BMC Nutrition

RESEARCH

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Dietary habits and weight change during the second wave of the COVID-19 pandemic among the Egyptian population

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Abstract

Background The pandemic of coronavirus disease–19 (COVID-19) has a profound influence on the health of the population. This study aimed to assess the weight changes and its relation to the dietary habits and physical activity among adult Egyptian population during the second wave of COVID-19 pandemic.

Materials and methods This cross–sectional study was conducted using anonymous online questionnaire. The questionnaire was distributed across Egypt via community–based networks, social and institutional emailing lists, and professional organizations to collect data on sociodemographic, clinical history, dietary and lifestyle habits, physical activity, anthropometric measurements, and stressing factors.

Results The study participants ($n=1000$) had a median (interquartile range) age of 34.0 (23.0–40.0) years, with 18.7% males, 96.6% having university or postgraduate education. Among them, 69.1% reported weight gain, 21.3% no change, and 9.6% weight loss. Weight loss was predicted by following COVID-19 pandemic reports daily [adjusted odds ratio (AOR) = 0.50 (95% CI, 0.27–0.93), $p=0.03$], monthly income change [AOR = 2.52 (95% CI, 1.51–4.22), $p<0.001$], starting antidepressants [AOR = 3.57 (95% CI, 1.08–11.76), $p=0.03$], and increase in social media use [AOR = 1.81 (95% CI, 1.05–3.13), $p=0.03$]. Weight gain was predicted by starting a diet during the second wave of COVID-19 pandemic [AOR = 1.57 (95% CI, 1.11–2.21), $p=0.01$], physical activity during the second wave of COVID-19 pandemic [AOR = 0.49 (95% CI, 0.35–0.69), $p<0.001$], and unhealthy food intake [AOR = 0.40 (95% CI, 0.28–0.57), $p<0.001$]

Conclusions More intervention programs aiming to improve dietary habits and increase physical activity should be rapidly implemented to reduce the consequences of the pandemic on the Egyptians to keep healthy weight.

Keywords Dietary habits, Egyptians, COVID-19 pandemic, Weight changes, Stressors

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Introduction

Coronavirus disease 2019 (COVID-19) has been a threat to worldwide public health since early 2019 with different patterns of morbidity and mortality across countries [1, 2]. On January 6, 2023, around 658.0 million cases were reported worldwide with 6.7 million deaths. Egypt has reported 515.5 COVID-19 cases and 24.8 deaths [3]. Besides vaccination, Egypt adopted different public health and social measures (PHSMs) to contain COVID-19 pandemic [4], including border closure, movement restriction, quarantine, and physical (social) distance [5]. These measures significantly impact health and wellbeing, despite their apparent benefits for safety and health. PHSMs can profoundly change the lifestyle behaviors including diet, physical activity, smoking, mealtimes, sleep patterns, and quality of life [6, 7]. Poor access to nutritious food and exercise facilities during the COVID-19 pandemic, especially during home confinement has been significant [8], potentially leading to detrimental behaviors like increased media watching and calorie consumption [9].

Moreover, people have reported greater worry and despair, along with increased stress eating behaviors, since the pandemic began. Unhealthy habits such as binge eating and more frequent nighttime eating episodes have contributed to weight gain [10]. Reduced physical activity and poorer dietary choices during lockdowns have also negatively affected weight management [11]. Various individual, sociodemographic, and environmental factors may influence positive or negative habits during confinement, with the pandemic serving as a natural experiment to assess the effects on diet and lifestyle behaviors and their impact on health outcomes such as weight gain or loss and self–perceived health [11, 12].

Several studies worldwide reported weight gain during the COVID-19 pandemic [13–15]. In Egypt, previous studies showed contradictory effects of the COVID-19 pandemic on the body weight among the different age population groups. There were either no changes [14] or increase in the body weight [16]. However, none of these studies were done during the second wave of COVID-19 pandemic. Hence, this study aimed to assess the weight changes and its relation to the dietary habits and physical activity among adult Egyptian population during the second wave of COVID-19 pandemic.

Patients and methods

Sample size

There were no published studies that assessed the weight changes among Egyptians during COVID-19 pandemic when we conducted the current study. Therefore, we assumed that 50.0% of the participants had weight changes during the second wave of COVID-19 pandemic. The sample size was calculated according to the following formula: $n = Z^2_{1-\alpha/2} * P(1-P)/e^2$.

