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Changes in dietary habits and eating behaviors during COVID-19 induced confinement: A study from Jordan

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ABSTRACT

Objective: This study aimed to evaluate dietary habits (DH) and eating behaviors (EB) among adults during confinement induced by COVID-19 in Jordan.
Method: In this cross-sectional study, an online survey designed to assess the change in DH and EB during April and May 2020 was distributed using various social media platforms.
Results: The survey was completed by a total of 1844 adult (18–72 years) participants from the public in Jordan. The results indicated an increase (42.5–61.8%) in most of the DH and EB examined in the current study in the majority of participants. Among these changes, they have increased ($p < 0.05$) the prevalence of fruit and vegetable, immune boosters, water, and hot beverage consumption, as well as decreased ($p < 0.05$) eating in restaurants and fatty food consumption, indicating a positive change. Conversely, a larger ($p < 0.05$) proportion of participants reported increased consumption of high-calorie food and late-night eating, indicating a risky behavior for obesity and subsequent chronic complications. Additionally, age, sex, obesity, education, income, and type of job appeared to contribute ($p < 0.05$) to changes in DH and EB. Overall, confinement caused by COVID-19 appears to compel adults to adopt a specific DH and EB. Although most of these changes were positive, some were negative.
Conclusion: This study provides essential information for designing subpopulation recommendations and developmental programs for adults under such conditions.

1. Introduction

The outbreak of coronavirus disease 2019 (COVID-19) from Wuhan, China, has quickly become a global health pandemic emergency. As of October 2022, more than 630 million cases and 6.5 million deaths have been reported worldwide. The disease is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the seventh of the coronavirus family [1]. Like other coronaviruses, COVID-19 is most probably transmitted from bats to humans, through an intermediate host like civet cats and raccoon dogs, after acquiring mutations that enable the virus to infect human cells [1,2].

COVID-19 has been identified as a highly contagious and rapidly spreading infectious disease transmitted from human to human via contact, droplets, and fomites [3]. It is clinically characterized as pneumonia, dry cough, fever, and fatigue, with occasional gastrointestinal complications. Although most patients have mild to moderate symptoms, some cases experience severe complications of pulmonary edema and various degrees of respiratory failure [4,5].

At the start of the pandemic, due to the rapid global spread of COVID-19, the World Health Organization (WHO) and governmental authorities acted swiftly. The goal was to contain the pandemic by "naturally exhausting the virus." Subsequently, drastic and unpopular measures, such as confinement, travel restrictions, and nationwide lockdown, were implemented [6]. While these measures may help to abate the pandemic spread and flatten the infection curve, such limits impose a severe burden on individual lifestyles, including dietary habits (DH) and eating

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behaviors (EB), which could lead to long-lasting health consequences.

Eating a balanced diet is crucial to boost the immune system and to lower the risk of chronic illnesses and infections, especially during confinement [7,8]. It has been emphasized that specific nutrients or nutrient combinations could activate and modify the expression of signaling molecules involved in the immune system's response to pathogens [8]. Furthermore, adequate intake of zinc, iron, folic acid, selenium, and vitamins is essential to maintain immune functions [9, 10]. Besides, a proper diet may modulate immune responses through the specific effects of dietary ingredients on the gut microbiota [11]. Conversely, the intake of excess fats and certain micronutrients, such as particular amino acids, can impair immune function [12]. Additionally, nutritional deficiencies are associated with immune dysfunction and increased susceptibility to infectious diseases [9,10]. For example, zinc deficiency increases the risk of bacterial and viral infections by lowering the number and activity of lymphocytes [13]. A low level of vitamin C challenges the body to counteract oxidative stress during the immune response to pathogens [14]. Thus, maintaining a well-balanced diet is crucial, especially when the immune system is needed to fight back (i.e., stress). The WHO has recommended essential nutrition and dietary guidelines for adults during the COVID-19 pandemic. These recommendations often focus on eating fresh and unprocessed foods to maintain a regular supply of vitamins, minerals, dietary fibers, proteins, and antioxidants. In contrast, avoiding sugar, salt, and fat to reduce the risk of obesity, cardiovascular diseases, and diabetes mellitus [15].

