermore, this study can help the Saudi authorities develop guidelines to direct Saudi food markets to increase advertising and promote healthy foods during situations like the COVID-19 pandemic.

1. Introduction

Coronavirus disease (COVID-19) is considered a major international health problem. It was declared a pandemic by the World Health Organization (WHO) on March 13, 2020 (Organization, 2020). By November 17, 2020, the WHO had reported 54,301,156 confirmed cases and 1,316,994 deaths worldwide (World Health Organization. (2020). The COVID-19 reached Saudi Arabia on March 2, 2020 (Ministry of Health. (2020); thereafter, the Saudi government implemented urgent measures to protect the safety and health of the citizens and residents living in the Kingdom, such as mandatory quarantine and border control. Although quarantine helped in controlling the number of reported cases, it also affected dietary behaviors (Mumena, 2020) and the psychological and mental health of the Saudi population (Al-Musharaf, 2020). Presently, Saudi Arabia has been documented with more than half million infected and recovered cases of COVID-19.

During quarantine, the consumption of unhealthy foods and snacking frequency increased (Ammar et al., 2020, Reyes-Olavarría et al., 2020), especially among those whose work status changed (Ingram et al., 2020). Females were more affected by

* Corresponding author.
E-mail address: nalafeef@ksu.edu.sa (N.O. Alafif).
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increased energy consumption (Gallo et al., 2020), unhealthy intake (Drywień et al., 2020), comfort food intake due to anxiety, and having a modified appetite (Di Renzo et al., 2020b). Also, EE scores and stress were positively correlated (Al-Musharaf, 2020). In the United States, it seems that quarantine made participants consume more sweets and salty foods (Bin Zarah et al., 2020). Moreover, obese people were found to be influenced by quarantine—as obese participants had the most significant change in their eating behaviors (Sidor and Rzymski, 2020). Those who were more frightened by COVID-19 had higher restraint to eating behaviors (Haddad et al., 2020). In a Lithuanian study, the majority of participants increased fruit and vegetable intake (Kriaucioniene et al., 2020).

Along with the changes in eating behaviors discussed above, body weight was also affected for many reasons, such as changes in dietary habits and physical activity levels during quarantine (Kriaucioniene et al., 2020). Weight gain was found to be related to decreased physical activity and increased consumption of red meat, carbonated drinks, pastries, and snacks. In contrast, weight loss was associated with increased physical activity and increased consumption of vegetables, fruits (Drywień et al., 2020), and fish (Reyes-Olavarría et al., 2020). In a Polish study, 34% of female participants gained weight and 18% lost weight (Drywień et al., 2020). Another study showed that 29.9% of participants reported weight gain, and 18.6% reported weight loss (Sidor and Rzymski, 2020). Some previous studies have shown that being female (Reyes-Olavarría et al., 2020) or older in age (Kriaucioniene et al., 2020), obese or overweight (Drywień et al., 2020), lower educational level, boredom, and anxiety (Pellegrini et al., 2020) were associated with weight gain and increased physical activity. However, remote work and/or study were associated with weight loss (Drywień et al., 2020).

Emotional Eating (EE) behavior is defined as the tendency to overeat as a coping mechanism for reducing and regulating negative emotions, such as anxiety, depression, and stress (Ganley, 1989). The increased feeling of negative emotions, social isolation, and loneliness generated by the pandemic might have played major roles in the lifestyle changes. Generally, emotional changes and mood disorders influence food choices with the search for comfort foods, such as processed snacks and sweets (Macht, 1999; Macht, 2008). Furthermore, the results from some studies showed that boredom/solitude, anxiety, and depression during the pandemic enhanced the eating and consumption of unhealthy foods, snacks, and sweets. Thus, it resulted in being the most relevant factor in predicting the increase in body weight after adjusting the consumption of unhealthy foods (Pellegrini et al., 2020). Also, it resulted in a gender difference regarding EE. EE is very common among young women during the pandemic (Al-Musharaf, 2020). More so, some studies showed that females appeared to be likelier to "stress-eat" and consume hyper-palatable "comfort" foods than males (Gallo et al., 2020). Therefore, this study aims to identify the effects of quarantine on eating behaviors and weight changes. Also, it determines the main changes in eating behaviors and weight among KSU students in Riyadh from March 23 to June 21, 2020 (28th of Rajab to 29th of Shawwal 1441H).

