



Nutritional and health behaviour predictors of the weight gain during the COVID-19 pandemic

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Received: 31 August 2021 / Accepted: 2 March 2022 / Published online: 24 March 2022
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Abstract

Purpose This study aims to examine the effects of the COVID-19 pandemic on the body weight, nutritional habits, physical activity, and food consumption of adults living in Turkey and evaluate the effects of changes in these health behaviours on body weight.

Methods A cross-sectional study was conducted with an online questionnaire. Data were collected through social media platforms using the snowball sampling method. A self-reported questionnaire included socio-demographic information, anthropometric data, dietary habits, food consumption, and lifestyle changes. In this study, 4181 people were included. Logistic regression analysis was used to evaluate the variables associated with the increase in body weight.

Results The findings obtained in this study showed that the bodyweight of 58.5% of the participants increased during the COVID-19 pandemic, and this increase was the highest (66.3%) among the obese. The rate of those who stated that their physical activity decreased was 69.5%. The foods consumed the most by individuals were homemade desserts (54%), nuts (53.8%) and fresh fruits (52.3%). Those whose serving size increased [OR = 4.98 (3.76–6.60)], those whose physical activity decreased or increased [OR = 2.94 (2.38–3.63) or 2.52 (1.84–3.45), respectively], and those whose number of main meals consumed increased [OR = 2.17 (1.72)–2.75], those with increased consumption of white bread (OR = 1.63 (1.20–2.22) and those with increased consumption of packaged sweet products [OR = 1.53 (1.23–1.89)] were more likely to gain weight.

Conclusion The results of this study show that there are significant changes in the body weight, physical activities, and eating habits of the participants during the COVID-19 pandemic. It is necessary to provide and follow-up specific guidance and support services for different groups to protect public health, improve and prevent nutrition-related diseases.

Keywords COVID-19 pandemic · Nutritional habits · Change in health behaviours · Bodyweight changes · Physical activity

Introduction

COVID-19 is a disease caused by a new coronavirus called SARS-CoV-2. Primarily it affects the respiratory system in humans. Fever, dry cough, fatigue are among the most common symptoms. Immediately after it was seen in China, it quickly spread to the whole world; the significant public health problem in many countries was defined as a

global epidemic (pandemic) on March 11, 2020 due to the spread and severity of the virus. On March 11, 2020, it was announced that the first case was seen in Turkey [1, 2].

Republic of Turkey Ministry of Health, to combat the COVID-19, Coronavirus Science Committee was formed on January 10, 2020. The scientific board determined the rules to be followed in the fight against COVID-19 and reported them to the relevant ministries. To maintain social distance and prevent people from coming together, travel restrictions have been imposed, working from home has become widespread, schools, restaurants, entertainment venues, and gyms have been closed. In addition, individuals over the age of 65 and under the age of 20 have been prohibited from using public transport. All these restrictions have seriously affected daily life. [3].

One of the most affected issues, especially with social isolation, is the change in eating habits. Food consumption

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is a necessary behavior for the protection, development, and maintenance of health. However, it involves not only physiological but also psychological, sociological, and cognitive processes. It is affected by both cultural and sociological factors [4–11]. Determining how nutritional habits are involved in the social isolation process will help us combat preventable diseases (e.g., heart diseases, Type 2 diabetes, and obesity).

This study aims to examine the effects of the COVID-19 pandemic on the body weight, nutritional habits, physical activities, and food consumption of adults living in Turkey and evaluate the effects of changes in these health behaviors on body weight.

Methods

Study design

This research was a cross-sectional, retrospective, and national web-based online study. The data were collected through social media platforms, such as Facebook, Instagram, WhatsApp, and using the snowball sampling method between January 01–20, 2021. The questionnaire was prepared using the online Microsoft Forms tool to examine the demographic characteristics, sleep status, physical activity status, food consumption, and changes in the eating habits of the participants. After the participants were informed about this study, the participants who approved the informed consent form filled in the questionnaire and sent it online. Also, the participants could leave the questionnaire at any time.