Confinement is experienced during a few circumstances, including pandemic, imprisonment, spaceflights, and Antarctic camping [16–19]. Similar to these confinement circumstances, COVID19-induced confinement is a challenge that can impose changes in DH and EB through multiple mechanisms. Lockdowns are usually associated with financial hardship, and limited access to fresh fruits, vegetables, and foods from animal sources, which are the primary sources of essential micronutrients in diets. These challenges may compromise the chances of maintaining a well-balanced diet during confinement [20]. For example, changing daily routines due to confinement may cause people to eat more as a compensatory tactic against fear, boredom, monotony, and anxiety due to uncertainty associated with calamities [21–24]. On the other hand, some people may turn to healthy DH and EB practices, like eating more fresh fruits and vegetables, reducing processed food, and drinking more water to boost the immune system and body health [25].

Accordingly, elucidating the effect of confinement on individuals' DH and EB is crucial to assess the impact of governmental measures on health consequences during the COVID-19 pandemic. In a study conducted in Italy, changes in DH and EB were reported by approximately 50% of the study sample during the lockdown [26]. These include access to fruit/vegetables and purchasing ready-made meals [26]. In a study from Germany, the COVID-19 pandemic lockdown was reported to have significantly affected alcohol drinking behavior with the female sex, lower body mass index, and younger age associated with a decrease in weekly alcohol consumption [27]. Differences in DH and EB during the pandemic have also been reported across countries, gender, professions, and age groups [28–31]. Therefore, in this study, we aimed to examine the impact of COVID-19 confinement on the DH and EB of adults in Jordan. Additionally, factors influencing DH and EB during the COVID-19 confinement will be identified. The current study will shed light on the possible changes in DH and EB in Jordan during the pandemic. Subsequently, make plans to encourage people to maintain healthy food choices and implement strategies to counter the effects of unhealthy eating habits.

2. Methods

2.1. Design and recruitment

Current data are derived from a larger project, "Behavior, Knowledge, Stress and, Quality of Life during COVID19-induced Confinement (BKSQ-COVID19)". The study is a cross-sectional survey distributed during April and May 2020 examining changes in DH and EB.

Adults (over 18 years of age) of both sexes were invited to participate in the study. Participants were from cities, towns, and villages from all governorates of Jordan. Adult individuals physically, mentally, and psychologically able were included in the study. Individuals with acute medical conditions that preclude them from filling out the survey were excluded from the study.

The questionnaire was distributed using an anonymous online survey posted on social media platforms (Facebook, and WhatsApp.). The survey was posted on the indicated social media groups and distributed via direct communication with contacts, friends, contacts of the contacts, etc., which resembles convenience sampling methods. Participants were informed about the study's objectives and consented electronically before filling out the questionnaire. The Institutional Review Board (IRB) of Jordan University of Science and Technology approved the study procedures (approval ID: 245/2020). Trained individuals completed study measurements under the supervision of qualified university professors.

2.2. Questionnaire

The research team developed the questionnaire to assess the change in DH and EB during COVID-19-induced confinement. The questionnaire covers demographics, perceptions about COVID-19 disease, and changes in DH and EB during the pandemic-induced confinement. Demographic parameters include age, gender, weight, height, job type (i.e., educational, medical, versus administrative), education, and income. Additionally, COVID-19 perception and confinement information, such as the likelihood of infection, knowing somebody infected with COVID-19, and the implemented governmental confinement procedures. For study parameters other than DH and EB, information was collected by asking the study participants to self-fill them in the study survey. Choices for the questions were (yes/no, or low, moderate, and high, as shown in Table 2). For DH and EB, nine questions were imparted to the

Table 1
The participant demographic (n = 1844).