Where n = the minimum number of respondents required; $Z^2 = (1.96)^2$ relative to the 95% confidence interval (CI); P = the prevalence rate estimated in the previous study; e = the required precision (5%), design effect of 2, and non–response rate of 25%. Accordingly, the minimum sample size n for this study was 960 participants. A total of 1112 participants completed the survey. We excluded 112 participants due to incomplete sheets or being <18 years old. The final sample included 1000 adults' population aged 18 years or above who had access to internet and used smartphones or computers.

Sampling technique

The final questionnaire was distributed online across Egypt using a tailored message that included the consent letter and study details via community–based networks, social (Twitter, Facebook, and Instagram), institutional mailing lists, and professional organizations. The survey was shared from November 1, 2020, till January 31, 2021.

Data collection tools

Questionnaire development and validation

A thorough assessment of the literature was undertaken to find studies on pandemic–related weight change, which aided in the development of a draft of the study questionnaire using questions from existing scales and studies (i.e., to establish face validity). A panel of experts ($n=4$) then examined the questionnaire for face and content validity. The expert panel offered improvements that were implemented following authors discussion, which aided in establishing content validity.

The final questionnaire (supplementary file 1) composed of four sections. The first section focused on collecting sociodemographic data such as age, gender, educational level, place of residence, current studying/employment status, the effect of COVID-19 pandemic on monthly income, marital status, and having children. It also included data on clinical history of chronic diseases, anthropometric measurements, and lifestyle habits such as smoking history, alcohol consumption and sleep pattern.

The second section consisted of 10 items on dietary habits (follow/ tried to follow diet during the second wave of COVID-19 pandemic, consumption of home–cooked or delivery food, acquirement of healthy or unhealthy food habits, pattern of meals intake, increase or decrease consumption of food during the second wave of COVID-19 pandemic, types of food consumed, frequency of supermarket visit, history of stress eating before and during the COVID-19 pandemic, and daily intake of breakfast and dinner).

The third section covered two items assessing the physical activity (exercising before and during COVID-19 pandemic and duration of exercise). Finally, the fourth section constituted of 5 items to determine the stress factors (intake of antidepressants/anxiolytics, following the news and social media, fear of COVID-19 infection, following COVID-19 infection report, and fear of leaving home).

Statistical analysis

Quantitative data was summarized using mean and standard deviation (SD) or median and interquartile range (IQR) according to data distribution, while qualitative data was presented as percent frequency. Cross tabulation of categorical data by weight change (no change versus increases versus decrease) with testing the association by Chi square test ($\chi 2$ test). Comparison of continuous variables was done using t–test or Mann– Whitney, when appropriate. Multinomial logistic regression analyse was conducted to investigate the association between weight change (dependent) and continuous or categorical ones (independent). All variables with $p<0.15$ in the bivariate analysis were included in the model. Interaction between all the independent predictors was investigated by calculating the product of each predictor with each other and by introducing this multiplication term into the multiple logistic regression model already including the two factors of the product as separate variables [17]. The final model was built including the following variables: age, marital status, having children, following/trying to follow diet during COVID-19 pandemic, sports practice during COVID-19 pandemic, following reports of COVID-19 cases daily, monthly income affected by the COVID-19 situation, resorting to eating during stress, increase in supermarket visit during the second wave of COVID-19 pandemic, antidepressant intake during the second wave of COVID-19 pandemic, social media use during the second wave of COVID-19 pandemic, and acquiring unhealthy food habits during the second wave of COVID-19 pandemic. The adjusted odds ratio (AOR) and 95% confidence interval (CI) were reported for all variables.

Ethical approval

The study protocol was approved from the Ethics Committee of Faculty of Medicine, Alexandria University (IRB number: 00007555) in accordance with the International Ethical Guidelines for Epidemiological studies [18]. The informed consent was obtained from all participants.

Results

Baseline characteristics

Table 1 shows that the median (IQR) age of the study participants was 34.0 (23.0–40.0) years, 18.7% were males, 96.3% received university or postgraduate education, 96.5% lived in urban areas, 58.3% were ever–married, 56.2% had children, 61.1% were full time workers, 56.3% were working from home. Additionally, 2.9% had diabetes mellitus, and 7.1% were hypertensive. The mean ± SD of the weight was 75.1 ± 18.2 kg and the mean ± SD of the height was 165.0 ± 24.1 cm.

