



Dietary practices of adult Egyptians before and during the COVID-19 lockdown

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Abstract

Aim The aim of this study was to describe dietary practices of adult Egyptians, estimate changes in their body mass index (BMI), and identify possible determinants of such changes before and during the COVID-19 lockdown.

Subject and methods A cross-sectional web-based survey was conducted during the nationwide COVID-19 partial lockdown. Data were obtained from 430 Egyptian adults regarding their personal and socio-demographic characteristics, routine daily physical activities, dietary patterns, practices related to food purchase and food handling, and weight and BMI before and during the lockdown using an online web-based questionnaire.

Results The number of daily meals and daily snacks significantly increased during the lockdown. Moreover, the consumption of all types of snacks increased, except for chocolate and sweets, whose consumption decreased. Eating of fast food decreased, whereas the number of individuals practicing indoor physical activities increased during the lockdown. During the lockdown, no significant changes in the mean BMI were observed. The mean weekly consumption of starch, meat, milk, fat, and free foods decreased, whereas the mean weekly consumption of fruits and vegetables increased. Food handling practices improved during the lockdown. Based on the results of the linear regression analysis, age, the number of daily meals, practicing of physical activities during lockdown, and mean weekly consumption of meat were the independent predictors of BMI during the lockdown.

Conclusion During the lockdown, no significant changes in the BMI of adult Egyptians were observed, whereas dietary practices and food handling practices changed.

Keywords Body mass index · COVID-19 · Dietary habits · Egyptians

Introduction

A pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) has affected countries and territories around the world, leading to the development of the coronavirus disease 2019 (COVID-19) [1, 2]. Globally, more than 157 million confirmed cases of COVID-19, including more

than 3 million deaths, were reported to the World Health Organization (WHO). The Eastern Mediterranean Region ranked fourth with 9,428,010 confirmed cases. In Egypt, from January 3, 2020, to May 16, 2021, a total of 244,520 confirmed cases and 14,269 deaths were reported [3].

Because of the COVID-19 pandemic, many countries enforce strict confinement rules on their citizens to reduce the spread of the contagious disease, such as working from home, closing of schools and shops, and ceasing of any other non-essential activities [4]. Obligatory mass quarantine is useful in controlling the spread of infectious diseases, but it must be weighed carefully against the possible adverse health effects of the exposure to unpleasant experiences during the lockdown including loss of freedom, uncertainty over disease status, and boredom [5, 6].

A lot of restrictions were imposed in Egypt during the COVID-19 pandemic. All schools and universities, restaurants, and religious places like churches and mosques

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were closed. All touristic trips were cancelled. A restriction between 8 pm and 6am local time had been introduced. All airports were closed, and air travel and international flights have been postponed. The number of governmental employees had been reduced in all sectors. Supermarkets, bakeries, and pharmacies remained open. These restrictions have been changed continuously to reduce the risk of infection transmission during Ramadan, Easter, and Eid breaks. In addition, putting facial masks became mandatory in public places [7].

During the lockdown, dietary habits change because of the reduced availability of goods and limited access to food caused by restricted store opening hours. This leads to food stockpiling and unhealthy food choices [8]. People in such situations are forced to consume fewer fruits, vegetables, and fish, which are rich in antioxidants, and rely on highly processed ones, such as convenient foods, junk foods, and ready-to-eat cereals, which tend to be high in fats, sugar, and salt [9]. The pathophysiology of hypertension and atherosclerosis involves oxidative stress that results from low antioxidant intake [10]. Boredom sensation resulting from staying at home, online education and work, limited physical activity and outdoor recreation, and more time spent watching TV can lead to excessive energy intake [11] due to the increase in the snacking frequency, especially that of energy-dense snacks, fast foods, and soda beverages [12, 13].

People can also develop inappropriate eating behaviors during the COVID-19 quarantine, including emotional eating (psychological and emotional responses to the COVID-19 outbreak) [14–17], stress-related eating (coping with stress by eating and drinking to feel better) [18, 19], and food craving (consuming a high amount of comfort foods rich in sugar to cope with the stress associated with hearing news about the COVID-19 from media) [20, 21]. Such eating behaviors are characterized by the regular consumption of unhealthy foods. The lack of social support from friends and family was indicative of stress-driven eating during the quarantine [18, 19]. Exposure to stress due to the quarantine, which is translated into sleep disturbances, further worsens stress and increases food cravings among individuals [22]. Food craving is associated with an increased risk of obesity and cardiovascular diseases, beyond a chronic state of inflammation, which has been demonstrated to increase the risk for more severe complications of COVID-19 [23, 24]. By contrast, physiological stress can sometimes lead to the restriction of food intake and increase in satiety sensation [25].

During the quarantine, several countries have prohibited most outdoor and social activities (e.g., going to the gym and sports centers), resulting in a reduction of physical activity level and a sedentary lifestyle [8]. As a result of the current situation, physical activity and exercise levels have greatly decreased, whereas dietary habits remain unchanged

or have even worsened, leading to positive energy balance, increased risk of overweight and obesity, and increased oxidative stress [26–28].

