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Article

Lifestyle Variations During and After the COVID-19 Pandemic: A Cross-Sectional Study of Dietary, Physical Activities and Weight Gain Among the Adult Population

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Abstract: Since its inception in 2019, COVID-19 has been associated with significant changes in lifestyle-related behavior, including physical activity, diet, and sleep, which are vital to maintaining our well-being. This study measures lifestyle-related behavior during the COVID-19 pandemic lockdown using a 21-item questionnaire. The responses were collected from March 2021 to September 2021. Four hundred sixty-seven participants were engaged in assessing the changes caused by the pandemic and their effect on BMI. The validity and reliability of the questionnaire were tested for 71 participants. Cronbach's alpha values for the questionnaire all exceeded 0.7, demonstrating good validity and internal consistency for it. The effect of each question regarding physical activity and dietary habits over the BMI difference was studied using ANOVA. The study shows that more than half of the participants reported snacking more between meals and increased their sitting and screen time, while 74% felt more stressed and anxious. These indications were the cause of the increase in the BMI rate for individuals in the lockdown. In contrast, 62% of the participants showed more awareness about their health by increasing the intake of immunity-boosting foods, and 56% of the participants showed an increase in the consumption of nutrition supplements. Females and married individuals tended to be healthier, so their BMI showed stability compared to others based on their gender and marital status.

Keywords: COVID-19 Pandemic; Dietary habits; BMI; Nutrition; Family; Household; Healthy Food; Dietary Supplements intake; lifestyle; weight gain.

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1. Introduction

Throughout history, humanity has experienced several pandemics and diseases that affected lives and caused massive infections and deaths, such as the Cyprian Plague in 250 AD, Leprosy in the 11th century, and the Black Death in 1350. Moreover, the Russian and Spanish Flu in 1889 and 1918 respectively, and severe acute respiratory syndrome (SARS) in 2003, ending with COVID-19 in 2019 until the present [1-2]. These pandemics led to enormous life-changing challenges in many aspects such as human health, lifestyle, and social life. Moreover, it affected local and global economies [1].

Several researchers have studied the effects of these pandemics. For instance, Horgan [3] mentioned that the Cyprian Plague caused political turbulence as the outbreak claimed the lives of two emperors: Claudius II Gothicus in 270 CE and Hostilian in 251 CE. Moreover, turbulence in the economic situation appeared as the farmers moved to cities instead of farms because of the spread of the pandemics in the rural areas, which minimized agricultural production, leading to instability in the economic situation.

Furthermore, Black Death also had a massive economic effect in 1350. In North Africa, mainland Italy, Spain, France, Austria, Hungary, Switzerland, Germany, and several countries went into extreme inflation since it was hazardous to procure goods through external traders and because of the difficulty to produce goods due to the massive number of deaths between workers and farmers. So, the prices of both goods produced locally and those imported from afar skyrocketed [3]. In 2003, SARS emerged, which infected 8,096 people in 29 countries, and 774 died. Moreover, during the SARS outbreak, China's growth dragged down in the first quarter of 2003 from 11.1% to 9.1% [4].

Recently, all humanity worldwide suffered from SARS modified virus that was named Coronavirus disease (COVID-19). The first case was declared in Wuhan, China, on Nov 17, 2019 [5]. Then World Health Organization (WHO) declared it a global pandemic on Mar 11, 2020, because of its rapid spreading [6]. Thus, COVID-19 started and was followed by subsequent global outbreaks for months. The WHO recorded over 218 million reported cases of coronavirus and approximately 4.5 million deaths globally until Sept 1, 2021 [7]. Because of the disease's rapid dissemination at the beginning of the pandemic, governments worldwide were forced to impose strict measures to stop or decrease its spread, such as total or partial lockdowns, quarantine, and social distancing [8-11].

In Jordan, parallel with most countries worldwide, the government quickly restrained the spread of the virus due to this outbreak. Complete lockdowns began on Mar 21, 2020, for two weeks, and partial lockdowns were implemented until Sept 1, 2021, closing the non-essential public places. In addition, telework and distance learning was initiated, delivery services like delivering drugs to chronically ill patients were provided, and during the night and the lockdown, cities were sanitized as part of the National Disinfection Program [10-11].

During the quarantine worldwide, uncertainty about the future led work owners to reduce the number of workers or the wages because of the spread of this virus. Moreover, with the work shortages and reducing salaries, healthy nutrition accessibility and affordability were compromised, causing people to adopt more palatable, cheaper, and potentially unhealthy choices, affecting their diet consistency [12-14]. Several studies noted that

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an unhealthy diet and the side effects of the quarantine on movement have negatively impacted people and their immune status [15]. People's psychological situation was also affected because of the long time they spent in their houses and prevented them from going out. Because of these reasons, people focused on their daily needs, like cooking, eating, and sleeping. Moreover, people increased their laziness, decreased the number of exercises, and adopted terrible eating habits. Several researchers have shown the harmful effects of negative eating habits such as elevated calorie intake, more regular snacking, decreased fresh fruit and vegetable consumption, and weight gain during the lockdown [14-16].

A study conducted in the U.K. and Scotland [17] attempted to identify the effect of lifestyle restrictions on mental health. It found that the changes in diet, quality of sleep, and physical activity negatively affected people's mood and health behaviors in the lockdown. Another study conducted in Australia found a significant effect of the lockdown on social connectedness, relationships, financial stress, health-promoting behaviors, and emotional well-being [18]. A study conducted in Cyprus found that COVID-19 lockdown affected all lifestyle aspects: diet, stress, sleep, social support, and physical activity [19]. An online cross-sectional survey conducted during the social lockdown in the United Kingdom found that lifestyle behaviors associated with weight gain are likely to have been affected by the COVID-19 crisis. Successful weight control was not possible with the diet's health and binge eating habits; therefore, people with mental health and obesity problems may be at higher risk [20].