Materials

Participants' characteristics

The criteria for inclusion in the present study were determined as being 18 years old and over, not having COVID-19 infection, not being pregnant/breastfeeding, living in Turkey and speaking Turkish. Participants; gender (female, male), age (years), marital status (married, single), education level, occupations, and current employment status (home working, flexible working and full-time work in the workplace, on leave, does not work) were asked.

Anthropometric measurements and body weight changes

Self-reported weight and height were used to calculate body mass index (BMI) as weight in kilograms divided by height in meters squared. Weight status was classified according to WHO categories as follows: underweight (BMI < 18.5), normal weight (BMI between 18.5–24.9), overweight (BMI between 25 and 29.9) and obesity (BMI ≥ 30) [12]. In

addition, participants were asked whether there was a change in body weight (increased, decreased, unchanged) during the pandemic period compared to the pre-pandemic period.

Self-reported physical activity and sleep

Participants were asked to respond to changes in physical activity and sleep status during the pandemic as “increased”, “decreased” or “unchanged” compared to the pre-pandemic period.

Eating behaviour and food consumption

To investigate the effects of the COVID-19 pandemic on the eating behaviour of the participants, the participants were asked to answer the changes in the number of main meals and snacks, processed-packaged (foods with high sugar content) food consumption and serving sizes of the meals they consumed as “increased”, “decreased” or “unchanged” compared to the pre-pandemic period.

Statistical analysis

Statistical analysis was performed using the statistical package IBM SPSS Statistics (Version 25.0; IBM, New York, USA). Categorical data were presented in count (*n*) and percentage figures (%), and continuous data were analyzed with mean and standard deviation (SD). Logistic regression analysis was used to evaluate the associations between self-reported weight gain (dependent variable) and health behaviours and nutritional habits changes (independent variables). Statistical analysis techniques were applied to examine the independent factors affecting weight change. Odds ratios (OR), 95% confidence intervals for odds ratios (lower–upper bound), and significance values (*p*) were given in all estimated logistic regression models. First, it was tested if the covariates were associated with weight gain ($p < 0.05$). Gender, marital status, employment status, age groups were used for adjustment. Education was not used for adjustment because there was not a significant relationship between education and self-reported weight gain. Crude and adjusted ORs with 95% confidence intervals (CI) and *p* values were provided in a table. In addition, health behaviours and nutritional habits changes were presented by age groups. $p < 0.05$ was considered significant.

Results

Participants

In this study, 4354 people participated. One hundred seventy-three people who did not fully answer the survey

questions ($n = 117$), did not live in Turkey ($n = 32$), were younger than 18 years old ($n = 19$) and were pregnant/breast-feeding ($n = 5$) were excluded from the sample, so 4181 participants were included in the present study. Table 1 shows the characteristics of the participants. 78.8% of the participants were female and 21.2% were male. While the mean BMI of the participants was $24.7 \pm 4.63 \text{ kg/m}^2$, 52.5% had a normal weight, 28.9% were overweight and 13% were obese.

Table 1 Participants' characteristics

Gender n (%)	
Female	3293 (78.8)
Male	888 (21.2)
Age (years) [($\bar{x} \pm \text{SD}$) (min–max)]	36.2 ± 13.45 (18–73)
Age groups n (%)	
18–30	1687 (40.3)
31–50	1802 (43.1)
51–65	635 (15.2)
> 65	57 (1.4)
Marital status n (%)	
Single	1996 (47.7)
Married	2185 (52.3)
Education n (%)	
Primary	138 (3.4)
High school	491 (12.0)
Bachelor degree	2919 (71.4)
Graduate	543 (13.2)
Employment n (%)	
Work from home	992 (24.0)
Flexible working	642 (15.5)
At the workplace	800 (19.4)
Unemployed	1696 (41.1)
Self-reported weight status and change in health behaviours	
BMI [($\bar{x} \pm \text{SD}$) (min–max)]	24.7 ± 4.63 (15.0–47.07)
Class of BMI n (%)	
Underweight	234 (5.6)
Normal	2185 (52.5)
Overweight	1205 (28.9)
Obesity	540 (13.0)
Change in body weight n (%)	
Increased	2444 (58.5)
Unchanged	949 (22.7)
Decreased	788 (18.8)
Change in physical activity n (%)	
Increased	557 (13.4)
Unchanged	714 (17.1)
Decreased	2903 (69.5)
Change in sleep habits n (%)	
Increased	1379 (33.0)
Unchanged	1777 (42.6)
Decreased	1018 (24.4)

In this study, 58.5% of the participants reported that their weight increased during the pandemic, while 18.8% reported that it decreased. The proportion of those who stated that their physical activity decreased was 69.5%, and the rate of those who stated that it increased was 13.4%.