The aim of the present study was to describe the dietary practices of adult Egyptians, estimate changes in their body mass index (BMI), and identify possible determinants of such changes before and during the COVID-19 lockdown.

Subjects and methods

A cross-sectional web-based survey was conducted during the nationwide COVID-19 partial lockdown. Data were obtained from May 24 to June 24, 2020. Adult Egyptians aged 18 years and above, both males and females, who were currently living in Egypt and could read and write in Arabic were included in the study.

The sample size was calculated using the Epi Info software. Based on the worldwide prevalence of consuming unhealthy food during the COVID-19 lockdown (23.3%) [29] and the 4% confidence limits, the minimum required sample size at 95% confidence level was calculated to be 429 and was rounded to 430 participants. Egyptian adults were invited to participate on different social media platforms, and their responses were consecutively recorded until the completion of the required sample size. The survey questionnaire was also distributed using different social media platforms (Facebook, WhatsApp, and Instagram) that are popular among the Egyptian population and was readily available on any device with an Internet connection. The responses were consecutively recorded until the fulfillment of the required sample size.

An online web-based questionnaire, which was designed using Google Forms, was used for data collection. The questionnaire consisted of five sections. The first section included personal and socio-demographic characteristics of the participants (age, gender, the governorate of current residence, marital status, the level of education, work status, and family income). It also included questions regarding their routine daily physical activities and/or exercises before and during the lockdown such as indoor (home workouts) and outdoor physical activity (walking, jogging, cycling, swimming, and gym workouts). The second section included 20 questions about the dietary habits of participants before and during the lockdown, such as the number of meals per day, main meal, snacks, fast food consumption, tea and coffee consumption, dieting and weight loss trials, and searching for nutritional advice.

Data about practices related to food purchase and food handling (e.g., grocery shopping, methods for cleaning and washing canned food, fresh vegetables and fruits, and disinfecting kitchen surfaces, utensils, and cutting

boards) before and during the lockdown were included in the third section of the questionnaire, which consisted of 10 questions. The fourth section included the weight and height of participants before and during the lockdown. The BMI was calculated using the appropriate formula ($\text{BMI} = \text{Weight (kg)}/\text{Height Squared (m}^2\text{)}$) and categorized as underweight ($< 18.5 \text{ kg/m}^2$), normal ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25\text{--}29.9 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$) [30]. Also, the body image perception of the participants was recorded in this section. The final section consisted of 26 questions about specific food items and was constructed guided by the Food Frequency Questionnaire (FFQ) [31]. Each participant was asked to indicate, on a 5-point scale, the average weekly consumption of each food item before and during the lockdown. The original validated FFQ was not used in the present study because specific food measuring units (cup, ounce, tablespoon, and teaspoon) are rarely used in the Egyptian culture. The internal consistency of this section was tested (Cronbach's $\alpha = 0.778$). A special scoring system was constructed to assess the frequency of consumption of each food item. The responses were scored as follows: each response with "never" was given a score of 0, "less than twice per week" was given a score of 1, "twice per week" was given a score of 2, "3–4 times per week" was given a score of 3, and "daily" was given a score of 4. Different food items were then classified into seven groups (starch, fruit, vegetable, milk, meat, fat, and free food) guided by the food exchange list [32]. After completing the survey, nutritional advice was provided to the participants based on the WHO recommendations during the COVID-19 pandemic [33].

Statistical analysis

The responses were downloaded on an Excel file and then exported into the Statistical Package for the Social Sciences version 21 software for analysis. Quantitative variables were described using means and standard deviations (SDs). A paired sample t-test was used to determine whether the mean difference between the paired observations (before and during lockdown) was significantly different from zero. For categorical variables, McNemar's test was used for 2×2 tables, whereas the McNemar–Bowker test was used for $R \times C$ tables to determine any differences before and during the lockdown. Pearson's correlation was used to test the relationship between the quantitative variables. The multiple linear regression model was used to identify the predictors of BMI during the COVID-19 lockdown. The 0.05 level was used as the cut-off value for statistical significance.

Results

The age of the participants ranged from 18 to 72 years with a mean of 33.1 ± 9.3 years. Nearly half (49.1%) of the participants were aged from 30 to < 40 years, and 32.1% were aged from 20 to < 30 years. More than two-thirds of the participants (68.4%) were females. The highest percentage of the participants (51.7%) were from the Alexandria Governorate, followed by the Cairo Governorate (14.4%); 57.9% and 38.1% were married and single, respectively; and 54.9% and 41.6% had university and postgraduate education, respectively. Approximately 69% were currently employed; 50.9% had sufficient family income and could save; and 43.7% had sufficient family income but could not save.

Table 1 indicates that during the lockdown, the percentage of adults who practiced indoor physical activities significantly increased by 12.6%, whereas the percentage of adults who practiced outdoor physical activities significantly decreased by 30% compared with the data before the lockdown. During the lockdown, a decrease in the percentage of all types of outdoor physical activities was observed. Moreover, these changes were considered statistically significant. The mean number of hours spent at home significantly increased from 14.23 ± 4.31 h before the lockdown to 20.16 ± 4.67 h during the lockdown.