In Jordan, restaurants and shops were closed during the full quarantine for twenty-seven days from Mar 15 to Apr 12, 2020, and home delivery of fast food, meals, and daily requirements were highly restricted. The lockdown has impacted the eating habits of people during the pandemic. Most households depended on home cooking at least for the main meals because of the limited access to fast food, food delivering and staying at home. Recent studies have discussed the effect of diet and lifestyle on the health of the Jordanian population. One of these studies [21] discussed the effect of sedentary hours, homemade food, and fast food on obesity and body mass index (BMI). The increase in sedentary hours, lack of adequate daily exercise, and fast food and snacking habits increased obesity in the Jordanian population. Another study also discussed the tendency of eating ready food instead of homemade meals and their effect on the weight and BMI of subjects [22].

In this paper, we conducted a questionnaire to study the changes in Jordanians' behavior during the quarantine and after the lockdown of the country and its effect on gaining weight and BMI changes. The questionnaire addressed significant lifestyle-related behaviors, namely diet, physical activity, and sleep patterns, with short, crisp, scientifically structured, easy to use, and relevant questions for the Jordanian population to assess lifestyle-related behaviors. And to collect better quality data, a reliable and valid questionnaire was constructed. Validity and reliability are two fundamental elements used in the evaluation of the questionnaires. Validity refers to the appropriateness, significance, and usefulness of a measure for a specific purpose. In addition, it refers to the extent to which the measures are useful predictors of essential outcomes [23]. Reliability is concerned with the ability of a questionnaire to measure consistently. The reliability of a questionnaire

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does not depend on its validity, and a questionnaire cannot be valid unless it is reliable [24].

To ensure that the questionnaire is reliable or not, we should provide a measure for internal consistency. It must be noted that internal consistency should be determined before examining the survey to ensure validity. Cronbach Alpha, which is considered one of the most widespread reliability measure methods, was developed by Lee Cronbach in 1951 to indicate internal consistency [24]. It is associated with the inter-relatedness of questions, which indicates that items in the test measure have the same construct. The alpha value is expressed as a number range between (0 and 1) depending on the test's nature. The value of alpha increases if the items in a test are correlated to each other, which means that items are more strongly interrelated. Cronbach's alpha equal to zero indicates no internal consistency, whereas alpha equal to one reflects perfect internal consistency. Still, it does not mean that if we have a high alpha value, the test always has a high degree of internal consistency. Because sometimes, it indicates that some items may be redundant or may be affected by the length of the questionnaire. The alpha value decreases as the test length is short and increases as the number of items and variability of each item increases [25]. Practically, Cronbach's Alpha of at least 0.70 has been suggested to indicate adequate internal consistency.

Validity means "measure what is intended to be measured" [26]. It is essential to realize that any measurement technique measures what it is designed to measure. It is much easier to assess with the help of principles component analysis (PCA). PCA is a dimensionality – statistical reduction technique. It was initially developed to enhance the understanding of questionnaires composed of a large number of correlated variables. It is achieved by transforming many possibly correlated variables into a smaller number called 'principal components' while retaining the variation present in the data set. Thus, a smaller data set of uncorrelated variables are easier to understand, realize, visualize and use in further analysis than a more significant set [27-28].

Some researchers [24-29] are interested in measuring the reliability and validity of their questionnaires to get good results, but sometimes they may hesitate to use the alpha method to test reliability. Since alpha is affected by the number of items count, increasing the number of items could indicate a high similarity, but the correlation does not change. Also, it requires the question's covariances to be equivalent, implying they have at least one common factor. Likewise, the PCA technique to test the validation of a survey has a drawback that may affect its application. The covariance of data obtained is difficult to evaluate accurately, so that it could affect the accuracy of the results obtained later.

2. Materials and Methods

2.1. Subjects

The questionnaire population consisted of Jordanian people from different social strata above the age of 18. We received 467 responses distributed as follows; we received 297 (64.026%) responses from females and 170 (36.403%) from males. The population age was between 18 to 103 years old. The mean and standard deviation of the respondents' height was 168.2 cm and 9.4, respectively. Moreover, the mean and standard deviation for the

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respondents were 73.4% and 18.3, respectively. Most respondents (86%) live as a small family formed by mother and father and their children only, called the nucleus family.

2.2. Research Tools and Data Collection

The questionnaire was prepared previously in research by Balanzá–Martínez named "*A short questionnaire to assess changes in lifestyle-related behavior during COVID 19 pandemic*" [30]. In the current study, this questionnaire was applied to the Jordanian society with a population of 6000000 after translating the questionnaire from English into Arabic. Using the software, we calculated the needed number of responses which is 385 or more, to have a confidence level of 95%. And the real value is within ±5% of the measured/surveyed values. The 21-item questionnaire was filled by Jordanian people aged 18 years and above who could read, write, and respond to an online web-based questionnaire. Responses under each item consist of *significantly increased, slightly increased, grossly similar, slightly decreased significantly decreased*. In scoring, five points were assigned to answer "*significantly increased*," and one point was assigned to answer "*significantly decreased*." In addition, the investigators recruited participants in different demographic strata such as age, gender, and socio-economic status to fulfill maximum diversity. Questionnaires were completed online by using Google forms. The online data was collected in August 2021. In the beginning, A sample of 71 respondents data was collected to validate the questionnaire. Then, a total of 467 responses was received. All the candidates completed the questionnaire by themselves, and there were no missed answers in the responses.

2.3 Statistical analysis

2.3.1 Construct Validity and reliability.

The Cronbach's α coefficients for the questions were calculated; the α coefficient reflects the degree of the internal consistency directly. Cronbach's α coefficients are generally considered to indicate good internal consistency if $\alpha \geq 0.70$ [31]. The validity of a questionnaire was established by construct-related evidence. Items were subjected to a principal components analysis.