Gender (%; male)	30.5
Age (yrs, mean ± SD)	33.7 ± 11.3
Weight (kg, mean ± SD)	72.6 ± 16.3
Height (cm, mean ± SD)	166.3 ± 9.0
BMI (kg/m^2)	26.3 ± 12.2
Obesity (BMI; %)	
Under weight	2.1
Normal weight	43.3
Overweight	35.4
Obese	14.8
Overly obese	4.4
Level of Education (%)	
High school and less	19.4
Associate degree	14.1
Bachelor's degree	51.3
Graduate degree	15.3
Income (%)	
Low	34.5
Middle	65.5
High	
Job type	
Unemployed/retired	35.6
Military/Police	4.8
Education	23.9
Agriculture	1.8
Health	14.0
Manufacturing	2.8
Engineering	5.8
Management	8.2
Crafting	3.2

Table 2
Perception and Confinement Information related to COVID-19 (n = 1844).

Likelihood of getting infected	
Low	59.5
Moderate	34.5
High	6.0
Know somebody who is infected	
Yes	6.3
No	93.7
Self-quarantine	
Yes	93.5
No	6.5
Physical distancing	
Yes	96.8
No	3.2
Banning group events (i.e., weddings)	
Yes	98.2
No	1.8
School closure	
Yes	99.0
No	1.0
Lockdown	
Yes	97.0
No	3.0

participants. Each participant was asked to give information about the consumption of fruits, vegetables, high-fat and high-caloric, immune boosters, water, hot beverages, and supplement, as well as late-night eating and eating in restaurants. The questions were:

1. "What changes have you experienced in fruit and vegetable consumption during confinement due to coronavirus?"
2. "What changes have you experienced in fatty food consumption during confinement due to coronavirus?"
3. "What changes have you experienced in eating high-caloric food during confinement due to coronavirus?"
4. "What changes have you experienced in consuming immune booster food during confinement due to coronavirus?"
5. "What changes have you experienced in drinking water during confinement due to coronavirus?"
6. "What changes have you experienced in drinking hot beverages during confinement due to coronavirus?"
7. "What changes have you experienced in supplement consumption during confinement due to coronavirus?"
8. "What changes have you experienced in late-night eating during confinement due to coronavirus?"
9. "What changes have you experienced in eating in restaurants during confinement due to coronavirus?"

The participants would select one choice out of four options, including "increase", "decrease", "no change", and "never practiced this behavior."

2.3. Statistics

The SPSS (version 21) was used to examine the data statistically. The α was fixed beforehand at 0.05. The mean ± SD, frequency, and percentages were used to present the data. The $\chi 2$ goodness-of-fit was used to determine the differences in the distribution of the participant responses, "increase", "decrease", versus "no-change" in DH and EB. Cross-tabulation was used to determine the relationship of potential factors with the participant responses to the questions about the changes in DH and EB, "increase", "decrease", or "no-change." Possible factors were age, gender, income, education, job type, and worried about being infected with COVID-19. Residual adjusted standardized (ADRs) above 1.96 was used in the post-hoc analysis to determine subgroup differences.

3. Results

3.1. Participants

The characteristics of the participants are presented in Table 1. A total of 1844 individuals answered the questionnaire. The age, weight, and height ranges were 18–72 years (33.7 ± 11.3), 38–144 kg (72.6 ± 16.3 kg), and 120–198 cm (166.3 ± 9.0 cm). Most participants were women with bachelor's degrees, middle-income earners, and unemployed. As in Table 2, very few participants were worried about getting infected and know a person who was infected. Additionally, most participants reported a range of confinement practices and advisories, including self-quarantine, social distancing, lockdown, school closure, and event banning.

3.2. Changes in dietary habits and eating behavior

The chi-square goodness-of-fit test demonstrated differences ($p < 0.05$) in responses to the DH and EB questions, "increase", "decrease", versus "no-change". Fig. 1 shows that the majority of participants reported an increase (42.5–61.8%) in most dietary habits.

3.3. Factors contributing to the changes in dietary habits and eating behaviors

Cross-tabulation tests were used to examine the relationship of DH and EB measures with potential contributing factors where age, gender, obesity, education, income, and job type contributed ($p < 0.05$) to the changes in DH and EB. Values are expressed as a percentage (Table 3).