Although no significant change was observed in the main meal of the participants during the lockdown compared to that before the lockdown (Table 2), a significant increase was observed in the mean number of daily meals and snacks during the lockdown compared to that before the lockdown. During the lockdown, the consumption of all types of snacks decreased, whereas the consumption of chocolate and sweets decreased. The increase was significant for the consumption of salad and cooked vegetables. The mean weekly consumption of fast food decreased from twice per week before the lockdown to more than one-and-a-half times per week during the lockdown, and this change was considered statistically significant, whereas the increase in the mean daily consumption of tea and coffee during the lockdown was insignificant.

Table 2 also indicates the increase in the proportion of participants who reported being on diet programs during the lockdown when compared with the data before the lockdown, but this increase was statistically insignificant. Weight loss and weight maintenance were the most common reasons for being on a diet program. An insignificant decrease in the percentage of participants who were on diet plans for weight loss and a statistically significant increase in the percentage of participants who were on diet plans for weight maintenance and general health were observed during the lockdown when compared with the data before

Table 1 Distribution of adult Egyptians according to their physical activity practices before and during the COVID-19 lockdown

Physical activity practices	Before LD No. (%)	During LD No. (%)	% change	Test of significance
Practicing PA				
Indoor	93 (21.6)	147 (34.2)	12.6	McNemar–Bowker test = 112.1 ($p < 0.001^*$)
Outdoor	182 (42.3)	53 (12.3)	−30.0	
Both	11 (2.6)	5 (1.2)	−6.0	
No	144 (33.5)	225 (52.3)	18.8	
Type of physical activity (top 5)^a				
Walking	140 (49.0)	66 (32.2)	−16.8	McNemar $p = 0.001^*$
Daily household chores	102 (23.9)	85 (41.5)	17.6	McNemar $p = 0.557$
Gym workout	68 (16.0)	17 (8.3)	−7.7	McNemar $p < 0.001^*$
Indoor workouts	61 (14.3)	82 (40.0)	25.7	McNemar $p = 0.001^*$
Running	33 (7.7)	11 (5.4)	−2.3	McNemar $p = 0.004^*$
Number of hours spent at home (mean \pm SD)	14.23 \pm 4.31	20.16 \pm 4.67		Paired t-test = −27.48 ($p < 0.001^*$)

SD, standard deviation

*Significant ($p < 0.05$)

^aResponses are not mutually exclusive

the lockdown. More than two-thirds of the participants reported searching for nutrition-related advice before and during the lockdown. Common sources of nutritional advice before the lockdown included nutritionists, physicians, family members or friends, and influencers. During the lockdown, the only significant change could be observed in the percentage of participants asking family members and friends for nutritional advice.

Table 3 demonstrates that the mean number of days of stockpiling food had significantly increased from 7.18 ± 5.75 days before the lockdown to 8.73 ± 6.93 days during the lockdown. An almost fourfold increase could be observed in the percentage of adults who reported cleaning or disinfecting canned food containers before using or storing and a 10.3% increase in the percentage of participants who reported cleaning or disinfecting kitchen utensils and surfaces before use during the lockdown when compared with the data before the lockdown. This increase was considered statistically significant. Moreover, almost all participants reported washing fruits and vegetables before and during the lockdown.

Table 4 indicates that the proportion of participants with overweight and obesity slightly increased during the lockdown compared with the data before the lockdown, whereas the mean BMI was almost the same before and during the lockdown. By contrast, the proportion of participants who believed that they were slightly or highly obese had increased, and the proportion of participants who believed that they were slightly slim or had a normal weight had decreased during the lockdown when compared

with the data before the lockdown, and these differences were statistically significant.

Figure 1 indicates that the mean weekly consumption of starch, meat, milk, fat, and free foods decreased, whereas the mean weekly consumption of fruits and vegetables increased during the lockdown. The decrease in the mean weekly consumption of starch, meat, milk, and fat and the increase in the mean weekly consumption of fruits were statistically insignificant ($p = 0.18, 0.09, 0.35, 0.83,$ and 0.24 , respectively), but the decrease in the mean weekly consumption of free foods and the increase in the mean weekly consumption of vegetables were statistically significant ($p = 0.001$ and 0.015 , respectively).

The correlations between the BMI during the lockdown and the number of hours spent at home, the number of daily snacks, the frequency of drinking tea and coffee per day, the number of days of stockpiling food, and the number of times of eating fast food during the lockdown were positive, weak, and statistically insignificant, whereas the correlation between the BMI during the lockdown and the participants' age and number of daily meals during the lockdown was positive, weak, and statistically significant ($r = 0.201$ ($p < 0.001$) and $r = 0.155$ ($p = 0.001$), respectively). A positive, weak, and insignificant correlation was detected between the BMI and the weekly consumption of starch, fruits, milk, fat, and free foods during the lockdown, whereas the correlation of BMI with the weekly consumption of vegetables during the lockdown was negative, weak, and insignificant. Furthermore, a positive, weak, and significant correlation was observed between the BMI and the