2. Materials and methods.

2.1. Study design and participants

This was a cross-sectional study that assessed the effect of quarantine on eating behaviors and weight change from March 23 to June 21, 2020. It was performed on a sample of bachelor's degree students at King Saud University in Riyadh, Saudi Arabia, using a self- administered online questionnaire. The questionnaire was created using Google forms and distributed through WhatsApp and other social media platforms, including Twitter and Telegram, in a snowball sampling fashion, and participants were asked to forward the questionnaire to their colleagues. A consent from the participants was obtained after reading the study's aim. The questionnaire contained four sections and took approximately 10 min to complete. The study was ethically approved prior to conducting it by the Institutional Review Board (IRB) of King Khalid University Hospital, Riyadh (IRB number: E-20–5386).

2.2. Inclusion and exclusion criteria

The inclusion criteria for participants were Saudi bachelor's students at KSU, ages 18–26, who were residing in Saudi Arabia during the studied period. The exclusion criteria were non-Saudi nationals, females who were pregnant, and students who were tested positive for COVID-19. Any participants who met the exclusion criteria were automatically excluded and, hence, unqualified to complete the questionnaire.

2.3. Sample size

The statistics of KSU showed that the number of bachelor students was 47,494. The acceptable margin of error was 5%, and the confidence level was 95%. Hence, the appropriate sample size was n = 382. The total number of responses to the questionnaire was 1053; after the elimination of 320 responses that met the exclusion criteria, 733 students were included in the study.

2.4. Data collection

Data were obtained using an online self-administered questionnaire-based survey derived from the three-factor eating questionnaire (Stunkard and Messick, 1985) that was generated in two languages. English and Arabic, and included 36 closed questions developed based on previous studies. The questionnaire comprised four sections. The first section included eight questions about the students' characteristics. The second section comprised six questions about the students' anthropometrics and weight change data. The third section comprised 18 questions about the students' eating behavioral data. Lastly, the fourth section comprised four questions about students' EE behavioral data.

2.5. Variables measured

General and Sociodemographic Information. These variables included age, nationality, gender, and a yes/no question for females on whether they were pregnant during the quarantine period. Other variables were affiliated with educational level, academic track, and year of study.

2.6. COVID-19-Related knowledge

This question collected information about infection by COVID-19 during the quarantine period from March 23 to June 21, 2020.

2.7. Eating behaviors and body weight information

Questions regarding the mandatory quarantine period included changes in weight (gain/loss/no change), changes in food quantity (no change/increased/decreased), following a certain diet (yes/no) and the purpose of following such a diet, changes in hunger and satiety, changes in the dietary meal routine, intake frequency of food groups, intake of food consumed to increase immunity, consumption of coffee, tea, soft drink, and amount of water intake. Some of these questions were taken from valid

questionnaires—COVIDiet Questionnaire and Mediterranean diet adherence screener (MEDAS). Additionally, participants were asked about their exercise patterns and sleeping hours.

2.8. Emotional eating behavior

EE behavior questions were asked to assess the urge to eat under the influence of negative emotions, including anxiety, boring, and depression. Questions were developed based on the Three-Factor Eating Questionnaire.

2.9. Statistical analyses

Data were analyzed using SPSS version 27, and descriptive statistics were performed to accurately interpret and present the results of the students' characteristics and responses to changes in weight and eating behaviors during the quarantine period. Chi-square test was used to investigate the association between weight changes and eating behaviors of the students. Also, Likart scale was used to interpret the attitude of the students' responses.