Dietary habits

Among the study population, 44.7% followed/ tried to follow diet, 46.9% acquired healthy food habits, while 44.0% acquired unhealthy food habits. Additionally, 46.3% reported an increase in the supermarket visit during the second wave of the COVID-19 pandemic and 46.8% reported that their rate of unhealthy snacking increased. As regards daily intake of food meals, 69.8% were taking their breakfast, 49.1% were taking the dinner (Table 1).

Lifestyle habits, stress factors, and physical activity

Table 1 shows that only 10.3% were current smokers and 5.4% were alcohol consumers. Almost two–thirds (65.6%) of the study participants had sleep disturbances. Most individuals (76.7%) reported an increase in social media use during the second wave of COVID-19 pandemic, 82.7% followed daily reports of COVID-19 and feared being infected with COVID-19. Only 5.8% started taking antidepressants during the second wave of COVID-19 pandemic, 50.9% resorted to eating during stress, and 44.0% reported that their monthly income was affected during the second wave of COVID-19 pandemic. More than half of the responders (55.7%) were practicing sports before the COVID-19 pandemic. This percentage decreased to 30.1% during the second wave of COVID-19 pandemic.

Figure 1 demonstrates that among practitioners, 17.4% of those who practiced sport before the second wave of the COVID-19 pandemic and 11.2% who practiced during the second wave of COVID-19 spent 2–4 h/week in sports practice. In addition, only 1.5% of the second wave of COVID-19 pandemic practitioners and 0.4% were practicing sports for more than 8 h/week.

Among the study population, 69.1% reported a weight increase, 21.3% reported no change, and 9.6% reported a weight decrease (Fig. 2).

Almost one–half (47.5%) of individuals reported that their weight changes took 1–3 months, while 8.1% mentioned that it took more than one year for their weight to be changed (Supplementary Fig. 1). Among those who reported weight changes during the second wave of the COVID-19 pandemic, 39.3% had a change in their weight by 3–4 kg, 21.2% demonstrated a weight change by 5–6 kg, while 8.1% reported a weight change of more than 8 kg (Supplementary Fig. 2).

Table 1 Baseline criteria of the Egyptian study population during the second wave of COVID-19 pandemic

Baseline characteristics	Total sample (*N* = 1000)
Age (years) Median (IQR)	34.0 (23.0–40.0)
Gender, **n (%)**	
Male	187 (18.7)
Female	813 (81.3)
Education level, **n (%)**	
Below university	37 (3.7)
University/postgraduate studies	963 (96.3)
Residence, **n (%)**	
Urban	965 (96.5)
Rural	35 (3.5)
Working/ studying, **n (%)**	
Student	249 (24.9)
Housewife/non-employed	140 (14.0)
Full-time workers	611(61.1)
Working status during the second wave of COVID-19 pandemic, **n (%)**	
Not working	239 (23.9)
Working from home	563 (56.3)
Working outside home	198 (19.8)
Marital status, **n (%)**	
Not married	417(41.7)
Ever– married	583(58.3)
Having children, **n (%)**	562(56.2)
History of chronic diseases, **n (%)**	
Diabetes mellitus	29(2.9)
Hypertension	71(7.1)
Renal diseases	4(0.4)
Liver disease	1(0.1)
Autoimmune disease	34(3.4)
Neurological disease	33(3.3)
Other diseases	125(12.5)
Height in cm mean ± SD	165.0 ± 24.1
Weight in kg mean ± SD	75.1 ± 18.2
Dietary habits	
Diet follow/ try to follow	447(44.7)
Acquire healthy food habits	469(46.9)
Acquire unhealthy food habits	440(44.0)
Increase in the frequency of supermarket visit	463 (46.3)
Breakfast intake on daily basis	698 (69.8)
Dinner intake on daily basis	491(49.1)
Increase in the rate of unhealthy snacking	468(46.8)
Lifestyle habits	
Smoking status, **n (%)**	
Non/ Ex-smoker	897(89.7)
Current smoker	103(10.3)
Disturbed sleep pattern, **n (%)**	656(65.6)
Alcohol consumption, **n (%)**	54(5.4)
Stress factors	
Social media use, **n (%)**	
Increase	767(76.7)
Decrease	24(2.4)

Table 1 (continued)