Table 2 Distribution of adult Egyptians according to their dietary habits before and during the COVID-19 lockdown

Dietary habits	Before LD No. (%)	During LD No. (%)	% change	Test of significance
Main meal				
Breakfast	56 (13.0)	57 (13.3)	0.3	McNemar–Bowker test = 0.28 (p = 0.96)
Lunch	329 (76.5)	331 (77.0)	0.5	
Dinner	45 (10.5)	42 (9.7)	−0.8	
Number of daily meals (mean ± SD)	2.74 ± 0.88	2.86 ± 0.91		Paired t-test = −2.04 (p = 0.017*)
Eating snacks				
Always	109 (25.3)	144 (33.5)	8.2	McNemar–Bowker test = 12.05 (p = 0.007*)
Sometimes	276 (64.2)	237 (55.1)	−9.1	
No	45 (10.5)	49 (11.4)	0.9	
Number of daily snacks (mean ± SD)	1.95 ± 0.85	2.19 ± 0.98		Paired t-test = 4.02 (p = 0.000*)
Type of snacks^a				
Fruits and fresh fruit juices	267 (70.4)	272 (72.3)	1.9	McNemar p = 0.720
Chocolate and sweets	180 (47.5)	171 (45.5)	−2.0	McNemar, p = 0.661
Homemade sandwiches	90 (23.7)	107 (28.5)	4.8	McNemar p = 0.082
Milk and yogurt	78 (20.6)	88 (23.4)	2.8	McNemar p = 0.222
Salad and cooked vegetables	73 (19.3)	135 (35.9)	16.6	McNemar p < 0.001*
Carbonated beverages	72 (19.0)	72 (19.1)	0.1	McNemar p = 0.795
Nuts	5 (1.3)	9 (2.4)	1.1	McNemar p = 0.727
Eating fast food				
Always	54 (12.6)	28 (6.5)	−6.5	McNemar–Bowker test = 99.5 (p < 0.001*)
Sometimes	298 (69.3)	196 (45.6)	−23.7	
No	78 (18.1)	206 (47.9)	29.8	
Weekly number of times of eating fast food (mean ± SD)	2.04 ± 1.83	1.76 ± 1.17		Paired t-test = 2.4 (p = 0.017*)
Drinking tea and coffee	372 (86.5)	359 (83.5)	−3.0	McNemar p = 0.019*
Number of times drinking tea and coffee daily (mean ± SD)	2.40 ± 1.05	2.45 ± 1.09		Paired t-test = −0.14 (p = 0.887)
On diet	152 (35.3)	163 (37.9)	2.6	McNemar p = 0.406
Reason for the diet program				
Weight loss	98 (64.6)	90 (55.2)	−9.4	McNemar p = 0.180
Weight maintenance and general health	40 (26.3)	53 (32.5)	6.2	McNemar p = 0.049*
Improve athletic performance	9 (5.9)	10 (6.1)	0.2	McNemar p = 1.000
Therapeutic	3 (2.0)	8 (4.9)	2.9	McNemar p = 1.000
Weight gain	2 (1.2)	2 (1.2)	0.0	
Searching for nutrition-related advice	304 (70.7)	305 (70.9)	0.2	McNemar p = 1.000
Source of nutritional advice^a				
Nutritionist	260 (60.0)	253 (58.8)	−1.2	McNemar p = 0.477
Physician	164 (38.2)	167 (38.8)	0.6	McNemar p = 0.801
Family or friends	76 (17.7)	57 (13.3)	−4.4	McNemar p = 0.001*
Influencers	46 (10.7)	51 (11.9)	1.2	McNemar p = 0.511
Chef	29 (6.8)	30 (7.0)	0.2	McNemar p = 1.000
Internet	4 (0.9)	2 (0.5)	−0.4	McNemar p = 0.625

SD, standard deviation

*Significant (p < 0.05)

^aResponses are not mutually exclusive

Table 3 Distribution of adult Egyptians according to their food handling practices before and during the COVID-19 lockdown

Food handling practices	Before LD No. (%)	During LD No. (%)	% change	Test of significance
Number of days of stockpiling food (mean ± SD)	7.18 ± 5.75	8.73 ± 6.93		Paired t-test = 6.56 (p < 0.001*)
Cleaning or disinfecting canned food containers before using and storing	161 (37.4)	369 (85.8)	48.4	McNemar p < 0.001*
Washing fruits and vegetables before eating	423 (98.4)	427 (99.3)	0.9	McNemar p = 0.125
Cleaning or disinfecting kitchen utensils and surfaces before use	348 (80.9)	392 (91.2)	10.3	McNemar p < 0.001*

SD, standard deviation

*Significant (p < 0.05)

Table 4 Distribution of adult Egyptians according to their BMI and body weight perception before and during the COVID-19 lockdown