4. Discussion

The rapid and rampant spread of the COVID-19 pandemic has compelled governments around the globe to declare national lockdown. This has mandated all public and private sector institutions, except for essential services such as health care facilities, to close and operate remotely. Additionally, people were asked to stay home and follow various social distancing advisories. While these drastic measures may help to cut the transmission path of the virus, abate the pandemic spread, and flattens the infection curve, such limitations may inflict a severe burden on individual lifestyles, including DH and EB. Subsequently, it could negatively affect overall physical and mental health and lead to long-lasting health complications. However, the impact of these restrictions on DH and EB during mandated COVID-19 confinement is mainly unknown. Accordingly, the current study examined changes in DH and EB in Jordan during COVID-19-induced confinement. COVID-19 cases started to be reported in Jordan in March 2020, with daily incidences ranging between 0 and 40. However, from October 2020 through 2021, Jordan faced a fast spread of COVID-19, with hundreds-thousands of cases reported daily. The data show an increase in most of the DH and EB examined in the current study among the majority of the participants. This could be explained by boredom and monotony feelings resulting from interruption of the daily routine, outdoor activities, and movement restriction due to confinements. Boredom has been associated with a high tendency to increase fat, carbohydrate, protein and total energy intake [21]. Besides, the anxiety and uncertainty of these unfortunate situations compel people toward overeating as a compensatory tactic to lessen fear and anxiety [22,32]. Interestingly, a search in the "Google trends tool" shows a global increase in inquiry about the terms "food recipe" and "boredom," concurring with the start of confinement in March of 2020. Fortunately, the changes in DH and EH experienced among the participants in the current study seem to be in a healthier direction. For example, increased fruit and vegetable consumption and immune-boosting food (e.g., garlic and pepper) during confinement. Additionally, the majority of participants were taking dietary supplements (e.g., vitamins and minerals) and

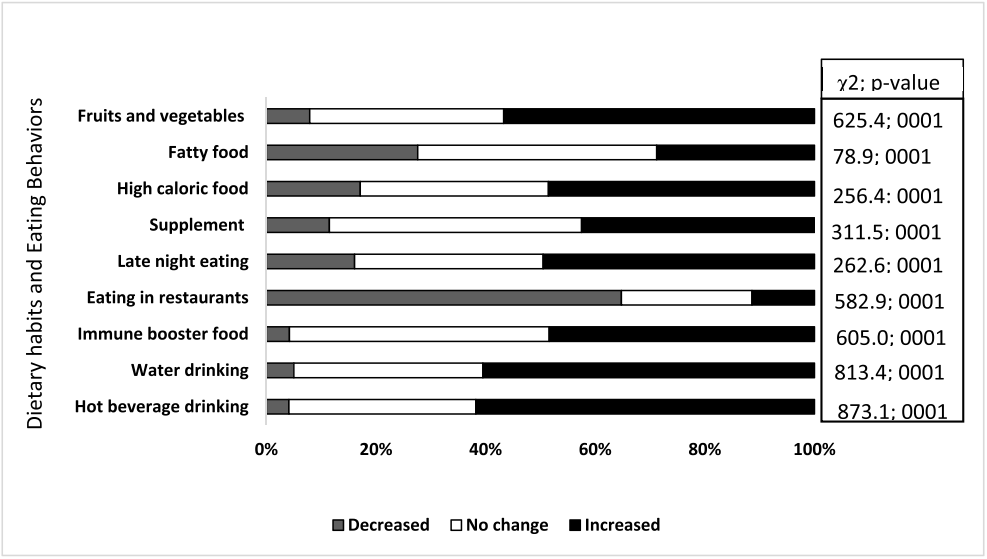

Fig. 1. Changes in dietary habits and eating behaviors.