3. Results

3.1. Reliability measures

Using Cronbach's alpha test, the reliability statistics showed that the Cronbach's alpha for the two changes in food quantity and changes in appetite items was 0.664, the 11-consumption quantity of food groups items was 0.638, the 15-consumption frequency of food and drinks items was 0.658, and the four EE items was 0.662. Here, this means that the data obtained were reasonably complete, met intended purposes, and were not subject to inappropriate alteration.

3.2. Student characteristics

A total of 733 male and female students were studied. The students' sociodemographic characteristics (Table 1). Most of the students were in the medical track (32.7%) and Science track (29.5%). Moreover, most of the students were in the third or fourth year of study (40.8%). The students were predominantly females (78.7%), and males were about 21.3%.

3.3. wt change during quarantine

Of the 733 students, 587 (80%) reported weight changes during the quarantine period, and 146 (19.9%) reported no changes (p = 0.074). Among those students who reported weight changes, 315 (53.7%) gained weight, while 272 (46.3%) lost weight. Majority of the students who gained weight during quarantine gained over 1–3 kg (42.2%), followed by 29.2% who gained over 3–5 kg, (18.4%) who gained over 5 kg, and (10.2%) gained 1 kg or less. However, 38.6% of the students reported weight loss over 5 kg, 30.5% lost over 1–3 kg, 21.0% lost over 3–5 kg, and 9.9% lost 1 kg or less. The statistical analysis showed that the test used (Chi-square) for weight gain and loss was highly significant (p = < 0.001) (Table 2).

Table 1
Characteristics of Participants (n = 733).

Characteristic	Categories	Number of participants	n (%)
Age (years)	18–20	317	43.2%
	21–23	367	50.1%
	24–26	49	6.7%
Academic track	Science	216	29.5%
	Medical	240	32.7%
	Humanities	167	22.8%
	Administrative	110	15.0%
Year of study	year 1 or 2	238	32.5%
	year 3 or 4	299	40.8%
	year 5 or 6	196	26.7%
Gender	male	156	21.3%
	female	577	78.7%

3.4. Eating behaviors during quarantine

Adherence to different types of diets during quarantine. Most of the students who did not adhere to specific diets during the quarantine period comprised 78.4% of total students. Also, there were 9.1% of the students followed a weight reduction diet, and the percentages of students who followed either intermittent fasting or a ketogenic diet were 5.9% and 1.4%, respectively. Also, 5.3% of the students reported following other types of diets, including vegetarian diet, calorie counting diet, low carbohydrate diet, and high Kcal diet. However, the goals of following the previously mentioned types of diets varied. The majority of students who were following certain types of diets to lose weight comprised 45.6% of the total students.

Changes in food quantity and appetite

Mostof the students who increased the quantity of the consumed foods were 39% of the total students, whereas 35.3% of them decreased the quantity of the foods consumed, and 25.6% of the total students did not change their food quantity. When it comes to changes in appetite, 38.5% of the total students experienced increased appetite during the quarantine period, and 29.1% experienced less appetite during the quarantine period.

Changes in meals and cooking

Regarding dietary changes in meals during the quarantine period, the attitudes of most students indicated no changes in their breakfast (54.6%) or lunch (62.8%) meals, while 15.8% and 10.6% of students canceled their dinner and snacks, respectively. Besides, approximately half of the students (52.4%) reported snacking more during quarantine. Table 3 shows the changes in meals during the quarantine. Regarding the changes in cooking frequency during the quarantine period, the majority of the students (61.2%) reported that they cooked more, and 6.68% of the students did not cook.

Quantity of foods and drinks consumed

The following are the percentages of the students who changed their consumption of certain food groups. The attitude of the students' responses showed that the quantity of vegetables, fruits, dairy products, red meat, poultry, eggs, starch, sweets, fast, and salty food consumed is as usual, with percentages of 46%, 40.2%, 53.1%, 45.3%, 57.6%, 46.4%, 48.8%, 26.9%, 24%, and 33.8%, respectively. While 49.8% of the students did not eat fish, 34.5% and 67.5% did not drink either soft or energy drinks, respectively. About half of the students reported that they consumed more sweets (45%) and coffee (47.1%) during quarantine; however, 36.6% and 16.4% of students reported that they consumed fewer fish and fast foods, respectively (Table 4).