2.3.2 Data analysis

Descriptive statistics were used to analyze the Sociodemographic variables by counts and percentages for discrete variables and mean and S.D. for continuous variables. Afterward, Q-Q plots and O'Brien test were used to assess normality and unequal variances for the BMI difference variable, respectively. Since no violations were found, ANOVA was used to test the means of BMI difference. Then if the p-value was significant for the ANOVA, Tukey-Kramer HSD was applied to study pairwise comparisons and find the differences. On the other hand, Q-Q plots and O'Brien test were used for the age variable, a violation was found for normality assumption. So log transformation was applied before the ANOVA model was utilized. Moreover, the Chi-square test was used to study the effect of demographic variables on the respondents' choices for physical activity and dietary questions.

All these analyses are done by using JMP software with confidence interval $\alpha = 0.05$.

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3. STATISTICAL RESULTS

3.1 Reliability of the Questionnaire

Cronbach α is calculated to know the internal consistency. All Cronbach α values for the questionnaire are greater than 0.7, as shown in Table 1. It is considered an accurate estimate for reliability; because the values of 0.7 or 0.8 are considered an acceptable high value [35, 36].

Table 1: Cronbach α values for the questionnaire questions

Question Number	Question	Alpha
Q 10	During the COVID pandemic, how has your weight changed?	0.7277
Q 11	Have you ever had COVID-19?	0.7530
Q 12	During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?	0.7296
Q 13	During the COVID pandemic, how has your habit of snacking between meals changed?	0.7046
Q 14	During the COVID pandemic, how has your quantity/portions of meals and snacks changed?	0.7152
Q 15	During the COVID pandemic, how has your daily intake of fruits and vegetables changed?	0.7387
Q 16	During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, legumes, eggs, nuts, fruits, and vegetables) changed?	0.7515
Q 17	During the COVID pandemic, how has your consumption of junk food/fast food changed?	0.7277
Q 18	During the COVID pandemic, how has your consumption of fried food changed?	0.7247
Q 19	During the COVID pandemic, how has your intake of sugar-sweetened beverages (carbonated soft drinks, sugar-sweetened juices) changed?	0.7221
Q 20	During the COVID pandemic, how has your consumption of sweets/candies/chocolate changed?	0.7048
Q 21	During the COVID pandemic, how has your participation in cooking new/traditional recipes changed?	0.7392
Q 22	During the COVID pandemic, how has your consumption of unhealthy food when you are bored or stressed or upset changed?	0.7212

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Q 23	During the COVID pandemic, how has your intake of immunity-boosting foods (lemon, garlic, turmeric, green leafy vegetables, and citrus fruits) in the diet changed?	0.7403
Q 24	During the COVID pandemic, how has your intake of nutrition supplements to boost immunity changed?	0.7413
Q 25	During the COVID pandemic, how has the support of your family and friends in eating healthy changed?	0.7499
Q 26	During the COVID pandemic, how has your interest in learning healthy eating tips from the media (newspaper articles/magazines blogs/videos/T.V. shows/text messages) changed?	0.7471
Q 27	During the COVID pandemic, how has your participation in aerobic exercise changed?	0.7416
Q 28	During the COVID pandemic, how has your participation in leisure and household chores changed?	0.7407
Q 29	During the COVID pandemic, how has your sitting and screen time changed?	0.7260
Q 30	During the COVID pandemic, how have your hours of sleep changed?	0.7405
Q 31	During the COVID pandemic, how have your stress and anxiety levels changed?	0.7395

3.2 Validation of the Questionnaire

There are two tests and two P values. The first test χ^2_{231}= 645.801, P-value <0.0001, which is a significant value, so the H_0 was rejected, which indicates there is a common factor between the questions. The second test χ^2_{131} = 152.714, P-value = 0.0943. So H_a was rejected. That indicates that more than five factors are needed to describe the principal component. The item loading 0.40 or more under these five factors was considered. Studying the factor loadings point out that each of the factors has an explanation except for factor five. As factor five had only two items, one of them had a negative sign which indicates that question number eleven that has the negative sign is excluded from the computation because it had a negative effect on the factors.

We named the first factor bad dietary habits because all the questions discuss changes in eating habits during the pandemic. The second factor was called social awareness about health, and the third factor was named changing in doing activities during the lockdown. Furthermore, factor four was labeled changing in consuming healthy food. As seen in Table 2, Factor 1 includes eight items, Factor two includes four items, Factor three includes three items, and Factor four includes two items. These four factors accounted for 43.468% of the variance. Factor 1 accounts for 18.053 % of the total variance, Factor 2 10.920 %; Factor 3 7.404 %, and Factor 4 7.091%, respectively.

The results of the principal component analyses with subsequent Varimax rotation are detailed in Table 2:

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Table 2: principal component analyses result with subsequent Varimax rotation

Question number	Factor 1 (18.053 %)	Factor 2 (10.920 %)	Factor 3 (7.404 %)	Factor 4 (7.091 %)	Factor 5 (5.707 %)
Q 13	0.819114				
Q 20	0.773951				
Q 14	0.741105				
Q 22	0.660766				
Q 18	0.626691				
Q 19	0.605300				
Q 10	0.571305				
Q 17	0.529364				
Q 26		0.759410			
Q 25		0.745917			
Q 23		0.685521			
Q 24		0.421876			
Q 28			0.617566		
Q 29			0.588326		
Q 21			0.532338		
Q 16				0.728755	
Q 15				0.712990	
Q 12					0.671860
Q 11					-0.503897
Q 27					
Q 30					

3.3 Demographics Summary

Since reliability was studied and it showed good internal consistency, and the validation proved that the questionnaire could be used successively, we studied the effect of each variable on the BMI difference and the effect of each variable among others.