reported no change or decrease in eating high-fat food and eating out during confinement. These results agree with the WHO nutrition and dietary guidelines during COVID-19-induced confinement. These guidelines specifically recommend avoiding high-fat diets and increasing fruits and vegetables intake to get the body's need for vitamins, minerals, dietary fiber, and antioxidants [15]. Subsequently boosting the immune system and lowering the risk of chronic and infectious diseases [7]. Similarly, consistent with the WHO recommendation, our data reported a marked increase in drinking water and hot beverages. Conversely, the participants reported an increased high-caloric food (e.g., bread, sweets, and potato chips) and late-night eating. In Jordan, the typical diet relies mainly on wheat/rice, vegetables, milk/dairy products, meat, olive oil, and local sweets [33,34]. Thus, the observed shift in diet patterns associated with snacks, a pretext for high fat and caloric intake, and a significant increase in the risk of cardio-metabolic and musculoskeletal diseases. A recent study from Belgium showed reduced odds of consuming fruits and vegetables, along with an increase in the odds of soft drinks consumption while in confinement [35]. During COVID-19 home isolation in Italy, consuming fruits, vegetables, and fish was positively associated with exercise, whereas consuming cereals and legumes was associated with depression [36]. Another study from the USA showed that during mandated confinement, 43.8% of study participants reported increased consumption of sweets, and 37.4% reported increased consumption of salty snacks [37].

Additionally, the study identified factors that could influence DH and EB during COVID19-induced confinement in Jordan. For instance, job type seems to contribute changes in to fruit and vegetable consumption. In contrast, age, gender, education, and job type were associated with the consuming fat and high-calorie food. Additionally, age, education, and income were related to supplement consumption. Consumption of immune boosters was related to obesity, education, income, and job type. On the other hand, water consumption was related to age and education. Drinking hot beverages was related to age, obesity, and education. Late-night eating was associated with age. Eating in restaurants was associated with age, obesity, and gender. The novelty of the disease and scarcity of information imposes difficulty in explaining the current results. However, the current data are consistent with previous reports suggesting biological, educational, and financial factors influence DH and EB [38–40]. Food acquisition, preparation, and consumption vary according to age, gender, education, income, and socioeconomic status [38–41]. Therefore, more studies are warranted to validate the current findings under confinement situations, namely, during pandemics. Subsequently, design studies and strategies to encourage healthy DH and EB among adults during pandemic-induced confinements.

The results of this study examined the changes in DH and EB during the COVID-19-induced confinement in Jordan, thus helping to understand the dietary impact of confinement due to COVID-19. Subsequently, prepare tactics to counteract the negative nutritional effects of the current and future calamity. In Jordan, the prevalence of chronic diseases is high. For example, the majority of diabetes in adults aged 25 and more was reported at 23.7% in 2017 [42]. Concerning hypertension, the age-standardized prevalence was 33.8% among men and 29.4% among women [43]. About 35% of Jordan's deaths are attributed to cardiovascular diseases [44]. The observed changes in DH and EB might increase the risk of chronic diseases in the country. Thus, awareness programs are needed to provide individuals with the knowledge to choose healthy alternatives during such confinement due to pandemics. The current study provides crucial information to design subpopulation recommendations and development programs for adults under similar conditions.

This study is cross-sectional, which makes concluding a cause-effect relationship difficult. The parameters of DH and EB examined in this study are crude without details of quantity, frequency, and mealtime. Additionally, the inherited misrepresentation in questionnaire research is considered a limitation of the current study. Furthermore, although the sample size is relatively large and reflects the population of Jordan to a reasonable extent, the study findings might only apply to some countries, and ethnicities. Being an online survey distributed through social media, this study could suffer from self-selection bias as participants, as we had no control over who could select to participate in the study. Therefore, future interventions and longitudinal studies in different regions of the world using objective measures of DH and EB are needed to expand knowledge about the impact of confinement during the current and future pandemics.

This study concluded that COVID-19-induced confinement compels adults to adopt a specific DH and EB. Particularly, this study outlined increases in most of DH and EB examined in the majority of the participants. Participants showed some positive changes, including more consumption of fruits, vegetables, immune boosters, water, and hot beverages. Additionally, eating in restaurants and consuming fatty food decreased among most participants. Conversely, a greater percentage of the participants reported an increase in high-calorie food consumption and late-night eating, which are alarming and indicate an increased risk of obesity and subsequent chronic complications. Additionally, changes in DH and EB were related to age, gender, obesity, education, income,

Table 3
Factors contributing to changes in dietary habits and eating behaviors.