Frequency of foods and drinks consumed

It has been found that the attitude of students is that they consumed vegetables, fruits, dairy, red meat, eggs, sweets, fast foods, salty foods, and soft drinks 1–3 times a week, with percentages of 59.3%, 62.6%, 42.2%, 55.5%, 51%, 47.7%, 46.1%, 50.9%, and 34.1%,

Table 2
Weight change during quarantine.

	Respond	Number of participants	n (%)	p-value*
Did your weight change during quarantine?	yes	587	80.1%	
	no	146	19.9%	
Type of weight change	gain	315	53.7%	0.074
	loss	272	46.3%	
Weight gain	1 kg or less	32	10.2%	
	Over 1 kg to 3 kg	**133**	42.2%	
	Over 3 kg to 5 kg	92	29.2%	**<0.001**
	Over 5 kg	58	18.4%	
	Total	315		
Weight loss	1 kg or less	27	9.9%	
	Over 1 kg to 3 kg	83	30.5%	**<0.001**
	Over 3 kg to 5 kg	57	21.0%	
	Over 5 kg	**105**	38.6%	
	Total	272		

*The test is considered significant if the p-value < 0.05 and Highly significant if P-value < 0.001.

Table 3
Changes in meals during quarantine period.

Meal	no change		canceled		more		Mean	SD	Attitude
	Number of participants	n (%)	Number of participants	n (%)	Number of participants	n (%)			
Breakfast	400	54.6%	217	29.6%	116	15.8%	1.61	0.754	No change
Lunch	460	62.8%	199	27.1%	74	10.1%	1.47	0.672	No change
Dinner	421	57.4%	116	15.8%	196	26.7%	1.69	0.865	Canceled
Snacks	271	37.0%	78	10.6%	384	52.4%	2.15	0.933	Canceled

Table 4
Consumption quantity of food groups.

Food item	I don't eat it		less		as usual		more		Mean	SD	Attitude
	Number of participants	n (%)	Number of participants	n (%)	Number of participants	n (%)	Number of participants	n (%)			
Vegetables	171	23.3%	69	9.4%	338	46.1%	155	21.1%	2.65	1.057	As usual
Fruits	168	22.9%	96	13.1%	295	40.2%	174	23.7%	2.65	1.078	As usual
Dairy products	95	13.0%	82	11.2%	389	53.1%	167	22.8%	2.86	0.916	As usual
Redmeat	171	23.3%	99	13.5%	332	45.3%	131	17.9%	2.58	1.034	As usual
Fish	365	49.8%	120	16.4%	205	28.0%	43	5.9%	1.90	1.002	less
Poultry	68	9.3%	58	7.9%	422	57.6%	185	25.2%	2.99	0.839	As usual
Eggs	88	12.0%	91	12.4%	340	46.4%	214	29.2%	2.93	0.945	As usual
Starch	26	3.5%	91	12.4%	358	48.8%	258	35.2%	3.16	0.7171	As usual
Sweets	62	8.5%	144	19.6%	197	26.9%	330	45.0%	3.08	0.990	As usual
Fast foods	79	10.8%	268	36.6%	176	24.0%	210	28.6%	2.71	0.999	As usual
Salty foods	90	12.3%	160	21.8%	248	33.8%	235	32.1%	2.86	1.005	As usual

respectively. Also, 45.4%, 61.9% 42.7%, 44.2%, and 59.8% of students consumed dairy products, starch, tea, poultry, and coffee over 4 times a week, respectively. While fish (62.6%), soft (45.2%), and energy drinks (74.9%) were not consumed a week (Table 5).