The following charts (Figure 1 and Figure 2) contain a summary of demographic variables. Also, the normality of the BMI difference was tested by using a Q-Q plot per group for each variable, and no violation for the normality assumption to use ANOVA was found.

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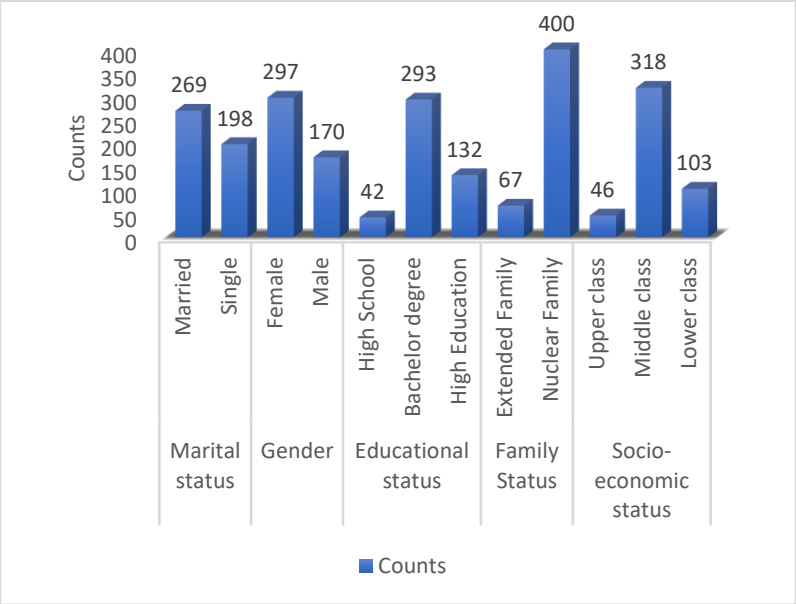

Figure 1: Distribution of respondents counts over demographic variables

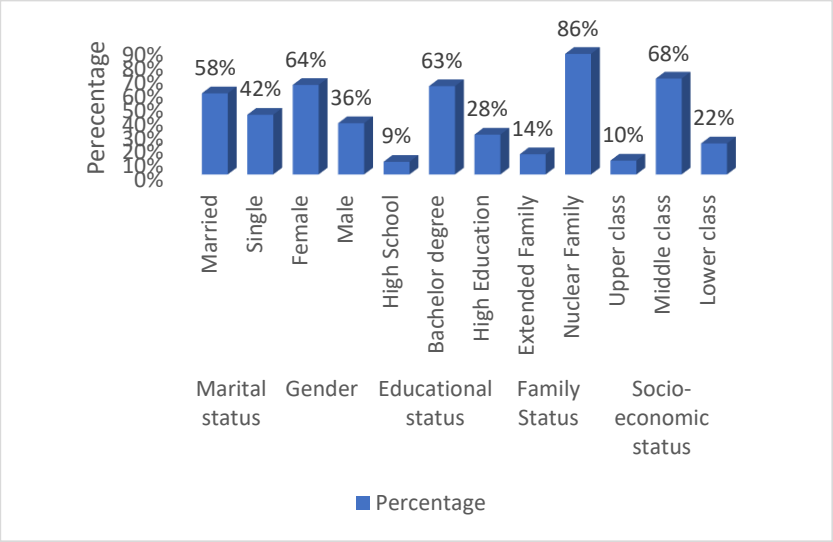

Figure 2: Distribution of respondents' percentage over demographic variables

The following graphs (Figure 3 (A-D)) summarize the demographic data concerning gender and BMI changes before and after the pandemic. In the first chart, there is a difference between single males and females. In general, males increased their BMI, in contrast with females' BMI, where their BMI decreased during the quarantine of the COVID-19 pandemic. On the other hand, married females showed an increase in BMI over married males.

Moreover, in the second chart, the males from high school strata, from the educational status, showed a decrease in their BMI compared to relative stability in the BMI in the higher educational strata.

Furthermore, in the third chart, the males from the extended families clearly decreased their BMI during the pandemic. Also, males in the extended family showed an

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increase in their BMI while females from the same category showed a decrease in their BMI.

Finally, in the fourth chart, males of below-average economic and social strata decreased their BMI, whereas the females showed an increase. The increase in the BMI illustrates unhealthy habits that the people in the COVID-19 pandemic adopted.

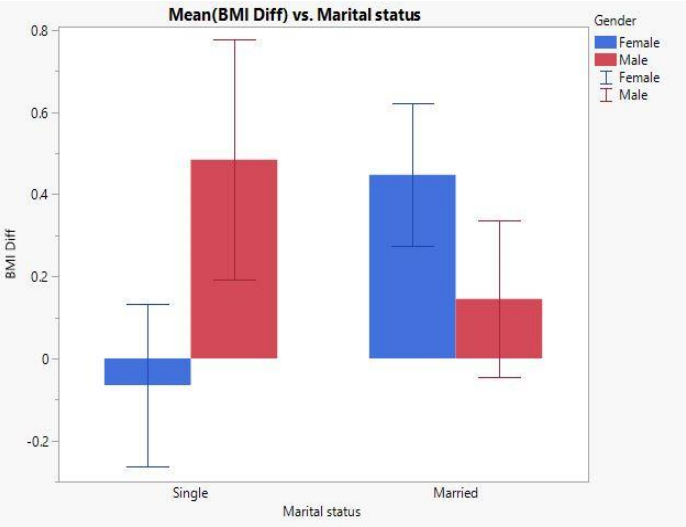

Figure 3-A: Summary of the respondents regarding Marital Status, gender, and changes in BMI values.