Baseline characteristics	Total sample (*N* = 1000)
No change	209(20.9)
Fear of getting COVID-19 infection, n (%)	827(82.7)
Daily follow of COVID-19 reports, n (%)	827(82.7)
Start intake of antidepressant, n (%)	58(5.8)
Eat during stress, n (%)	509(50.9)
Monthly income affected, n (%)	440(44.0)
Physical activity	
Physical activity practice before COVID-19 pandemic, n (%)	557(55.7)
Physical activity practice during the COVID-19 pandemic n (%)	301(30.1)

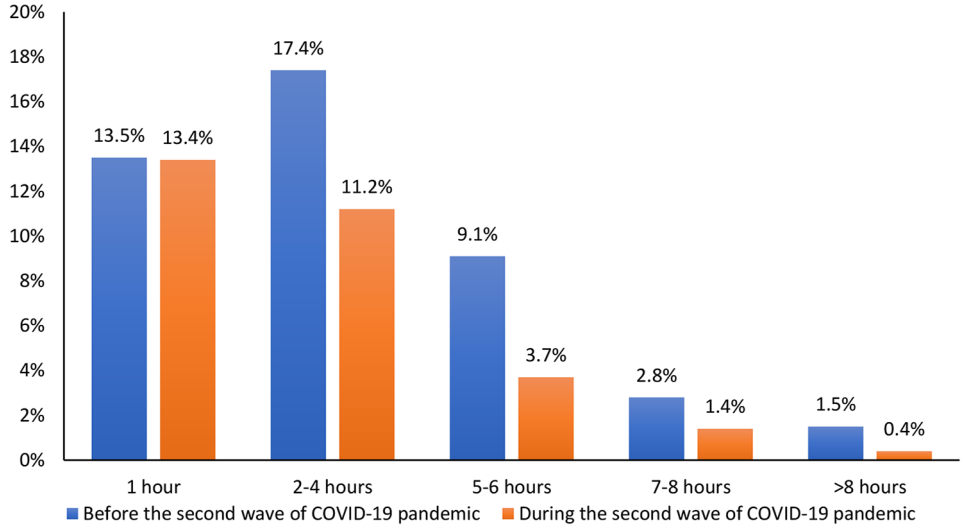

Fig. 1 Number of hours spent practicing physical activity among the Egyptian population before and during the second wave of the COVID-19 pandemic Weight changes

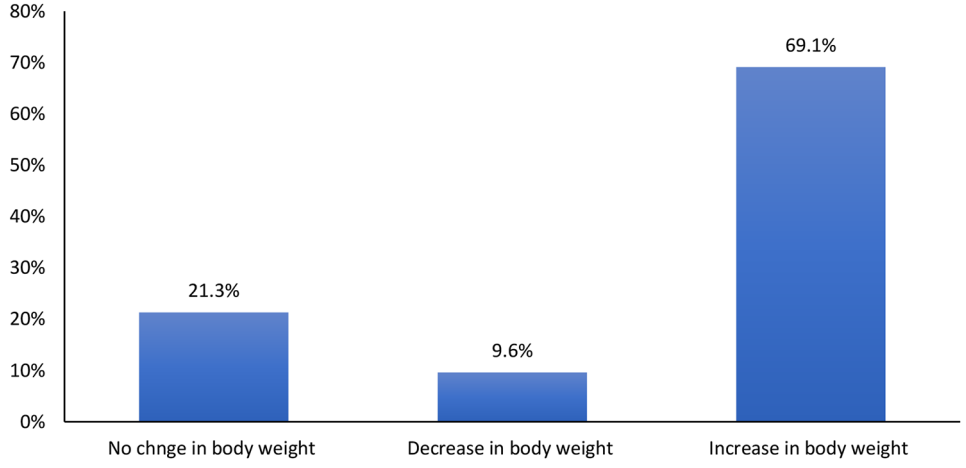

Fig. 2 Weight changes among the Egyptian population during the second wave of COVID-19 pandemic

Meal consumption and food type

More than two–thirds reported taking two or three meals daily (36.3% and 39.6%, respectively) (Supplementary Fig. 3). Most individuals (70.4%) reported an increase in home–cooked food, while only 7.4% mentioned that their consumption of delivery food increased during the second wave of the COVID-19 pandemic (Supplementary Fig. 4).

The percentages of the study population who consumed carbohydrates (47.0%) or sweets (46.2%) were the

highest followed by nuts (37.4%). Only 12.6% consumed salty food during the second wave of the COVID-19 pandemic (Supplementary Fig. 5).