Weight changes of participants according to BMI classes

Figure 1 shows the distribution (%) of the self-reported weight change during the COVID-19 pandemic according to the self-reported weight status. Weight gain was reported by 35.9% of the participants who are underweight, 56.3% of the participants with a normal weight, 63.2% of the participants with overweight and 66.3% of the participants with obesity.

Compared to participants in the normal weight range, the odds of gaining weight was higher for overweight participants [$\text{OR}_{\text{adj}} = 1.88$ (1.54–2.29), p value < 0.001] and those with obesity [$\text{OR}_{\text{adj}} = 2.18$ (1.68–2.81), p value < 0.001], and lower for underweight participants [$\text{OR}_{\text{adj}} = 0.38$ (0.27–0.54), p value < 0.001].

Relationships between health behaviours, food consumption and weight gain

As shown in Table 2, the relationships between the participants' health behaviours and weight gain were evaluated. It was determined that those whose physical activity decreased [$\text{OR}_{\text{adj}} = 2.94$ (2.38–3.63), $p = < 0.001$] and those sleep duration increased [$\text{OR}_{\text{adj}} = 1.36$ (1.10–1.66), $p = 0.005$] during the pandemic were more likely to gain weight. Participants whose consumption of sweet or salty snacks increased was 1.48 [$\text{OR}_{\text{adj}} = 1.48$ (1.22–1.80), $p = < 0.001$] times more likely to gain weight. The increase in the number of main meals consumed [$\text{OR}_{\text{adj}} = 2.17$ (1.72–2.75), $p = < 0.001$] significantly increased the weight gain. The highest odds ratio for the increase in body weight in the COVID-19 pandemic was found in individuals whose serving size increased [$\text{OR}_{\text{adj}} = 4.98$ (3.76–660), $p = < 0.001$].

Figure 2 shows the changes in the food consumption of the participants during the COVID-19 pandemic. 54% of the participants stated that homemade desserts increased during the pandemic. Nuts (53.8%) and fresh fruits (52.3%) were the other nutrients that were consumed the most.

Table 3 shows the effects of change in self-reported food consumption during the pandemic period on self-reported weight gain. We saw that the increase in the consumption of white bread had the most significant effect on weight gain during the pandemic period [$\text{OR}_{\text{adj}} = 1.63$ (1.20–2.22), $p = 0.002$]. An increase in the consumption of packaged sweet foods was another important risk factor for weight gain [$\text{OR}_{\text{adj}} = 1.53$ (1.23–1.89), $p = < 0.001$].

Fig. 1 Distribution (%) of the self-reported weight change during the COVID-19 pandemic according to the self-reported weight status