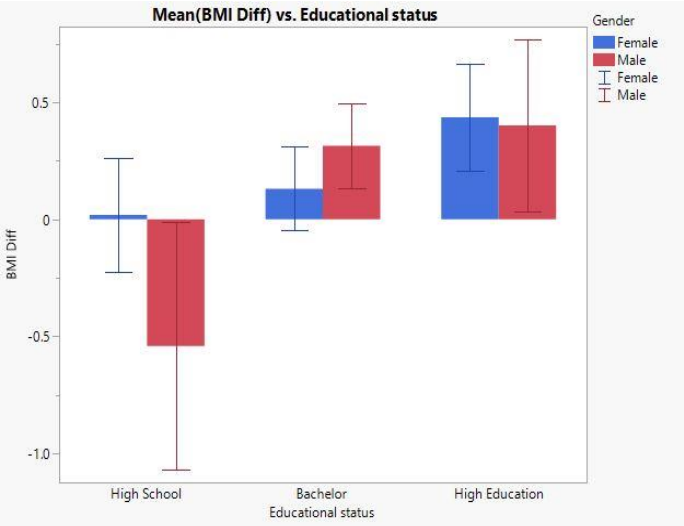

Figure 3-B: Summary of the respondents regarding Educational Status, gender, and changes in BMI values.

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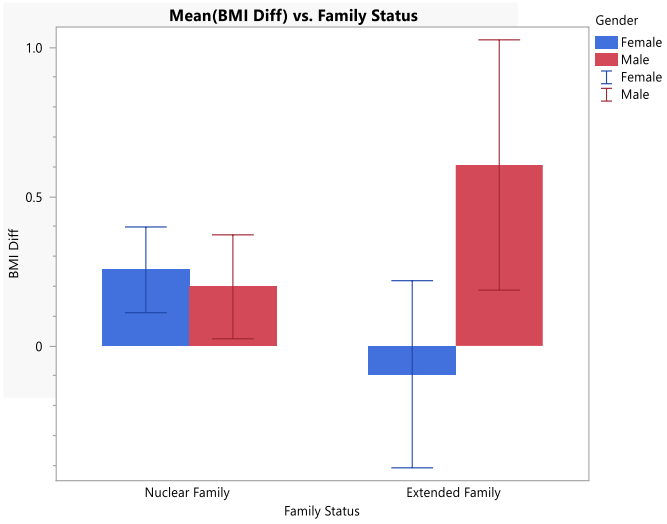

Figure 3-C: Summary of the respondents regarding family status, gender, and changes in BMI values.

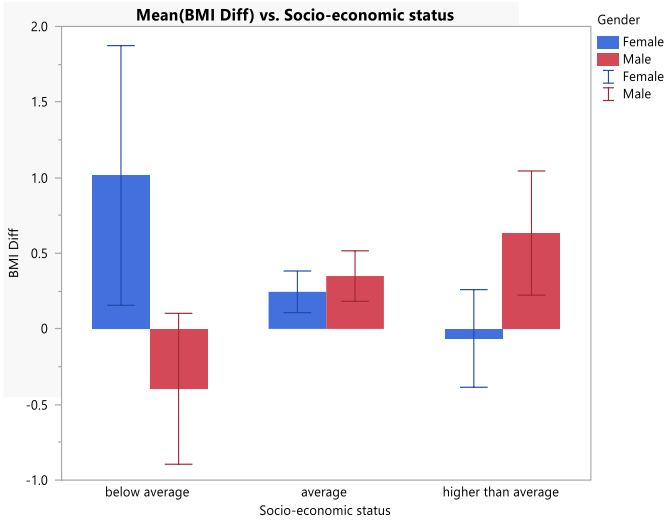

Figure 3-D: Summary of the respondents regarding Socio-economic Status, gender, and changes in BMI values.

We found the percentages of participants who exhibited a different behavior concerning the different variables in the questionnaire. In the following graph, we stated the questions that have an increased response behavior in the questionnaire.

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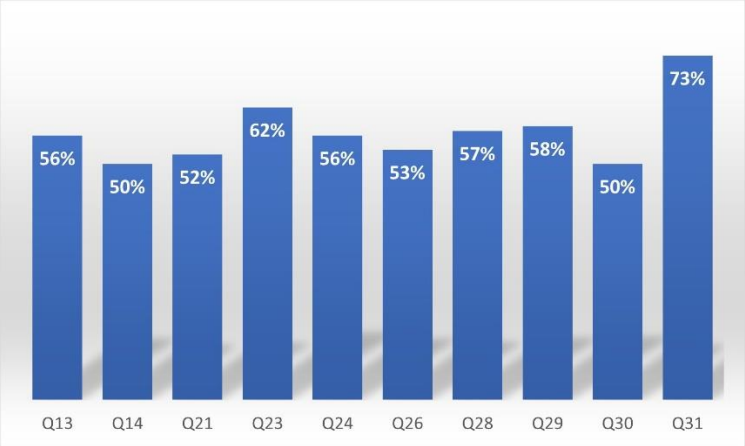

Figure 4: Percentages of participants showed an increased behavior according to questions.

Moreover, unequal variances for each variable were tested, and it was found to be insignificant. Then the ANOVA test was used. For the significant questions, the ratio between the higher S.D. and the lower S.D. was tested. We found that all ratios are around two, which is acceptable. So, we ended up using the ANOVA test again to test the effect of each question on the BMI difference. After using ANOVA for all questions, we found twelve significant questions. The P-value for each significant question is shown in Table 3.

Table 3:The P-value for each significant question in the questionnaire.