Association between different factors and weight changes during the second wave of the COVID-19 pandemic

Table 2 shows that there was significant difference between the study group in age ($p=0.006$), marital status ($p=0.002$), having children ($p=0.03$), followed/tried to follow diet ($p=0.006$), acquired healthy food habits ($p=0.001$), acquired unhealthy food habits ($p<0.001$), increased supermarket visit frequency ($p=0.007$), increased dinner intake on daily basis ($p=0.03$), and increase in the rate of unhealthy diet intake ($p<0.001$). Additionally, there were a significant associations between weight change groups and social media use ($p=0.001$), following reports on COVID-19 daily cases ($p=0.009$), intake of antidepressants ($p=0.04$), resorting to eating during stress ($p=0.04$), and affection of monthly income due to COVID-19 ($p=0.007$).

Predictors of weight change during the second wave COVID-19 pandemic

Table 3 demonstrates the predictors of weight change during the second wave of the COVID-19 pandemic. For weight decrease, following the reports about the COVID-19 pandemic daily was associated with reduced risk of weight decrease [AOR=0.50 (95%CI, 0.27–0.93), $p=0.03$], while monthly income change [AOR=2.52(95%CI, 1.51–4.22), $p<0.001$], starting antidepressants [OR=3.57(95%CI, 1.08–11.76), $p=0.03$] and increased social media use during second wave of COVID-19 pandemic [OR=1.81(95%CI, 1.05–3.13), $p=0.03$] increased the odds of weight reduction.

On the other side, the probability of weight gain was increased by starting diet during the second wave of COVID-19 pandemic [AOR=1.57(95%CI, 1.11– 2.21), $p=0.01$], decreased by practicing sports during the second wave of COVID-19 pandemic [AOR=0.49(95%CI, 0.35–0.69), $p<0.001$] and unhealthy food consumption during the second wave of COVID-19 pandemic [AOR=0.40(95%CI, 0.28–0.57), $p<0.001$].

Discussion

This study reported that 77.8% of the Egyptian population had changes in body weight during the second wave of the COVID-19 pandemic either by increase (69.1%) or by decrease (9.6%). According to one study, 48% of American adults gained weight, compared with 18% who lost weight during the pandemic [19]. Previous Egyptian studies revealed increased body weight during lockdown by 37.4%, weight loss by 20.1%, and a 50.0% change in the sum of daily meals [20, 21]. In contrast, findings from the My Nutri Life COVID-19 survey showed that weight changes were shown in 62.9% of all participants with semi–equal distribution between losing weight (32.2%) and weight gain (30.7%) [22]. These results contradict also the 18.1% weight loss and 33.6% weight gain among Polish women and the 12.8% weight gain among Spanish adults, respectively [23, 24]. Zachary et al. [14] found that 22% of participants reported gaining>5 pounds during the peak–second wave of COVID-19 pandemic period and some participants also reported weight loss (18.2%). Besides racial differences, adherence to physical activity and diet regimen during the second wave of COVID–19 pandemic was higher in these studies and may be the explanation for the low percentage of weight gain. Almzandoz et al. [25] also reported that 70.8% of participants lost weight and only 28.2% gained weight.

We found that participants who gained weight were older than those who lost weight with no sex differences. Similarly, Ali et al. [26] reported that older age was associated with higher body weight gain during the second wave of the COVID-19 pandemic. In contrary, Almandoz et al. [25], in his survey showed no sex or age differences between participants who gained or lost weight during the pandemic. Also, Khubchandani et al. [19] did not find significant age and sex effects on weight changes. Maltoni et al. [27] reported sex differences regarding the causes of weight gain during the second wave of the COVID-19 pandemic as he reported that the main cause in males was the sedentary life pattern more than in females. In hand with Khubchandani et al. [19], we reported that having children and being ever married increased the odds of weight gain but without statistical significance in multi-variable analysis.