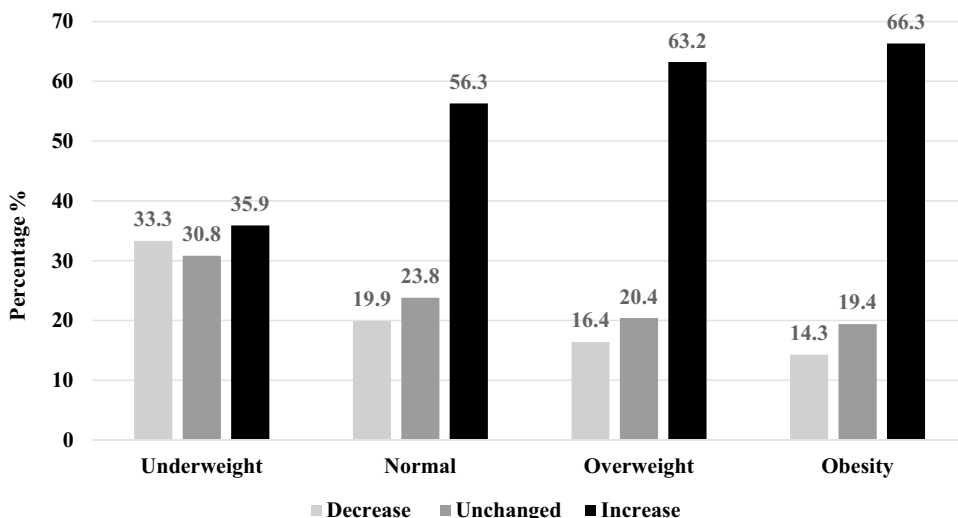


Table 2 Self-reported weight gain by change in self-reported health behaviours

	Crude			Adjusted [†]		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Change in physical activity (reference = unchanged)						
Increased	2.61	1.91–3.57	<0.001	2.52	1.84–3.45	<0.001
Decreased	3.03	2.46–3.73	<0.001	2.94	2.38–3.63	<0.001
Change in sleep status (reference = unchanged)						
Increased	1.33	1.09–1.63	0.006	1.36	1.10–1.66	0.005
Decreased	1.29	1.04–1.60	0.021	1.26	1.01–1.56	0.039
Change in the consumption of sweet or salty snacks (reference = unchanged)						
Increased	1.52	1.25–1.85	<0.001	1.48	1.22–1.80	<0.001
Decreased	1.52	1.10–2.10	0.013	1.55	1.12–2.15	0.004
Change in the number of main meals consumed (reference = unchanged)						
Increased	2.20	1.74–2.78	<0.001	2.17	1.72–2.75	<0.001
Decreased	1.52	1.14–2.03	0.004	1.52	1.14–2.03	0.004
Change in portion size (reference = unchanged)						
Increased	4.93	3.73–6.52	<0.001	4.98	3.76–6.60	<0.001
Decreased	0.83	0.63–1.12	0.219	0.86	0.64–1.14	0.286

[†]It has been adjusted for age, gender, marital status, and employment status during the pandemic

Association between food consumption, health behaviours and weight gain stratified by age group

Table 4 shows the effects of changes in health behaviours stratified by age group on body weight gain during the pandemic.