Question Number	Question	P-Value
Q 12	During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?	0.0002
Q 13	During the COVID pandemic, how has your habit of snacking between meals changed?	< 0.0001
Q 14	During the COVID pandemic, how has your quantity/portions of meals and snacks changed?	< 0.0001
Q 17	During the COVID pandemic, how has your consumption of junk food/fast food changed?	< 0.0001
Q 18	During the COVID pandemic, how has your consumption of fried food changed?	< 0.0001
Q 19	During the COVID pandemic, how has your intake of sugar-sweetened beverages (carbonated soft drinks, sugar-sweetened juices) changed?	< 0.0001
Q 20	During the COVID pandemic, how has your consumption of sweets/candies/chocolate changed?	< 0.0001

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Q 22	During the COVID pandemic, how has your consumption of unhealthy food when you are bored or stressed or upset changed?	< 0.0001
Q 25	During the COVID pandemic, how has the support of your family and friends in eating healthy changed?	0.0316
Q 26	During the COVID pandemic, how has your interest in learning healthy eating tips from the media (newspaper articles/magazines blogs/videos/T.V. shows/text messages) changed?	0.0182
Q 27	During the COVID pandemic, how has your participation in aerobic exercise changed?	0.0275
Q 29	During the COVID pandemic, how has your sitting and screen time changed?	< 0.0001

To find where the differences are, we used Tukey-Kramer HSD. We stated all significant pairwise comparisons in Table 4.

Table 4: The results of Tukey-Kramer HSD for significant pairwise comparisons.

Level	Level	Difference	P-Value
Q.12 During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?			
5	2	1.2923	0.0051
5	1	1.2392	0.0227
5	3	1.0599	0.0020
Q.13 During the COVID pandemic, how has your habit of snacking between meals changed?			
5	1	2.4795	< 0.0001
4	1	2.0390	< 0.0001
5	2	1.6959	< 0.0001
3	1	1.2864	0.0413
4	2	1.2554	0.0055
5	3	1.1931	< 0.0001
4	3	0.7526	0.0242
Q.14 During the COVID pandemic, how has your quantity/portions of meals and snacks changed?			
5	1	2.6626	< 0.0001
5	2	2.4653	< 0.0001
4	1	2.2646	< 0.0001
4	2	2.0674	< 0.0001
3	1	1.5543	0.0067
3	2	1.3570	0.0007

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5	3	1.3569	0.0004
4	3	1.1083	0.0240
Q.17 During the COVID pandemic, how has your consumption of junk food/fast food changed?			
5	1	2.2987	< 0.0001
5	4	1.6534	< 0.0001
5	2	1.6142	0.0001
5	3	1.4128	0.0001
3	1	0.8859	0.0084
Q.18 During the COVID pandemic, how has your consumption of fried food changed?			
5	1	2.5284	< 0.0001
4	1	2.0241	< 0.0001
1	2	1.8286	< 0.0001
4	2	1.3243	0.0011
5	3	1.3163	0.0003
3	1	1.2121	0.0101
4	3	0.8120	0.0207
Q.19 During the COVID pandemic, how has your intake of sugar-sweetened beverages (carbonated soft drinks, sugar-sweetened juices) changed?			
5	1	1.8895	< 0.0001
5	2	1.7487	< 0.0001
4	1	1.5723	< 0.0001
4	2	1.4314	0.0007
5	3	0.9997	0.0071
3	1	0.8898	0.0269
Q.20 During the COVID pandemic, how has your consumption of sweets/candies/chocolate changed?			
5	1	2.0835	< 0.0001
5	2	1.7454	< 0.0001
4	1	1.5265	0.0006
5	3	1.2218	< 0.0001
4	2	1.1884	0.0063
Q.22 During the COVID pandemic, how has your consumption of unhealthy food changed when you are bored or stressed, or upset?			
5	1	2.0007	< 0.0001
5	2	1.4506	0.0035
5	3	1.4294	< 0.0001
4	1	1.3947	0.0079
4	3	0.8234	0.0070

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Q.26 During the COVID pandemic, how has your interest in learning healthy eating tips from the media (newspaper articles/magazines blogs/videos/T.V. shows/text messages) changed?			
2	5	1.9564	0.0163
Q.29 During the COVID pandemic, how has your sitting and screen time changed?			
5	1	2.3644	< 0.0001
2	1	2.2563	0.0114
4	1	2.0589	0.0012
3	1	1.6029	0.0195
5	3	0.7615	0.0149

Moreover, for the other factors (gender, marital status, educational status, family status, socio-economic status), the significance of their effect over the choices of each question was studied using the usual chi-square test. And the P-values for the significant questions are mentioned below in Table 5. Afterward, the percentages for each choice for the questions with significant p-values were studied.

We found three significant questions associated with gender. In the three questions, females showed more increase in the percentage than males; in question sixteen, females with percent (18.52%) showed more increase in consuming healthy food than males with percent (8.24%). Moreover, in question twenty-one, females showed an essential interest in cooking new and traditional meals with percent (36.7%) more than males (18.24%). Also, in question twenty-eight, females increased the household chores with percent (32.32%) more than males (17.65%).

For the marital status, we found eight questions. We illustrated two of them; in question thirteen, single persons increased the amount of consuming snacks between the meals with percent (51%), whereas married people increased snacking with percent (61%). Also, in question thirty, there is a significant difference in the increase of sleeping hours, where married people increased the amount of sleep by a percent (38.66%), while single people increased them by only (21.72%).

For the educational status, we found eight significant questions. We noticed a variation between the high school persons with bachelors and highly educated people in question thirteen. High school persons increased their snacking by only (40%), the bachelor and highly educated people by 57% and 58%, respectively.

Moreover, we noticed that eating vegetables and healthy food in questions fifteen and twenty-five are significantly associated with nutrition supplements intake in question twenty-four. Similarly, we found a negative relation between the questions seventeen, eighteen, twenty, twenty-one, which are considered unhealthy dietary habits, with question twenty-four; most people increased their intake of nutrition supplements with the decrease of junk food intake or vice versa.