3.5. Lifestyle habits during quarantine

According to the results regarding sleep, the majority of the students slept 5–7 h (38.5%), whereas 7.2% only slept 5 h or less. When it comes to immunity foods/spices, (44.9%) did not ingest any products to increase immunity, (7.9%) chose honey, (6.5%) preferred lemon/orange, and (1.1%) black seeds, (0.5%) consumed ginger or anise, and (1.9%) chose garlic to increase their immunity. Water consumption during quarantine fluctuated between students, as almost half (41.6%) consumed between 1 and 1.5 L per day, 22% drank 1.6–2 L, and 10.8% consumed more than 2 L. When it comes to eating with a company, most of the students ate with their families (65.2%). Physical activity is an important variable during quarantine, as the majority (39.3%) did not exercise at all. Whereas 38.2% exercised sometimes, 22.5% said that they always exercised. Regarding snacking, 47.1% said they sometimes snacked while studying, 23.9% stated they never did, and 29.1% always did. Over half of the students stated that they always used an electronic device while snacking (59.2%). Supplementation of multivitamins was most prevalent among students, as 65.8% regularly consumed them, and 8.1% consumed vitamin C.

3.6. Emotional eating during quarantine

The attitudes of the students during quarantine showed that 37.1%, 30.3%, 30.7%, and 36.2% of the students reported that they sometimes experienced concerns over weight gain, more eating induced by anxiety, depression, and boredom. However, 43.5%, 48.7%, and 45.3% of the students did not experience changes in eating induced by concerns about weight gain, anxiety, and depression, respectively. Moreover, 38.1% of the students reported that they always ate more whenever they felt bored, 30.3% and 30.7% of the students experienced more eating induced by anxiety and

Table 5
Consumption frequency of food groups.

Food item	None in a week		1–3 times a week		more than 4 times a week		Mean	SD	Attitude
	number of participants	n (%)	number of participants	n (%)	number of participants	n (%)			
Vegetables	108	14.7%	435	59.3%	190	25.9%	2.11	0.628	1–3 times a week
Fruits	149	20.3%	459	62.6%	125	17.1%	1.97	0.611	1–3 times a week
Dairy	91	12.4%	309	42.2%	333	45.4%	2.33	0.686	1–3 times a week
Red meat	204	27.8%	407	55.5%	122	16.6%	1.89	0.658	1–3 times a week
Fish	460	62.8%	243	33.2%	30	4.1%	1.41	0.570	None in a week
Poultry	75	10.2%	334	45.6%	324	44.2%	2.34	0.655	more than 4 times a week
Eggs	116	15.8%	374	51.0%	243	33.2%	2.17	0.679	1–3 times a week
Starch	34	4.6%	245	33.4%	454	61.9%	2.57	0.581	more than 4 times a week
Sweets	85	11.6%	350	47.7%	298	40.7%	2.29	0.661	1–3 times a week
Fast food	203	27.7%	338	46.1%	192	26.2%	1.98	0.734	1–3 times a week
Salty food	156	21.3%	373	50.9%	204	27.8%	2.07	0.698	1–3 times a week
Soft drinks	331	45.2%	250	34.1%	152	20.7%	1.76	0.775	1–3 times a week
Energy drinks	549	74.9%	114	15.6%	70	9.5%	1.35	0.647	None in a week
Tea	177	24.1%	243	33.2%	313	42.7%	2.19	0.797	more than 4 times a week
Coffee	113	15.4%	182	24.8%	438	59.8%	2.44	0.746	more than 4 times a week

depression, respectively, while 36.2% of them experienced more eating when bored (Table 6).

3.7. Gender correlation with weight change and eating behaviors

Using the SPSS program analysis, the Chi-square test was utilized to investigate the association between gender and weight change and eating behaviors, and the association of weight changes with eating behaviors and EE. (p-value, Phi = measures the strength of association). There is a highly significant correlation between gender and weight change, and gender has a weak and moderate positive correlation with weight gain and loss, respectively (<0.001, Phi = 0.292). Moreover, females experienced weight changes more than males during quarantine.