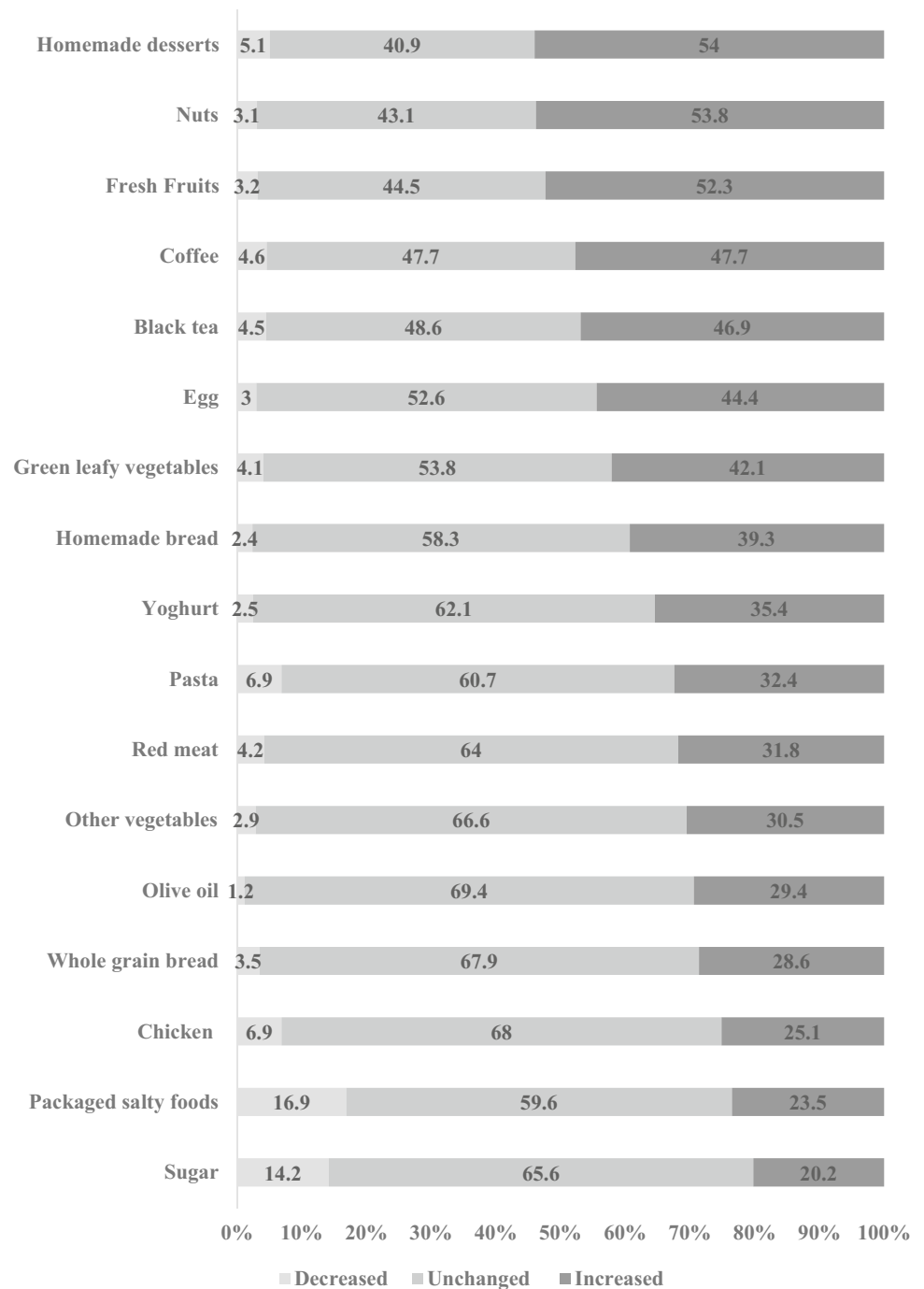
The findings obtained in this study showed that the decrease in physical activity during the pandemic significantly increased the probability of weight gain in all age groups. An increase in sleep status was a risk factor only for young adults [OR_{adj} = 1.39 (1.03–1.87), *p* = 0.032]. The increase in the consumption of sweet or salty snacks was associated with weight gain in young adults [OR_{adj} = 1.42 (1.05–1.92), *p* = 0.025] and older adults [OR_{adj} = 2.76

(1.57–4.86), *p* = <0.001]. The increase in serving sizes had the strongest association with weight gain in all age groups. This situation particularly affected the weight gain of older adults [OR_{adj} = 5.96 (2.14–16.61), *p* = <0.001].

The effects of changes in food consumption stratified by age groups on body weight are given in Table 5.

While the increase in the consumption of packaged sweet products was an important factor for weight gain in all age groups, the highest odds ratio was found in older adults [OR_{adj} = 2.51 (1.09–5.81), *p* = 0.031]. The increase in white bread consumption was associated with weight gain in young adults [OR_{adj} = 1.85 (1.22–2.81), *p* = 0.004], the increase in sugar consumption was associated with weight gain in middle-aged adults [OR_{adj} = 1.65 (1.05–2.59), *p* = 0.029], and

Fig. 2 Changes in food consumption of participants during the COVID-19 pandemic



the increase in nuts consumption was associated with weight gain in older adults [$OR_{adj} = 2.01$ (1.24–3.30), $p = 0.005$].

Discussion

The present study aimed to examine the effects of the COVID-19 pandemic on the body weight, nutritional habits, physical activities, and food intake of individuals and evaluate the effects of changes in these health behaviours

on body weight. To our knowledge, this study has the largest sample among similar studies conducted in Turkey. The bodyweight of 58.5% of individuals increased during the pandemic and this increase was higher in individuals who were overweight and obese at the beginning of the pandemic. 69.5% of the participants reported that their physical activities decreased. The most important effect on weight gain was the increase in the serving sizes consumed, the decrease in physical activity and the increase in the number of main meals. When the foods were evaluated,