BMI and body weight perception	Before LD No. (%)	During LD No. (%)	% change	Test of significance
BMI				
Underweight	4 (0.9)	5 (1.2)	0.3	McNemar–Bowker = 9.5 (p = 0.091)
Normal	123 (28.6)	112 (26.0)	-2.6	
Overweight	167 (38.8)	170 (39.5)	0.7	
Obese	136 (31.6)	143 (33.3)	1.7	
Mean ± SD	28.36 ± 6.70	28.57 ± 6.59		Paired t-test = -1.12 (p = 0.265)
Perception of body weight				
Highly slim	4 (0.9)	6 (1.4)	0.5	McNemar–Bowker = 40.79 (p < 0.001*)
Slightly slim	23 (5.3)	21 (4.9)	-0.4	
Optimum/normal	186 (43.3)	140 (32.6)	-10.7	
Slightly obese	167 (38.8)	179 (41.6)	2.8	
Highly obese	50 (11.6)	84 (19.5)	7.9	

SD, standard deviation

*Significant (p < 0.05)

Fig. 1 Distribution of adult Egyptians according to their mean weekly consumption of different food groups before and during the COVID-19 lockdown

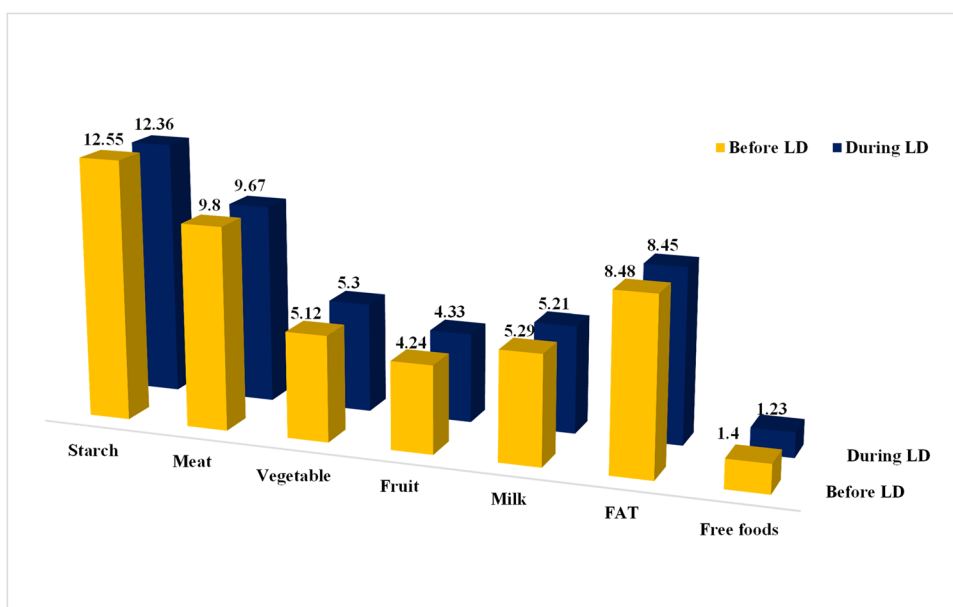


Table 5 Comparison of adult Egyptians' BMI and dietary trends before and during the COVID-19 lockdown classified by their personal and demographic characteristics