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Table 5: The P-value of the significant questions concerning the demographics variables

Q. Number		P-Value
	Gender	
Q.16	During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, legumes, eggs, nuts, fruits, and vegetables) changed?	0.0129
Q. 21	During the COVID pandemic, how has your participation in cooking new/traditional recipes changed?	< 0.0001
Q. 28	During the COVID pandemic, how has your participation in leisure and household chores changed?	0.0001
	Marital status	
Q.12	During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?	0.0049
Q.13	During the COVID pandemic, how has your habit of snacking between meals changed?	0.0097
Q.14	During the COVID pandemic, how has your quantity/portions of meals and snacks changed?	0.0478
Q.16	During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, legumes, eggs, nuts, fruits, and vegetables) changed?	0.0410
Q.21	During the COVID pandemic, how has your participation in cooking new/traditional recipes changed?	0.0299
Q.23	During the COVID pandemic, how has your intake of immunity-boosting foods (lemon, garlic, turmeric, green leafy vegetables, and citrus fruits) in the diet changed?	0.0191
Q.24	During the COVID pandemic, how has your intake of nutrition supplements to boost immunity changed?	0.0037
Q.30	During the COVID pandemic, how have your hours of sleep changed?	0.0007
	Educational status	
Q. 13	During the COVID pandemic, how has your habit of snacking between meals changed?	0.0213

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Q. 16	During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, legumes, eggs, nuts, fruits, and vegetables) changed?	0.0007
Q. 24	During the COVID pandemic, how has your intake of nutrition supplements to boost immunity changed?	0.0005
Q. 25	During the COVID pandemic, how has the support of your family and friends in eating healthy changed?	0.0362
Q. 29	During the COVID pandemic, how has your sitting and screen time changed?	0.0362
Q. 30	During the COVID pandemic, how have your hours of sleep changed?	0.0010
Q. 23	During the COVID pandemic, how has your intake of immunity-boosting foods (lemon, garlic, turmeric, green leafy vegetables, and citrus fruits) in the diet changed?	0.0278
Q. 28	During the COVID pandemic, how has your participation in leisure and household chores changed?	0.0279
	Family Status	
Q. 13	During the COVID pandemic, how has your habit of snacking between meals changed?	0.0019
Q. 22	During the COVID pandemic, how has your consumption of unhealthy food when you are bored or stressed or upset changed?	0.0201
	Socio-economic status	
Q. 12	During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?	0.0032
Q. 13	During the COVID pandemic, how has your habit of snacking between meals changed?	< 0.0001
Q. 14	During the COVID pandemic, how has your quantity/portions of meals and snacks changed?	0.0082
Q. 15	During the COVID pandemic, how has your daily intake of fruits and vegetables changed?	0.0002
Q. 16	During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, legumes, eggs, nuts, fruits, and vegetables) changed?	< 0.0001

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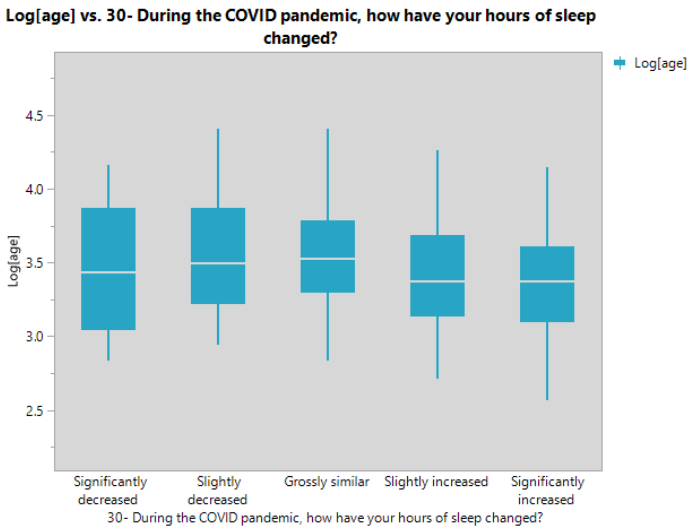
Q.18	During the COVID pandemic, how has your consumption of fried food changed?	0.0262
Q. 19	During the COVID pandemic, how has your intake of sugar-sweetened beverages (carbonated soft drinks, sugar-sweetened juices) changed?	0.0385
Q.21	During the COVID pandemic, how has your participation in cooking new/traditional recipes changed?	0.0007
Q. 23	During the COVID pandemic, how has your intake of immunity-boosting foods (lemon, garlic, turmeric, green leafy vegetables, and citrus fruits) in the diet changed?	0.0017
Q. 25	During the COVID pandemic, how has the support of your family and friends in eating healthy changed?	0.0149
Q. 30	During the COVID pandemic, how have your hours of sleep changed?	0.0181
Q. 31	During the COVID pandemic, how have your stress and anxiety levels changed?	0.0440

Furthermore, the relation between sleeping patterns and age has been studied. But, the age data didn't follow the normality assumptions, so the data were transformed using the Log transform before the analyses. And found that the respondents who increased their sleeping hours tend to have a younger mean of age for all significant pairwise comparisons. For more information about Log transform, see [37].
The following graph distributes the log of age on each group with the sleeping patterns.



The significant pairwise comparisons from the Tukey HSD test were found, and the differences were back-transformed (table 6).

Table 6: Significant pairwise comparisons from the Tukey HSD test.

Level	- Level	Difference	Exp(Difference)	p-Value

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2	5	0.202	1.224	0.0041*
3	5	0.172	1.188	0.0008*
3	4	0.122	1.130	0.0406*

4. Discussion and Conclusions

Covid-19 originated in Wuhan, China. It swiftly spread around the world. Furthermore, the zoonotic origin of Corona has not been confirmed yet [1, 11]. According to the propagation, many countries worldwide did total and partial lockdowns to prevent the spreading of the virus. Those lockdowns affected people's psychological, dietary, healthy, and social life behaviors [38-40].