Table 3 Self-reported weight gain by change in self-reported food consumption

	Crude			Adjusted [†]		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Change in egg consumption (reference = unchanged)						
Increased	1.33	1.13–1.58	0.001	1.32	1.12–1.57	0.001
Decreased	1.46	0.86–2.47	0.163	1.44	0.85–2.44	0.180
Change in nuts consumption (reference = unchanged)						
Increased	1.28	1.10–1.51	0.003	1.28	1.09–1.52	0.003
Decreased	1.13	0.72–1.79	0.593	1.23	0.78–1.94	0.385
Change in homemade desserts (reference = unchanged)						
Increased	1.22	1.27–1.94	0.028	1.13	0.94–1.35	0.189
Decreased	0.95	0.70–1.36	0.787	0.93	0.65–1.33	0.677
Change in white bread consumption (reference = unchanged)						
Increased	1.65	1.22–2.25	0.001	1.63	1.20–2.22	0.002
Decreased	1.08	0.86–1.34	0.523	1.10	0.88–1.37	0.433
Change in the consumption of packaged sweet products (reference = unchanged)						
Increased	1.57	1.27–1.94	< 0.001	1.53	1.23–1.89	< 0.001
Decreased	0.97	0.75–1.25	0.815	0.96	0.74–1.24	0.753
Change in sugar consumption (reference = unchanged)						
Increased	1.46	1.11–1.94	0.008	1.47	1.11–1.95	0.008
Decreased	0.96	0.75–1.25	0.783	0.96	0.74–1.24	0.765

[†]It has been adjusted for age, gender, marital status, and employment status during the pandemic. Bold fonts indicate significant difference

Table 4 Association between health behaviours and weight gain stratified by age group

	Young Adults* 18–34 y (<i>n</i> = 2017)			Middle aged adults* 35–54 y (<i>n</i> = 1727)			Older adults* 55 + (<i>n</i> = 437)		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Change in physical activity (reference = unchanged)									
Increased	2.83	1.70–4.27	< 0.001	2.50	1.58–3.97	< 0.001	1.32	0.52–3.36	0.567
Decreased	2.34	1.70–3.27	< 0.001	3.83	2.81–5.22	< 0.001	2.40	1.32–4.35	0.04
Change in sleep status (reference = unchanged)									
Increased	1.39	1.03–1.87	0.032	1.33	0.95–1.86	0.101	1.72	0.90–3.32	0.103
Decreased	1.34	0.93–1.93	0.112	1.15	0.84–1.58	0.378	1.23	0.69–2.18	0.486
Change in the consumption of sweet or salty snacks (reference = unchanged)									
Increased	1.42	1.05–1.92	0.025	1.33	0.99–1.80	0.06	2.76	1.57–4.86	< 0.001
Decreased	1.61	0.97–2.67	0.066	1.21	0.73–2.00	0.464	2.74	1.10–6.85	0.032
Change in the number of main meals consumed (reference = unchanged)									
Increased	1.83	1.32–2.54	< 0.001	3.01	2.03–4.50	< 0.001	2.09	0.90–4.85	0.086
Decreased	1.79	1.13–2.84	0.014	1.61	1.02–2.52	0.04	0.82	0.40–1.67	0.594
Change in portion size (reference = unchanged)									
Increased	5.24	3.57–7.69	< 0.001	4.34	2.76–6.84	< 0.001	5.96	2.14–16.61	< 0.001
Decreased	0.95	0.60–1.48	0.808	0.75	0.48–1.18	0.754	0.82	0.39–1.71	0.585

*It has been adjusted for gender, marital status, and employment status during the pandemic. Bold fonts indicate significant difference

it was found that the consumption of white bread, packaged sweet products and sugar were associated with weight gain. The decrease in physical activity, the increase in serving sizes and the consumption of packaged sweet products cause weight gain in all age groups of adults.

The prevalence of obesity has reached pandemic rates, which is one of the most important public health problems of our time. More than 13% and 39% of the global adult population are obese and overweight, respectively [13]. Current evidence shows that COVID-19 and obesity are related

Table 5 Association between food consumption and weight gain stratified by age group