We found a weak positive correlation between gender and lunch consumption (.001, Phi = 0.141). Most students' lunch patterns remained the same as before quarantine. Nevertheless, females seemed to have a change in lunch more than males. Regarding the quantity of fruits consumed, there is a weak positive correlation between gender and fruit consumption (0.005, Phi = 0.133). Consumption of fruits remained the same as before quarantine for most students, especially females, but more students started consuming more fruits than fewer fruits.

Red meat, fish, poultry, sweets, soft drinks, energy drinks, tea quantity, and frequency of consumption have a weak positive correlation with gender—since most students, mainly females, consumed the same amount of red meat, fish, poultry, salty foods, energy drinks, and tea as before quarantine. Furthermore, females increased their consumption of sweets and soft drinks.

Starch consumption frequency has very weak positive correlation with gender (0.047, Phi = 0.091)—since most students, especially females, consumed starch more than four times/week. Water consumption had a moderate positive correlation with gender (<0.001, Phi = 0.301). females consume more water than males, and 249 females consume 1–1.5 L/day. Foods that increase immunity (such as honey, lemon, orange, ginger, etc.) have a weak positive correlation with gender (<0.001, Phi = 0.221). Even though most students did not consume these foods, females ingested them to enhance their immunity more than males. Gender also had a weak positive correlation with eating with company (0.002, Phi = 0.117). Majority of the students had their meals with their families during quarantine, and more than two-thirds of females ate with their families. In conclusion, females seem more associated with changes in weight and eating behaviors.

3.8. wt loss/gain and academic track

No significant association between weight change and academic track was found.

3.9. wt Gain/Loss and eating behaviors

Weight gain/loss and changes in meals, food quantity, and appetite. No significant association was found between changes in meals and weight. Also, there is no association between weight gain and food quantity. Moreover, there is a significant association between weight gain and loss and appetite change (0.011, Phi = 0.230), (0.055, Phi = 0.213) with weak correlation, respectively. Also, there is a significant association between weight loss and changes in food quantity (< 0.001, Phi = 0.328) with moderate correlation.

wt gain/loss and quantity of foods and drinks consumed

There is a significant association between weight gain and fruit, (0.027, Phi = 0.245), and eggs (0.002, Phi = 0.291) with weak correlation. And a significant association between weight gain and sweets, with a moderate correlation (0.000, Phi = 0.337). Furthermore, a significant association between weight loss and vegetables, (0.002, Phi = 0.312) eggs (0.000, Phi = 0.370), starch

Table 6
Emotional Eating.

Emotional eating	always Number of participants	n (%)	sometimes Number of participants	n (%)	never Number of participants	n (%)	Mean	SD	Attitude
Concerns of weight gain	142	19.4%	272	37.1%	319	43.5%	2.24	0.756	sometimes
More eating induced by anxiety	154	21.0%	222	30.3%	357	48.7%	2.28	0.788	sometimes
More eating induced by depression	176	24.0%	225	30.7%	332	45.3%	2.21	0.805	sometimes
More eating induced by boredom	279	38.1%	265	36.2%	189	25.8%	1.88	0.790	sometimes

(0.005, Phi = 0.294), sweets (0.000, Phi = 0.382), and salty foods (0.002, Phi = 0.312) with moderate correlations. Also, a significant association between weight loss and fruit (0.005 Phi = 0.295), dairy products (0.008, Phi = 0.286), poultry (0.005, Phi = 0.295) and fast food (0.013, Phi = 0.277) with weak correlations.

wt gain/loss and frequency of foods and drinks consumed

For the frequency of food and drink consumption, weight gain was positively correlated with the consumption of red meat (0.203, Phi $\leq$ 0.05) and eggs (0.222,Phi $\leq$ 0.05), both with a weak correlation. However, weight loss was positively correlated with consumption of sweets (0.294, Phi $\leq$ 0.05) and salty foods (0.275, Phi $\leq$ 0.05), both with a weak correlation.