Variable	BMI		Starch		Meat		Vegetable		Fruit		Milk		Fat		Free foods		
	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	Mean (B-D)	p value	
Gender																	
Male (n = 136)	(28.8-28.9)	0.71	(12.9-12.3)	0.048*	(9.7-9.6)	0.47	(5.2-5.2)	1.00	(4.2-4.1)	0.79	(4.9-4.8)	0.67	(8.3-7.8)	0.09	(1.6-1.3)	0.002*	
Female (n = 294)	(28.1-28.4)	0.29	(12.4-12.3)	0.84	(9.8-9.7)	0.12	(5.1-5.3)	0.004*	(4.3-4.4)	0.08	(5.5-5.4)	0.39	(8.6-8.8)	0.23	(1.3-1.2)	0.04*	
Age (in years)																	
< 30 (n = 146)	(26.9-26.7)	0.50	(13.2-12.9)	0.25	(9.9-9.5)	0.08	(4.9-5.3)	0.01*	(4.2-4.4)	0.09	(4.5-4.4)	0.66	(8.8-8.3)	0.049*	(1.5-1.3)	0.002*	
30- (n = 259)	(29.9-29.4)	0.04*	(12.3-12.1)	0.45	(9.9-9.8)	0.38	(5.2-5.3)	0.28	(4.2-4.3)	0.72	(5.7-5.6)	0.50	(8.4-8.7)	0.09	(1.4-1.3)	0.17	
50+ (n = 25)	(30.2-30.4)	0.68	(11.7-11.6)	0.83	(8.8-8.9)	0.68	(5.5-5.5)	1.00	(4.6-4.4)	0.46	(6.1-5.9)	0.44	(7.8-7.4)	0.52	(1.1-0.8)	0.12	
Governorate																	
Alexandria (n = 222)	(28.9-29.3)	0.21	(12.1-12.2)	0.77	(10.1-9.9)	0.35	(5.2-5.3)	0.32	(4.3-4.2)	0.45	(5.4-5.4)	0.91	(8.3-8.4)	0.86	(1.3-1.2)	0.28	
Cairo (n = 62)	(26.8-27.1)	0.84	(12.3-11.8)	0.12	(9.7-9.5)	0.33	(5.3-5.6)	0.03*	(4.1-4.3)	0.17	(5.9-5.9)	0.73	(8.7-8.6)	0.94	(1.2-1.1)	0.12	
Others (n = 146)	(28.1-28.2)	0.93	(13.3-12.9)	0.07	(9.5-9.3)	0.26	(4.9-5.1)	0.08	(4.3-4.5)	0.049*	(4.9-4.7)	0.14	(8.6-8.5)	0.54	(1.6-1.3)	0.001*	
Marital status																	
Single (n = 164)	(26.5-26.3)	0.56	(13.1-12.8)	0.21	(9.5-9.2)	0.036*	(4.9-5.2)	0.043*	(3.9-4.1)	0.39	(4.1-4.3)	0.29	(8.3-7.9)	0.19	(1.4-1.2)	0.003*	
Ever married (n = 266)	(29.5-29.9)	0.038*	(12.2-12.1)	0.51	(9.9-9.9)	0.67	(5.2-5.4)	0.15	(4.4-4.5)	0.41	(5.9-5.9)	0.81	(8.6-8.7)	0.35	(1.4-1.3)	0.07	
Level of education																	
Secondary and below (n = 15)	(27.7-27.9)	0.76	(13.1-13.7)	0.22	(10.1-9.3)	0.23	(5.3-4.6)	0.15	(4.2-3.7)	0.31	(4.5-4.5)	1.00	(8.3-9.0)	0.25	(1.4-1.6)	0.19	
University (n = 236)	(28.7-28.9)	0.45	(12.8-12.7)	0.98	(9.6-9.6)	0.84	(4.9-5.2)	0.016*	(4.2-4.3)	0.20	(5.1-4.9)	0.14	(8.7-8.6)	0.65	(1.5-1.4)	0.09	
Postgraduate (n = 179)	(27.9-28.2)	0.42	(12.3-11.7)	0.019*	(10.0-9.8)	0.05	(5.3-5.4)	0.12	(4.3-4.4)	0.44	(5.5-5.6)	0.77	(8.3-8.3)	0.98	(1.3-1.1)	0.001*	
Work status																	
Employed (n = 297)	(28.3-28.5)	0.25	(12.2-12.0)	0.22	(9.9-9.8)	0.13	(5.2-5.4)	0.12	(4.3-4.2)	0.91	(5.4-5.3)	0.40	(8.4-8.3)	0.54	(1.4-1.1)	< 0.001*	
Unemployed (n = 133)	(28.5-28.7)	0.62	(13.3-13.1)	0.57	(9.4-9.3)	0.45	(4.9-5.2)	0.032*	(4.2-4.5)	0.009*	(5.2-5.1)	0.69	(8.8-8.9)	0.53	(1.5-1.5)	0.95	
Family income																	
Had sufficient family income and could save (n = 219)	(27.6-27.8)	0.24	(12.3-12.1)	0.35	(9.9-9.8)	0.54	(5.2-5.3)	0.15	(4.3-4.4)	0.15	(5.3-5.2)	0.56	(8.5-8.6)	0.70	(1.4-1.3)	0.13	
Had sufficient family income but could not save (n = 188)	(29.0-29.2)	0.68	(12.9-12.7)	0.59	(9.7-9.6)	0.37	(5.1-5.3)	0.06	(4.3-4.3)	1.00	(5.4-5.3)	0.48	(8.6-8.5)	0.72	(1.4-1.2)	0.013*	
Had insufficient family income (n = 23)	(30.3-30.6)	0.48	(13.0-12.2)	0.13	(9.3-8.3)	0.024*	(4.8-5.1)	0.51	(3.7-3.9)	0.44	(3.8-3.7)	0.91	(7.4-6.7)	0.23	(1.1-0.6)	0.039*	

*Significant (p < 0.05); BMI, body mass index; B, before lockdown; D, during the lockdown

weekly meat consumption during the lockdown ($r = 0.125$, $p = 0.009$).

Table 5 indicates that the mean BMI significantly decreased among the participants aged 30 to less than 50 years and significantly increased among ever married participants (who have been married at least once in their lives although their current marital status may not be “married”) during the lockdown when compared with the data before the lockdown. A significant decrease in the mean weekly consumption of starch during the lockdown compared to that before the lockdown was observed among males and participants with postgraduate education. A statistically significant reduction in the mean weekly consumption of meat during the lockdown compared to that before the lockdown was observed among single participants and those who reported having an insufficient family income. Moreover, a statistically significant increase in the mean weekly consumption of vegetables during the lockdown was observed among female participants, participants less than 30 years of age, participants living in Cairo, participants with a university education, and unemployed participants. A significant increase in the mean weekly consumption of fruits during the lockdown was also observed among participants who lived in governorates other than Alexandria and Cairo and among unemployed participants. During the lockdown, a significant reduction in the mean weekly fat consumption was observed among participants aged less than 30 years.