In the current study, we demonstrated many stressors associated with weight changes as following COVID-19 reports decreased the odds for weight loss. While a decline in monthly income and social media use increased the odds of weight loss. On the other hand, prior studies have described the relationship between weight gain and higher stress, depression, and anxiety during this pandemic. Particularly, studies evaluating the mental health status of adults during the pandemic found a 9-fold increase in anxiety levels compared with before the pandemic [28–30]. Previous reports proposed that people can be stressed during home confinement due to continuously watching, reading, or listening to news about COVID-19 from the media. People under stress may crave more “comfort foods” that are high in sugar and fat [31]. On the other hand, two studies [19, 25] found that stressors were associated with weight gain rather than weight loss. They proposed that stressors affected weight changes through a variety of behavioral and neuroendocrine pathways. Antidepressant use increased the odds of both weight gain and weight loss in the current study. Almandoz et al. [25] reported that

Table 2 Association between the different factors and weight changes among the Egyptian population during the second wave of the COVID-19 pandemic

Variables	No change body weight (*n* = 213)	Decrease body weight (*n* = 96)	Increase weight (*n* = 691)	*p*-value
Age (years) median (IQR)	34(25–40)	30(21–38)	34(23–40)	0.006
Gender				
Male	42(19.7)	20(20.8)	125(18.1)	0.74
Female	171(80.3)	76(79.2)	566(81.9)	
Education level				
Below university	12(5.6)	6(6.3)	19(2.7)	0.06
University/postgraduate studies	201(94.4)	90(93.8)	672(97.3)	
Residence				
Urban	206(96.7)	92(95.8)	667(96.5)	0.92
Rural	7(3.3)	4(4.2)	24(3.5)	
Marital status				
Not married	80(37.6)	56(58.3)	281(40.7)	0.002
Ever– married	133(62.4)	40(41.7)	410(59.3)	
Having children				
Yes	125(58.7)	42(43.8)	395(57.2)	0.03
No	88(41.3)	54(56.3)	296(42.8)	
Weight (kg) mean ± SD	73 ± 17	71 ± 17	76 ± 18	0.06
Height (cm) mean ± SD	164 ± 15	167 ± 9	166 ± 28	0.34
History of chronic diseases				
Diabetes mellitus	7(3.3)	4(4.2)	18(2.6)	0.65
Hypertension	20(9.4)	9(9.4)	42(6.1)	0.17
Renal diseases	1(0.5)	0	3(0.4)	0.81
Liver disease	0	0	1(0.1)	0.80
Autoimmune disease	9(4.2)	5(5.2)	20(2.9)	0.38
History of neurological disease	8(3.8)	6(6.3)	19(2.7)	0.18
History of other diseases	27(12.7)	13(13.5)	85(12.3)	0.94
Diet follow/ try to follow	75(35.2)	43(44.8)	329(47.6)	0.006
Acquire healthy food habits	104(48.8)	61(63.5)	304(44)	0.001
Acquire unhealthy food habits	54(35.4)	24(25)	362(52.4)	< 0.001
Increase in the frequency of supermarket visits	80(37.6)	41(42.7)	342(49.5)	0.007
Breakfast intake daily	157(73.7)	58(60.4)	483(69.9)	0.06
Dinner intake daily	106(49.8)	35(36.5)	350(50.7)	0.03
Increase in the rate of unhealthy snacking	61(28.6)	23(24)	384(55.6)	< 0.001
Smoking status				
Non/ Ex–smoker	188(88.3)	87(90.6)	622(90)	0.73
Current smoker	25(11.7)	9(9.4)	69(10)	
Disturbed sleep pattern	143(67.1)	63(65.6)	241(34.9)	0.86
Alcohol consumption	16(7.5)	4(4.2)	24(4.9)	0.29
Social media use				
Increase	157(73.7)	60(62.5)	550(79.6)	0.001
Decrease	2(0.9)	3(3.1)	19(2.7)	
No change	54(25.4)	33(34.4)	122(17.7)	
Fear of getting COVID-19 infection	169(79.3)	79(82.3)	579(83.8)	0.32
Daily follow of COVID-19 reports	183(85.9)	69(71.9)	575(83.2)	0.009
Start intake of antidepressant	5(2.3)	8(8.3)	45(6.5)	0.04
Monthly income affected	84(39.4)	56(58.3)	300(43.4)	0.007
Eat during stress	5(2.3)	8(8.3)	45(6.5)	0.04
Physical activity practice before COVID-19 pandemic	117(54.9)	57(59.4)	383(55.4)	0.74
Physical activity practice during COVID-19 pandemic	87(40.8)	35(36.5)	179(25.9)	0.001

Table 3 Multinomial regression analysis to identify the predictors of weight changes during the second wave of the COVID-19 pandemic