Fruit and Vegetables	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	9.3	7.4	8.0	7.0	10.1	8.0	9.1	7.6	8.1
	No-change (%)	35.6	35.2	34.0	37.1	37.2	29.7	31.5	36.4	41.2
	Increase (%)	55.1	57.4	58.0	55.9	52.7	62.2	59.3	56.0	50.7
	χ^2; *p*-value	1.926; 0.382		3.735; 0.443			11.245; 0.081			
Fatty Food Consumption	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	22.0	30.1	27.3	27.9	28.2	28.1	36.9	26.6	22.9
	No-change (%)	45.2	42.7	39.9	48.1	50.8	37.6	39.6	43.8	53.1
	Increase (%)	32.8	27.2	32.8	23.97	20.9	34.3	23.6	29.6	24.0
	χ^2; *p*-value	13.206; 0.001		21.337; 0.000			25.187; 0.000			
Eating High Caloric Food	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	14.1	18.4	15.9	18.4	19.6	17.9	20.2	16.4	15.6
	No-change (%)	38.3	32.4	30.3	40.3	39.1	24.5	31.1	36.2	42.8
	Increase (%)	47.6	49.2	53.8	41.4	41.3	57.7	48.7	47.4	41.6
	χ^2; *p*-value	8.101; 0.017		26.764; 0.000			27.008; 0.000			
Consuming Immune Booster	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	4.2	4.3	5.1	2.8	2.9	7.8	5.0	3.3	2.4
	No-change (%)	49.5	46.9	46.0	50.9	45.4	40.9	42.3	48.4	56.4
	Increase (%)	46.4	48.8	48.9	46.3	51.7	51.4	52.7	48.3	41.1
	χ^2; *p*-value	0.901; 0.637		7.961; 0.093			23.823; 0.001			
Drinking Water	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	4.7	5.2	6.4	2.3	4.8	7.0	5.8	4.4	4.0
	No-change (%)	38.2	32.9	30.5	39.9	40.2	30.2	32.2	33.7	44.2
	Increase (%)	57.2	61.8	63.121	57.762	55.026	62.805	61.983	61.894	51.825
	χ^2; *p*-value	4.475; 0.107		26.903; 0.000			17.318; 0.008			
Drinking Hot Beverages	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	23.9	76.1	5.4	2.6	1.2	5.3	4.5	4.0	2.6
	No-change (%)	36.3	33.2	32.0	36.8	36.6	26.6	31.8	33.7	45.9
	Increase (%)	60.6	62.3	62.6	60.7	62.3	68.1	63.6	62.3	51.5
	χ^2; *p*-value	2.896; 0.235		16.176; 0.003			26.301; 0.000			
Supplement Consumption	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	10.2	12.2	12.7	10.1	9.4	17.0	10.6	11.0	7.6
	No-change (%)	46.5	45.8	42.0	50.8	53.0	41.1	42.0	47.3	50.7
	Increase (%)	43.3	42.0	45.3	39.1	37.6	41.9	47.3	41.6	41.7
	χ^2; *p*-value	1.218; 0.544		12.62; 0.013			14.42; 0.025			
Late Night Eating	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	15.9	16.0	14.7	17.3	19.5	17.9	20.8	14.8	13.2
	No-change (%)	34.8	34.1	29.2	41.0	43.4	29.9	34.3	34.2	41.5
	Increase (%)	49.3	49.9	56.9	41.6	37.1	52.3	44.9	51.0	45.3
	χ^2; *p*-value	0.07; 0.965		38.65; 0.000			13.19, 0.040			
Eating In Restaurants	**Category**	**Gender**		**Age**			**education**			
		Male	**Female**	**18–29**	**30–39**	**>40**	**High School**	**Diploma**	**Bachelor**	**Postgraduate**
	Decrease (%)	55.4	69.0	64.9	66.6	56.9	61.9	63.6	65.3	66.7
	No-change (%)	29.9	21.0	20.9	25.9	37.1	22.9	24.7	23.7	24.8
	Increase (%)	14.7	10.0	14.1	7.6	6.0	15.2	11.7	11.1	8.6
	χ^2; *p*-value	21.33; 0.000		25.12; 0.000			4.97; 0.548			