Table 5 also indicates a statistically significant reduction in the mean weekly consumption of free foods during the lockdown compared to that before the lockdown in each of the following participants: males, females, participants less than 30 years, participants living in governorates other than Alexandria and Cairo, single participants, participants with postgraduate education, employed participants, participants who reported having enough family income but could not save, and participants with insufficient family income.

The multiple linear regression model showed four predictors of the BMI during the lockdown (Table 6). Older age, the larger number of daily meals, and a higher mean weekly consumption of meat during the lockdown were associated with higher BMI, whereas practicing physical activities during the lockdown was associated with lower BMI. The

model also indicates that 17% of the variability in BMI during the lockdown could be attributed to these four factors ($r^2 = 0.17$, $p < 0.001$).

Discussion

It has been established that the lockdown could lead to inevitable boredom and stress, which can result in disturbed eating patterns and frequent snacking on high-calorie food [11, 34]. The combination of disturbed eating patterns and prolonged hours of confinement, which is one of the consequences of social isolation, is a major risk factor for all-cause and cardiovascular mortality and is associated with an increased risk of obesity, diabetes, hypertension, and cardiovascular diseases [35].

Since the quarantine was implemented, health organizations including the American College of Sports Medicine (ACSM) reported that physical activity strengthens the immune system and that every minute of activity counts [36]. The present results indicate an increase in the number of individuals exercising indoors of approximately 13%, despite the surge in the mean number of hours spent at home by approximately 6 h. Similarly, the number of physically active individuals in Spain who did exercise ≥ 6 times per week was elevated by approximately 7% during confinement [37]. On the contrary, based on an international survey conducted by 35 research organizations from Europe, North Africa, Western Asia, and the USA, home confinement had a negative effect on all levels of physical activity and a rise in sitting time during the day by more than 28% [29]. Moreover, in Kuwait, the sedentary behavior was worsened as the percentage of physical inactivity was doubled from 20 to 40% and more than 6-h screen time was surged from 16 to 42% [38]. The increase in the number of individuals exercising indoors in the present study could be attributed to the initiative of the Egyptian Ministry of Youth and Sports that provided live exercise sessions performed by personal trainers on social media platforms to encourage people to train at home. A study also found a high acceptance rate of 15% for technological solutions to support people’s physical and mental health [39].

Table 6 Linear regression analysis of the factors predicting the BMI of adult Egyptians during the COVID-19 lockdown

Independent variables	B	Standard error	p value
Age	0.189	0.054	0.001*
Number of daily meals during the lockdown	0.844	0.422	0.047*
Practicing physical activities during the lockdown (yes)	-2.106	0.810	0.010*
Mean weekly consumption of meat during the lockdown	0.324	0.158	0.041*
Constant	14.636	3.466	<0.001*
	$r^2 = 0.17$	$F = 4.743$	$p < 0.001^*$

*Significant ($p < 0.05$)

By contrast, the number of individuals practicing outdoor physical activities decreased by 30% due to lockdown restrictions imposed by the Egyptian government, which included the closure of fitness facilities and clubs and the lack of street workout spots. However, more than half of the present sample did not practice any type of exercise during the quarantine. A similar finding was reported by an international online survey [29]. The variation in the physical activity levels during the COVID-19 pandemic could be linked to different strategies of preventing the spread of infection, which were applied not only in each country but also in each governorate in the same country.

The present study also found a significant increase in the number of daily meals and snacks, which is consistent with the results of other studies from Europe, South America, Asia, and Africa [29, 40]. A study among Polish adults reported that approximately 44% and 50% of the surveyed participants had a higher frequency of eating and snacking during the quarantine than before, respectively [41]. This can be attributed to the longer obligatory home-stay so that the residents had more time to cook, which might be a good way to reduce the consumption of junk food. This was observed in the current survey and the latter study in Poland [41].

Unexpectedly, the prevalence of overweight and obesity and the mean BMI in the present study did not change during the lockdown. On the contrary, in a study conducted in Poland, approximately 30% and 19% of the participants reported a gain and loss of weight during the quarantine, respectively. A significant weight gain was observed particularly among subjects with overweight and obesity [41]. Furthermore, an Italian study reported a significant weight gain during the lockdown among the obese patients attending the Obesity Unit of the Hospital of Torino [42], while 47% of the Spanish population did not gain weight and 37% gained between 1 and 3 kg during confinement [37]. The unchangeable BMI during the lockdown in the present study could be traced back to the increase in indoor physical activity engagement, increase in the consumption of salad and cooked vegetables and fewer desserts and fast foods; the reduced mean weekly consumption of starch, meat, milk, fat, and free foods; and the increased mean weekly consumption of fruits and vegetables reported by the participants.

The current study revealed that the consumption of take-away foods decreased while the consumption of fruits and vegetables increased during the lockdown which was consistent with the results of a study done on more than two thousand adults from four regions (Island of Ireland, Great Britain, USA, and New Zealand) [43]. Many studies found that the consumption of chocolate and sweets was increased during the lockdown which was in contrast with our study [40, 44]. These findings were not surprising because a statistically significant increase was observed in the percentage

of participants who were on diet for weight maintenance and general health during the lockdown.