Risk factors	Unit of increase	Weight loss	Weight gain
		OR (95%CI)	OR (95%CI), *p*-value
Age (1 year)	1 year	0.97(0.94–1.01), $p=0.10$	0.98(0.97–1.01), $p=0.19$
Marital status (not married)	0 = not married, 1 = ever married	0.25(0.08–0.77), $p=0.16$	0.75(0.38–1.47), $p=0.40$
Having children	0 = no, 1 = yes	2.54(0.79–8.11), $p=0.12$	1.30(0.67–2.54), $p=0.43$
Follow COVID-19 pandemic reports	0 = no, 1 = yes	0.50(0.27–0.93), $p=0.03$	0.79(0.50–1.25), $p=0.32$
Monthly income changes during the second wave of COVID-19 pandemic	0 = no, 1 = yes	2.52(1.51–4.22), $p<0.001$	1.07(0.77–1.49), $p=0.68$
Eat during stress	0 = no, 1 = yes	1.47(0.85–2.55), $p=0.17$	0.74(0.53–1.05), $p=0.09$
Antidepressant	0 = no, 1 = yes	3.57(1.08–11.76), $p=0.03$	2.47(0.93–6.54), $p=0.07$
Increase in social media use	0 = no, 1 = yes	1.81(1.05–3.13), $p=0.03$	0.97(0.66–1.43), $p=0.88$
Diet during the second wave of COVID-19 pandemic	0 = no, 1 = yes	1.66(0.98–2.82), $p=0.06$	1.57(1.11–2.21), $p=0.01$
supermarket visits increase during the second wave of the COVID-19 pandemic	0 = no, 1 = yes	1.36(0.81–2.29), $p=0.25$	1.29(0.92–1.81), $p=0.13$
Unhealthy food during the second wave of COVID-19 pandemic	0 = no, 1 = yes	1.34(0.74–2.44), $p=0.34$	0.40(0.28–0.57), $p<0.001$
Physical activity during the second wave of the COVID-19 pandemic	0 = no, 1 = yes	0.69(0.40–1.17), $p=0.17$	0.49(0.35–0.69), $p<0.001$

depression and antidepressants were more likely associated with weight gain. This could be a sign of improvement in patients who have lost weight due to depression or a residual symptom in patients who overeat when depressed [32].

We did not find an association between sleep patterns during the second wave of COVID-19 pandemic and weight changes either by decrease or increase. In contrast, Chin et al. [22] claimed that good sleep causes a decline in body weight opposite to poor sleep pattern. Almandoz et al. [25] found that participants who gained weight during the second wave of the COVID-19 pandemic were alongside less sleep. Mekkawy et al. [33] and Cheikh Ismail et al. [34] revealed a higher percentage of participants reporting poor sleep quality during the pandemic (28.1%) compared to before the pandemic (17.3) ($p<0.001$), and sleep disturbances were also more common during the pandemic (60.8%) compared to before (52.9%) which affected weight changes during the second wave of COVID-19 pandemic.

In this study, sports practice during the second wave of the COVID-19 pandemic decreased the odds of weight gain. On the contrary, sports practice before the second wave of the COVID-19 pandemic did not affect weight changes. Similar findings were reported by Chin et al. [22]. Also, Hu et al. [35] reported decreased physical activity during the second wave of COVID-19 pandemic and increased weight gain among adolescents. Similarly, Almandoz et al. [25] reported decreased exercise time (58.5% vs. 36.7%, $p<0.001$) among weight gain group. These results are consistent with earlier studies during the pandemic, which showed increased sedentary time and lower time and intensity of physical activity [28, 30].