	Young adults* 18–34 y (n=2017)			Middle aged adults* 35–54 y (n=1727)			Older adults* 55+(n=437)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Change in egg consumption (reference = unchanged)									
Increased	1.18	0.91–1.53	0.225	1.48	1.14–1.92	0.003	1.30	0.81–2.10	0.283
Decreased	1.17	0.59–2.31	0.651	1.60	0.63–4.10	0.324	3.93	0.42–6.48	0.229
Change in nuts consumption (reference = unchanged)									
Increased	1.19	0.92–1.53	0.180	1.21	0.94–1.56	0.142	2.01	1.24–3.30	0.005
Decreased	1.08	0.52–2.26	0.833	1.10	0.52–2.22	0.853	2.41	0.87–6.65	0.091
Change in homemade desserts (reference = unchanged)									
Increased	1.21	0.92–1.59	0.177	1.00	0.76–1.29	0.960	1.54	0.89–2.68	0.125
Decreased	0.82	0.47–1.42	0.476	1.00	0.56–1.76	0.987	1.02	0.42–2.46	0.965
Change in white bread consumption (reference = unchanged)									
Increased	1.85	1.22–2.81	0.004	1.56	0.94–2.60	0.084	0.77	0.21–2.76	0.688
Decreased	1.07	0.76–1.51	0.680	1.10	0.78–1.55	0.587	1.24	0.68–2.28	0.482
Change in the consumption of packaged sweet products (reference = unchanged)									
Increased	1.44	1.06–1.96	0.019	1.46	1.05–2.03	0.025	2.51	1.09–5.81	0.031
Decreased	0.93	0.63–1.37	0.713	1.00	0.66–1.49	0.976	0.98	0.46–2.10	0.958
Change in sugar consumption (reference = unchanged)									
Increased	1.46	0.99–2.17	0.058	1.65	1.05–2.59	0.029	1.02	0.37–2.77	0.975
Decreased	1.06	0.71–1.57	0.774	0.95	0.64–1.41	0.789	0.74	0.35–1.56	0.426

*It has been adjusted for gender, marital status, and employment status during the pandemic. Bold fonts indicate significant difference

and that lockdown practices are causing the obesity pandemic to worsen. Lockdown and other restrictions associated with COVID-19 have changed the social, physical, and economic environment of individuals, resulting in marked changes in many health behaviours and weight gain [7–11, 14]. Although the short-term results of lockdown practices vary between countries, it shows that the rate of individuals experiencing weight gain varies from 28.6% to 48.6%, especially women are more affected by this increase [5, 7, 10, 15–18].

In a study examining the effects of the 10 week period of the first lockdown practice in Turkey, the rate of weight gain was 35% in individuals, while in this study which evaluated 38–40 weeks after the lockdown, the increase rate was 58.5% [19]. Turkey is one of the countries with the highest obesity rate among the European countries and the Turkey Nutrition and Health Survey study conducted in 2017 showed that the obesity rate in the population over 19 years old was 34.1% [20, 21]. Considering the studies showing that individuals who are already overweight and obese at the beginning of the pandemic gain more weight during lockdown periods than participants with a normal weight, the magnitude of the danger regarding public health can be better understood [7, 9, 10, 18, 22]. In line with previous research examining BMI and weight-related behaviours before the COVID-19 pandemic, participants with a higher BMI reported a lower quality of diet, lower physical activity levels and increased

overeating relative to the participants with a lower BMI during the lockdown [9].

Obesity is a major risk factor for severe complications of COVID-19, such as respiratory failure, need for invasive mechanical ventilation, and death [23]. It has been reported that increasing visceral obesity causes low-grade inflammation by increasing proinflammatory cytokine levels, and this inflammation is associated with the “cytokine storm” seen in COVID-19. An increase in the amount of proinflammatory cytokines and a decrease in the amount of adiponectin lead to a decrease in the immunological response to the infections [24].

A decrease in physical activity is one of the most important results of lockdown practices [5–9, 17, 25]. The results of this study show that a decrease in physical activity is an important risk factor for weight gain in all age groups among adults. Practices, such as working from home during lockdown periods, closing schools, and restricting exercises outdoors or in gyms, have led to an increase in the time spent at home. Also, other studies have shown that this situation increases sedentary behaviour (sitting, lying, time spent in front of a screen) and is a major risk factor for weight gain [5, 7, 8, 10, 14, 26, 27]. A sedentary lifestyle may decrease resting energy expenditure by 10–50% [28]. Regular physical activity is a simple and effective way of providing weight control in quarantine, protecting from stress and maintaining sleep quality, inhibiting macrophage

activation and inflammatory cytokine pathways and providing positive effects on immune response and insulin resistance [29]. Thus, there is a need to develop programs specific to lockdown periods by authorized institutions to encourage individuals to increase their physical activity.