3.10. wt gain/loss and lifestyle habits

Regarding lifestyle habits, weight loss was positively correlated with litters of water drank per day (0.003, Phi $\leq$ 0.05), sedentary eating (0.011, Phi $\leq$ 0.05), eating in company with family (0.001, Phi $\leq$ 0.05), physical activity (0.007, Phi $\leq$ 0.05), and the consumption of supplements, such as multivitamins and vitamin C (0.008, Phi $\leq$ 0.05) all with a weak correlation. Furthermore, a moderate positive correlation of litters of water drank per day, weak positive correlations of sleeping hours, and physical activity with weight loss among students with values of (0.001, Phi $\leq$ 0.05), (0.046, Phi $\leq$ 0.05), and (0.010, Phi $\leq$ 0.05), respectively.

3.11. wt gain/loss and emotional eating

Lastly, a weak positive correlation was found between weight gain and anxiety (0.116, Phi $\leq$ 0.05). Also, a weak positive correlation between weight gain and feeling concerned regarding weight gain (0.021, Phi $\leq$ 0.05). Moreover, the statistics showed a significant association between weight gain and boredom (0.021, Phi $\leq$ 0 0.05). Finally, there was a strong correlation between weight loss and concerns regarding weight gain (0.296, Phi $\leq$ 0.05).

4. Discussion.

To the best of our knowledge, this is among the few studies conducted to determine the effects of quarantine on eating behaviors among Saudi students. Expectedly, the findings showed that the majority of students experienced weight changes. This could be because the changes that occur in daily lifestyle habits and eating behaviors are associated with quarantine. About half of the students gained weight, as has been shown in most previous studies. Particularly, females gained more weight than males, as was reported Reyes-Olavarría et al., 2020 and Kriaucioniene et al. (2020), which is similar to our results. As most of the studies discussed weight changes during quarantine, few studies showed that a few participants lost weight. Interestingly, the results of this study showed that 46.3% of the students lost weight. Moreover, most of them (78.4%) did not follow any type of diet during quarantine, unlike the Spanish population, who were likelier to adhere to the Mediterranean diet eating pattern during quarantine (Rodríguez-Pérez et al., 2020). Additionally, increased quantity of consumed food found in this study supports the findings of Pellegrini et al. (2020), Sidor and Rzymski (2020), Kriaucioniene et al. (2020), and Zachary et al. (2020), and this could lead to weight gain as long as the quantity increased is associated with poor eating behaviors and low physical activity levels. Increase in appetite among students that have been reported in this study and in Di Renzo et al. (2020a) could be a leading factor to the increment in food quantity.

Several studies worldwide have demonstrated the effect of the COVID-19 lockdown on the population's eating behaviors. However, our findings showed that most students indicated no changes in their breakfast, lunch, or dinner and reported an increase in snacking during quarantine. Regarding the quantity of food consumed, students reported increased consumption of sweets (45%), starch (35%), salty foods (32%), fast food (32%), eggs (29%), poultry (25%), dairy products (22.8%), fruits (23.7%), and vegetables (21%). In contrast, a few students reported decreased consumption of fast food, salty, and sweet foods (36.6%), (21.8%), (19.6%), respectively. Additionally, almost half of the students reported that they did not eat fish (49.8%), vegetables (23.3%), or fruit (22.9%), and a few students reported that they did not eat starch (3%). Also, it was found that the majority of students indicated that they did not drink energy drinks (67%), and approximately half of the students (47%) tended to drink more coffee during the quarantine. Since quarantine has been responsible for eating behavior changes, our results support previous findings showing that quarantine due to the COVID-19 pandemic is associated with negative eating behaviors, such as increased snacking and consumption of fried and junk foods. However, some positive changes—such as decreased consumption of fast food, carbonated, and sugary drinks, and increased consumption of protein, fruits, and vegetable intake during quarantine—were also identified (Kriaucioniene et al., 2020, Pellegrini et al., 2020, Reyes-Olavarría et al., 2020).