In the current study, following a diet regimen during the second wave of COVID-19 pandemic was associated with an increase in body weight either in univariate or multi-variable analysis. Unlikely, Chin et al. [22] proposed that the diet regimen during COVID-19 was associated with weight decrease. We observed that consumption of healthier food was associated with weight loss while depending on unhealthy food or snacks caused an increase in body weight. Also, following healthy food habits caused better control of body weight opposite to unhealthy habits as increased intake of soft food and increased consumption of sweeteners and beverages. These results came in concordance with the findings by the My Nutri Life survey [22]. This also came in hand with the previous evidence showing that cooking at home is associated with better diet quality, lower in energy, fat, and sugar contents as compared to foods consumed away from home, which subsequently linked with a lower prevalence of overweight and obesity [36]. Early studies showed that home confinement is associated with increased consumption of unhealthy foods, especially those with high fat and sugar [37]. Another survey by Almandoz et al. [38] reported that weight gain group was associated with less healthy eating (50.9% vs. 39.9%, $p<0.001$), less home–cooked meals (50.9% vs. 24.2%, $p<0.001$), more takeout/delivered food (59.3% vs. 17.7%, $p<0.001$), more comfort foods (85.3% vs. 33.3%, < 0.001), more fast foods (62.9% vs. 18.2%, $p<0.001$), overeating (79.8% vs. 21.3%, $p<0.001$), and binge eating (66.0% vs. 20.9%, $p<0.001$) [25]. In Palestine 41.7% of adolescents reported gaining weight due to an increase in consumption of fried foods, sweets, sugar–added drinks and dairy products during the second wave of COVID-19 pandemic [38].

Skipping meals, especially dinner was associated with decreasing body weight as eating dinner was related to either increased body weight or stable weight and lost its significance in multi-variable analysis in the current study. While skipping breakfast was more frequent in the

losing weight group with no statistically significant difference. In contrast, Chin et al. [22] reported that increased weekly frequency of eating dinner was associated with weight gain. It is possible that skipping main meals may reduce total daily caloric intake and contribute to faster weight loss in short–term [39].

Prior studies evaluated the risk factors for weight changes during the second wave of the COVID-19 pandemic. A previous Egyptian study showed that older age, the larger number of daily meals, and a higher mean weekly consumption of meat during the lockdown were associated with higher body mass index (BMI), whereas practicing physical activities during the lockdown was associated with lower BMI [26]. Alamrawy et al. [21] concluded that bodyweight changes are significantly associated with depression, anxiety, and insomnia ($p<0.001$). Dietary changes in the form of the number of daily meals, changes of dietary habits, practicing emotional and night eating recently, increased consumption of carbonated beverages, and increased consumption of caffeinated and energy drinks were significantly associated with depression, anxiety, and insomnia symptoms.

Strengths and limitations

Data were collected online, a method that, while non probabilistic, was both practical and effective for achieving the research objectives during a period of territorial restrictions due to the pandemic. This approach enabled the wide dissemination of the survey questionnaire, providing valuable insights into the Egyptian population's behaviors under challenging circumstances. Furthermore, recent data from the annual Egyptian report on internet usage shows that internet penetration reached 54% in January 2020, with mobile connections equivalent to 91% of the total population [40]. These statistics support the relevance of the online survey population despite inherent limitations.

However, the study is subject to several limitations. The reliance on self–reported body weight and behaviors introduces the potential for recall bias and inaccuracies, as individuals' reporting may not always align with objective measurements. This limitation is compounded by the cross-sectional design, which precludes establishing causation and makes the results reflective of a single point in time rather than changes over time. Additionally, the lack of baseline data limits the ability to compare findings directly with pre-pandemic conditions.

Despite these limitations, the study offers valuable initial insights into the dietary habits, physical activity patterns, and associated weight changes among Egyptians during the pandemic. It highlights the multifactorial nature of weight changes in this period and provides a foundation for future research. Longitudinal studies with objective measurements are needed to validate these findings and further explore the psycho–behavioral impacts of COVID-19 among Egyptians.

Conclusions

Most of the Egyptian population reported weight changes during the second wave of COVID-19 pandemic, manifesting as either weight gain or weight loss, driven by various factors. Stress-related events were more commonly linked to weight loss, while weight gain was associated with unhealthy eating habits, decreased physical activity, and older age. To address the health impacts of the pandemic, it is essential to implement targeted intervention programs aimed at improving dietary habits and promoting physical activity, particularly among older adults, to support maintaining a healthy weight.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40795-024-00977-0.

Supplementary Material 1

Supplementary Material 2

Acknowledgements
Not applicable.

Author contributions
Conceptualization: SAE, YAE, NGA, AYE Investigation: all authors, Data curation, formal analysis: SAE, ST, KMS, NGA, writing–original draft: SAE, MKN, RMG, writing–review & editing: All authors.

Funding
Not applicable.

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Alexandria University (IRB number: 00007555) following the International Ethical Guidelines for Epidemiological studies [18]. Informed consent was obtained from all participants.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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Received: 20 March 2024 / Accepted: 12 December 2024
Published online: 07 January 2025

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