Fruit and Vegetables	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	9.1	7.4	7.9	9.4	10.5	7.8	8.2	6.0
	No-change (%)	21.2	36.2	37.9	30.1	40.8	34.0	35.3	39.1
	Increase (%)	69.7	56.4	54.2	60.5	48.7	58.2	56.6	54.9
	χ^2; *p*-value	10.732; 0.217					1.613; 0.807		
Fatty Food Consumption	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	14.3	28.6	26.2	29.1	31.2	27.6	27.7	27.2
	No-change (%)	46.4	42.7	46.1	42.2	40.3	0.08	43.4	52.8
	Increase (%)	39.3	28.7	27.7	28.7	28.6	32.296	28.9	20.0
	χ^2; *p*-value	5.874; 0.661					7.865; 0.097		
Eating High Caloric Food	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	13.3	18.4	14.6	20.1	15.3	19.1	16.5	18.2
	No-change (%)	40.0	33.9	36.7	29.3	36.1	32.2	33.9	43.2

(*continued on next page*)

Table 3 (*continued*)

	Increase (%)	46.7	47.7	48.7	50.6	48.6	48.7	49.5	38.6
	χ^2; *p*-value	8.342; 0.401					7.296; 0.121		
Consuming Immune Booster	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	11.5	5.4	3.1	2.1	5.8	6.7	3.7	4.4
	No-change (%)	46.1	48.2	46.5	52.5	37.7	40.7	48.1	54.4
	Increase (%)	42.3	46.4	50.4	45.4	56.5	52.6	48.1	41.2
	χ^2; *p*-value	14.7; 0.065					9.9; 0.042		
Drinking Water	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	9.4	6.4	3.9	3.5	5.1	5.5	5.0	3.8
	No-change (%)	25.0	35.9	34.8	32.4	38.0	35.2	33.9	39.8
	Increase (%)	65.6	57.7	61.3	64.1	57.0	59.3	61.1	56.4
	χ^2; *p*-value	10.17; 0.253					2.3; 0.68		
Drinking Hot Beverages	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	10.0	5.5	2.3	3.2	3.9	4.5	4.0	3.8
	No-change (%)	43.3	34.9	34.8	28.5	40.3	28.4	34.6	40.0
	Increase (%)	46.7	59.6	62.9	68.8	55.8	67.2	61.4	56.2
	χ^2; *p*-value	19.787; 0.011					6.174; 0.186		
Supplement Consumption	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	10.7	12.0	11.4	10.6	12.5	17.130	11.101	5.983
	No-change (%)	39.3	45.3	46.9	48.8	46.4	40.741	46.209	52.991
	Increase (%)	50.0	42.7	41.8	40.6	41.1	42.130	42.690	41.026
	χ^2; *p*-value	1.694; 0.989					11.695; 0.020		
Late Night Eating	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	18.5	15.3	15.3	17.3	18.8	16.5	16.0	15.8
	No-change (%)	40.7	31.3	37.7	36.8	27.5	30.5	34.4	43.9
	Increase (%)	40.7	53.5	47.0	45.9	53.6	53.0	49.6	40.4
	χ^2; *p*-value	10.381; 0.239					6.558; 0.161		
Eating In Restaurants	**Category**	**Obesity**					**Income**		
		Under weight	**Normal weight**	**Overweight**	**Obese**	**Overly obese**	**Low**	**Middle**	**High**
	Decrease (%)	66.7	64.0	63.0	68.3	73.8	62.1	65.5	61.2
	No-change (%)	19.0	21.3	29.4	21.5	16.	22.6	24.1	24.3
	Increase (%)	14.3	14.6	7.5	10.2	9.5	15.3	10.4	14.6
	χ^2; *p*-value	20.748; 0.008					4.512; 0.341		