The correlation between BMI and daily snacking was positive, weak, and insignificant, whereas the correlation between BMI and the number of daily meals was weak, positive, and statistically significant, which was consistent with the findings of a study in Poland [41]. Moreover, during the lockdown, the present study found that the correlations between the weekly consumption of different food groups and BMI were insignificant. Only a positive and significant but weak correlation was observed between BMI and weekly meat consumption. Sidor et al. found a significant association between BMI and the frequency of consumption of selected food products during the quarantine, such as vegetables, fruits, legumes, fast food, meat, dairy products, and coffee [41].

Generally, the dietary pattern may or may not be affected by social or demographic factors. The current survey revealed that during the lockdown, the weekly consumption of the different food groups has changed according to gender, place of residence, work status, and level of education compared to that before the lockdown. A Polish survey reported a change in meat and instant products only according to gender [41].

Panic shopping was a huge problem in the first few months of confinement because people were afraid of long periods of quarantine. Consequently, they started to stockpile durable foods in a short span of time. In the current survey, the mean number of days of stockpiling food had significantly increased, which was consistent with the results of the studies conducted by Jambor et al. [45] and Murphy et al. [43].

The present study observed a rise in the adoption of some practices during the quarantine than before, such as cleaning or disinfecting canned food containers before using or storing and cleaning or disinfecting kitchen utensils and surfaces before use. These practices were recommended by the Directorate-General for Health and Food Safety, European Commission, to minimize the risk of foodborne transmission of the virus responsible for COVID-19 [46].

Strengths and limitations of the study

One of the article strengths was the limited numbers of articles that describe the dietary practices of adult Egyptians before and during the COVID-19 lockdown. Written nutritional advice was given to the participants after completing the questionnaire to help them to make better healthy food choice during this pandemic. The online questionnaire allowed for rapid and cost-efficient collection of self-reported information about dietary pattern. Online questionnaire was an effective method to collect information without

risk of COVID-19 infection transmission that may occur in face-to-face interview.

Some limitations were noted in this article, since an online survey was used, this study is not expected to represent the total population of adult Egyptians. The sample did not include illiterates and adults who do not own a smartphone or a PC and those who are not familiar with social media platforms. Small sample size and highly educated participants make the sample not completely representative for Egyptian population. The data show the modifications of a relatively short lockdown time, and different outcomes may have been obtained over longer durations.

Conclusion and recommendation

No significant changes in the BMI of adult Egyptians during the lockdown were observed, while the dietary practices and physical activity changed. The number of daily meals and snacks increased, whereas the consumption of chocolate, sweets, and fast foods decreased. The weekly consumption of starch, meat, milk, fat, and free foods decreased, whereas the weekly consumption of fruits and vegetables increased. The number of individuals practicing indoor physical activities has increased during the lockdown. The predictors of BMI during the lockdown included age, the number of daily meals, mean weekly consumption of meat, and physical activities.

Overall, the COVID-19 pandemic has created global inevitable distress. Despite the huge detrimental burden of the infection itself, the preventive measures, which were applied temporarily to decrease virus transmission, such as social distancing and lockdown at home, could also have long-lasting major negative effects on people's health, such as depression, anxiety, nervousness, and insomnia, which consequently lead to stress-driven eating behaviors and lack of exercise. During these hard times, maintaining the normal function of the immune system is important to combat the COVID-19 pandemic in case of infection. Therefore, adequate hydration, eating a balanced diet in an amount that meets the daily energy requirement, proper sleep duration and quality, regular physical activity, and positive thinking are the best ways of improving the physical and mental well-being of individuals.

Abbreviations BMI: Body mass index; SARS-CoV2: Severe acute respiratory syndrome coronavirus 2; COVID-19: Coronavirus disease 2019; WHO: World Health Organization; FFQ: Food Frequency Questionnaire; EMRO: Eastern Mediterranean Region; ACSM: American College of Sports Medicine

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Author contribution SAA and MOA conceived the idea on the basis of the article. SAA supervised the implementation of the study. MOA designed the web survey and was responsible for the data collection. NAE was responsible for the study design, analysis of data, and critical revision of the manuscript for important intellectual content. All of the authors developed the different parts of the manuscript and revised and approved the final draft.

Data availability Available upon request.

Code availability Available upon request.

Declarations

Ethics approval Approval of the Ethics Committee of the Faculty of Medicine, Alexandria University, was obtained (reference number: 0304825), and the study was conducted in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to participate The purpose of the research was stated at the beginning of the questionnaire, and the participants were able to accept or reject to participate. They were also able to withdraw from the survey any time before its completion. The participants were also assured that all data would be used only for research purposes. Their answers were anonymous and confidential, and they were not permitted to provide their names or contact information. It was declared that participation in this study was completely voluntary. Responses were saved only by clicking on the provided "submit" button, and each participant was able to submit his/her response only once.

Consent for publication By submitting the form, the participants were indicating that they have read the description of the study, were over the age of 18, agreed to the terms as described, and consented to participate in this study and for information to be published.

Conflict of interest The authors declare no competing interests.

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