The other major factor causing weight gain in the COVID-19 pandemic is the dramatic changes in individuals' eating habits and eating behaviours [5–8, 11, 17, 18]. In this study, the increase in the serving sizes consumed stands out as the most prominent factor causing weight gain. The ratio of the individuals who stated that they ate more during the lockdown period ranged from 43.5 to 59.6% [6, 22, 30]. A study determined that individuals whose routine serving sizes increased by 50% for 11 days increased their average energy per day by 423 ± 27 kcal [31]. A significant body of research indicates that a small positive energy balance over time is sufficient to cause weight gain in many individuals [32].

One of the most commonly reported findings in lockdown during the COVID-19 pandemic is the increased frequency of consumption of sweet or salty snacks [9–11, 14, 22, 25, 33]. In a cross-sectional study, it was determined that 51.8% of individuals consumed more snacks between meals compared to the pre-pandemic period, and as BMI increased, snack consumption increased and this situation was associated with an increase in fat mass [22]. In a study conducted in Belgium, it was determined that the consumption of salty or sweet snacks increased the most during the 6-week quarantine. In addition, it was determined that individuals with increased snack consumption had a 3.67 times greater risk of weight gain than others [7]. In our study, consumption of white bread and consumption of snacks have a significant effect on the weight gain of individuals. It has been reported that snacks consumed in response to environmental or emotional stimuli, especially while watching television, when not hungry, are a severe risk factor for overweight, obesity and cardio-metabolic risks; cancer, type-2 diabetes, and cardiovascular diseases; irritable bowel syndrome, depression, and frailty conditions; and all-cause mortality [34, 35].

Nutrition is one of the multiple factors that determine the immune response and good nutrition is important in supporting the immune response. Immune impairments associated with nutritional inadequacy increase susceptibility to infection and permit infections to become more severe, even fatal [36]. Adequate and balanced nutrition focused on fruits, vegetables, whole grains, plant and animal protein, and healthy fats is the best way to have all the essential nutrients we need for good health and normal immune function [37].

The strength of this study is that, in a short time, a large population sample covering a wide age range from all regions of the country was reached online. In addition, it provides information about the relatively long-term changes of the pandemic regarding the changes seen in the

body weights of individuals and health behaviours, such as eating habits and physical activity. This study has several limitations. As in previous online studies, highly educated and female participants constitute the majority in our study [5, 7, 10, 38, 39]. The limited participation of men, individuals with low education levels, and the elderly in studies may cause bias in the results [7, 40]. Another limitation is that data on body weight, physical activity level, nutritional behaviour and food intake are self-reported, which may lead to underestimation or overestimation of parameters. In evaluating changes in food consumption, learning the frequency of consumption of foods and the serving size will provide more accurate information about the consumption levels of healthy and risky foods.

Conclusion

During the COVID-19 pandemic, it has been seen that there are significant changes in nutritional and health behaviours in Turkish society. While there are severe decreases in the level of physical activity, although there is an increase in the consumption of healthy foods, there is an increase in the consumption of packaged sugary foods and the serving sizes consumed. The increase in body weight, especially seen in a large part of society, shows that obesity, an important health problem, may cause even bigger problems. Thus, given that lockdown may be used again in the future, it will be beneficial for the competent authorities to create and implement training programs using all media to increase physical activity and teach the basic principles of healthy nutrition and the construction of the health nutrition plate.

Author contributions All authors have contributed to the conception and design of the work presented in the paper AND have contributed to draft and review the manuscript AND have approved the final version to be published.

Funding This study was not funded by any source.

Data availability Data will be made available upon direct request to the authors of this paper.

Declarations

Conflict of interest The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Ethics approval The research was conducted by the ethical principles stated in the Declaration of Helsinki Republic of Turkey Ministry of Health (Confirmation number: 2020-11-11T22_53_51) and Ege University Faculty of Medicine from the Medical Research Ethics Committee (Approval Number: 21-1T/53) approval was obtained.

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