In this study, 61% of the students reported that they cooked more during the quarantine. Similarly, the findings from other studies showed that the majority of sample studies tended to cook more during quarantine (Kriaucioniene et al., 2020, Sidor and Rzymski, 2020); the reason for the change in mealtime and number of meals per day during quarantine was "boredom" and "having more time to cook" (Mumena, 2020). Besides, women reported cooking more frequently than men during quarantine (Reyes-Olavarría et al., 2020). In contrast to this study's results, Rodríguez-Pérez et al. (2020) reported that the participants increased their consumption of vegetables and fruits during quarantine, and only 28.5% did not consume fish in a week, while 56.1% had one to three servings of fish a week. In contrast, our findings showed that 62.8% of the students reported that they did not consume fish during quarantine. Also, Rodríguez-Pérez et al. (2020) reported a stronger association between males and fruit consumption, opposing our results that showed females had a stronger correlation with fruit consumption.

In contrast to earlier findings, ours showed no statistical association between changes in snack consumption and either weight gain or loss. Moreover, previous studies have shown that weight gain is related to increased food quantity (Pellegrini et al., 2020, Sidor and Rzymski, 2020). However, this study did not support these findings, as it has been shown that food quantity is associated with weight loss. Interestingly, change in appetite was associated with weight change. Similar to previous studies, which showed that there was an association between the quantity of different food groups and drinks and weight changes during quarantine (Kriaucioniene et al., 2020; Pellegrini et al., 2020). The results of this study confirm this relation, as they show a significant association between fruits, vegetables, starch, eggs, sweets, dairy products, salty, and fast food with weight changes.

Our findings suggest that there is a statistically significant association between the consumption of sweets and weight loss. On the contrary, the results by Pellegrini et al. (2020) indicated that the consumption of sweets is associated with weight gain. In addition to sweets, salty foods are also associated with weight loss. Drywień et al. (2020) observed different results, as they concluded that women who gained weight during the quarantine had a tendency to increase the consumption of salty foods.

Over half of the students (65.2%) stated that they ate with their families. Similarly, to Zachary et al. (2020) study where (59%) of the participants said they often ate with family or friends during the quarantine. Around a quarter of the participants stated that they always exercised during quarantine (22.5%). Apart from this, Di Renzo et al.'s (Di Renzo et al., 2020b) participants had a higher frequency of training during quarantine compared to the previous period, unlike Pellegrini et al. (2020), Rodríguez-Pérez et al. (2020), and Kriaucioniene et al. (2020), where 47%, 59.6%, and 60.6% of their participants stated they reduced their level of physical activity and exercise, respectively. Around 59.2% of the participants said they ate while doing some sort of sedentary activity, such as watching TV or using their phones. Similar to, Ammar et al.'s (Ammar et al., 2020) study, daily sitting time increased from 5 to 8 h per day, which may have contributed to the increased food consumption.

One of the strengths of our study were we have involved the students and one of the limitations of our study was we have recruited only from single city in the kingdom. The main limitation of this study is the limited time, as three months was insufficient to guarantee the appropriate sample and accurate results, as the number of responses was limited due to the restricted time that was given to conduct the study. Likewise, due to time constraints, we received more female respondents than males. Moreover, students' weight during quarantine period was not taken, as it validates and strengthens the results of this study. This study also showed an association between EE and weight change. Similar to what has been found in the previous studies. Our findings showed that anxiety and boredom contributed to weight gain among students. Furthermore, regarding the feeling of concern about weight gain, 37.1% of participants reported that they sometimes eat in response to concerns of gaining weight. Also, concerns of weight gain were related to weight loss among a majority of students, with a strong association.

5. Conclusion

The findings of this study have several important implications for future practice. For example, developing intensive awareness programs to help people tackle future situations like quarantine, and how they can manage it has either positive or negative effects on health. Furthermore, this study might help the Saudi authorities to develop guidelines to direct Saudi food markets to increase advertising and promote healthy foods during situations similar to COVID-19 pandemic. Also, future studies should be conducted among the general Saudi population to reach more male participants.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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