Fruit and Vegetables	Category	Job type								
		Not working	Military	Education	Agriculture	Management	Engineering	Manufacturing	Crafting	Health
	Decrease (%)	7.7	12.3	8.9	3.6	6.1	4.3	7.2	4.4	21.6
	No-change (%)	38.3	21.0	30.6	32.1	38.5	39.1	40.2	40.4	33.3
	Increase (%)	54.0	66.7	60.5	64.3	55.4	56.5	52.6	55.1	45.1
	χ^2; *p*-value	32.672; 0.008								
Fatty Food Consumption	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	28.6	28.6	25.3	24.1	27.9	16.7	26.0	30.5	32.0
	No-change (%)	41.8	32.5	39.9	41.4	50.9	57.1	53.1	44.3	46.0
	Increase (%)	29.5	38.9	34.8	34.5	21.2	26.2	20.8	25.2	22.0
	χ^2; *p*-value	30.237; 0.017								
Eating High Caloric Food	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease	16.5	19.0	15.5	31.0	18.3	9.1	14.4	19.4	18.0
	No-change	30.3	29.1	31.5	34.5	44.2	45.5	41.2	38.8	36.0
	Increase	53.2	51.9	53.00	34.5	37.5	45.5	44.3	41.8	46.0
	χ^2; *p*-value	33.722; 0.006								
Consuming Immune Booster	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	4.4	10.7	5.6	0.0	1.9	5.1	0.0	4.0	4.3
	No-change (%)	46.0	33.3	41.9	51.9	56.3	43.6	54.8	54.8	52.2
	Increase (%)	49.6	56.0	52.5	48.1	41.8	51.3	45.2	41.3	43.5
	χ^2; *p*-value	37.453; 0.002								
Drinking Water	**Category**	**Job type**								
			Military	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**

(*continued on next page*)

Table 3 (*continued*)

		Not working								
	Decrease (%)	5.1	8.6	5.9	0.0	2.2	12.5	4.0	2.9	5.7
	No-change (%)	35.4	30.9	33.6	42.9	34.1	35.4	44.4	33.6	30.2
	Increase (%)	59.5	60.5	60.5	57.1	63.8	52.1	51.5	63.5	64.2
	χ^2; *p*-value	22.195; 0.137								
Drinking Hot Beverages	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	4.5	2.6	5.9	0.0	1.7	2.1	5.3	2.2	0.0
	No-change (%)	33.0	35.9	33.6	32.1	38.5	39.6	42.1	28.9	34.6
	Increase (%)	62.5	61.5	60.5	67.9	59.7	58.3	52.6	68.9	65.4
	χ^2; *p*-value	23.913; 0.091								
Supplement Consumption	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	12.1	15.4	14.8	9.1	8.7	2.9	9.6	4.5	7.5
	No-change (%)	44.9	35.4	42.9	45.5	50.0	44.1	53.4	55.5	47.5
	Increase (%)	43.0	49.2	42.3	45.5	41.3	52.9	37.0	40.0	45.0
	χ^2; *p*-value	23.850; 0.093								
Late Night Eating	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	16.0	15.1	15.1	25.9	17.1	18.2	14.3	16.4	12.2
	No-change (%)	30.9	38.4	32.7	37.0	44.4	38.6	40.5	31.9	28.6
	Increase (%)	53.1	46.6	52.3	37.0	38.5	43.2	45.2	51.7	59.2
	χ^2; *p*-value	22.375; 0.132								
Eating In Restaurants	**Category**	**Job type**								
		Not working	**Military**	**Education**	**Agriculture**	**Management**	**Engineering**	**Manufacturing**	**Crafting**	**Health**
	Decrease (%)	68.6	48.2	63.5	45.8	64.8	65.7	64.1	68.2	56.8
	No-change (%)	21.5	30.4	22.3	41.7	27.5	20.0	26.9	22.4	32.4
	Increase (%)	9.9	21.4	14.2	12.5	7.7	14.3	9.0	9.4	10.8
	χ^2; *p*-value	22.998; 0.114								

and job type. However, more studies are needed to verify current results and evaluate disease-induced confinement's positive versus negative consequences. Additionally, strategies are warranted to encourage healthy DH and EB and counter the negative dietary effects during the current and future calamities.

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Declaration of competing interest

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

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