As this study aimed to discover the impact of COVID-19 quarantine on Jordanian people during the lockdowns, a questionnaire with 21 questions was prepared using Google forms, and 467 responses were received from several and varied people levels. Two hundred ninety-seven responses from Females were received, with a percent equal to 63.597%, and 170 responses for Males with a percent equal to 36.403%.

Moreover, 269 responses were received from Married people, with a percent equal to 57.602%, and 198 responses for Singles with a percent equal to 42.398%. Four hundred responses from Nuclear Families were received, with a percent equal to 85.653%. Also, 293 responses were received for bachelor degrees holders with 62.741%. Also, 318 responses were received for Middle-class people in socio-economic status with 68.094%.

After getting the responses and analyzing the responses categories, the questionnaire's validity and reliability were checked. The questionnaire was found to be reliable with a good internal consistency where the α= 0.7427. Moreover, each question has an α value smaller than the value α = 0.7515, which belonged to question 16, and greater than the value α=0.7046, which belonged to question 13. So, all the values are greater than 0.7. So we have good internal consistency.

Also, the validity of the questionnaire was studied and the 21-items were analyzed with the associated factors. We found that the questions were distributed in five factors, and the first factor is called bad dietary habits. It includes the questions 13, 20, 14, 22, 18, 19, 10, and 17. The second factor is called social awareness about health. It includes questions 26, 25, 23, and 24. The third factor is called *changing in doing activities during the lockdown*. It includes questions 28, 29, and 21. The fourth factor is called *the change in consuming healthy food*. It includes questions 16 and 15. Factor five contains only two questions; one of them has a negative sign: question 31, which means the question negatively affected the factor, and it was excluded from the computations. Moreover, we found three questions that did not belong to any factors, namely 27, 30, and 31.

Then, the effect of the questions on the difference in BMI before and after the pandemic was tested by using ANOVA. Twelve significant questions were found (12, 13, 14, 17, 18, 19, 20, 22, 25, 26, 27, and 29).

Tukey-Kramer HSD was used to study the significant pairwise comparisons. In question 26, the mean of the lower-level scale was higher than the mean of the higher-level scale. This difference means the decrease of good dietary habits causes an increase in BMI. On the other hand, the other questions that described bad dietary health have a

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higher mean for the higher-level scale than the lower-level scale, which increases terrible nutritional habits. That indicates that the decrease of bad dietary habits causes a reduction in BMI. That is logical and expected. Thus, that proves the integrity of the questionnaire.

Moreover, the effect of the other factors such as gender, marital status, educational status, family status, and socio-economic status over the questions choices were studied. We found three significant questions associated with gender, eight questions to the marital status, eight questions to the educational status, two questions to the Family status, and twelve questions to the Socio-economic status. Under the gender factor, several studies [41-42] showed that females generally have a healthy lifestyle. Men have a higher likelihood of smoking and being overweight, both of which are linked to harmful health [41]. Under the gender factor, several studies showed that females, in general, have a healthy lifestyle. Bothmer et al. [33] cross-sectional study showed that Females had healthier habits than their male counterparts in alcohol consumption and nutrition and were also more motivated for a healthy lifestyle. According to the research, the lockdown had just a negligible impact on the eating patterns of adults. The most significant findings were that a significant number of respondents reported eating more, snacking more, exercising less, and gaining weight during the lockdown. The quantity of time spent at home (e.g., a higher frequency of cooking) and a more considerable degree of emotional eating during the lockdown (e.g., a higher intake of pastries and wine) might be connected to the results. In general, women were more impacted than males [41]. The current questionnaire showed a noticeable difference between the females and the males in balanced diet intake. The females showed up some more care by increasing eating healthy ingredients, such as whole wheat, pulses, eggs, legumes, nuts, fruits, and vegetables, with a percent of 18.52% more than males where their percent is 8.24%. Moreover, the females spent more time cooking new/traditional recipes during the pandemic with a percent 36.7%, in comparison with 18.24% for males.

Furthermore, the last question that the gender factor affected is increased participation in leisure and household chores. The change increasingly was in males' percent with 40.0%, which referred to the increase in their free time in the quarantine. Conversely, the females, with a percent of 33.33%, had grossly similar household chores work. So, the pandemic did not affect their proportion of the work.

Family Status is one of the main factors in the questionnaire. The extended families that consist of the grandparents, uncles, parents, and children showed more commitment in not taking snacks between the main meals where the percent of increasing was 20.9% only. On the other hand, the nuclear families increased their consumption of snacks with percent 26.25%. Several studies illustrated that living in extended families encourages people to live healthier than living in nuclear families [33, 34, 42]. People in extended families were more likely to favor veggie meals. On the other hand, people in nuclear families enjoyed snacks more. Oyen et al. [42] showed that people living only with a spouse or in a nuclear family had a higher probability of mental ill-health in the absence than in the presence of people showing concern for their well-being.

Concerning the educational and socio-economic status, the two categories' *high socio-economic* and *educational levels* showed stability in their dietary and psychological life during the pandemic.

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Moreover, people in high education and average salaries stratum dietary habits did not change a lot compared to the people with high school and below average in salaries levels were 60.87% of them showed a massive increase in stress and anxiety levels. Eisinga et al. [34] showed that people with lower income and education have less healthy dietary habits because of their higher priority for familiar food and price. Their lower priority was for health as a motive for healthy food purchases.

In some studies, there was a favorable relationship between the parents' higher degree of academic education and the frequency of consuming quick meals and snack consumption [44-46]. And finally, the effect of age on sleeping patterns was studied. The data of age was transformed by using the log transform. After transforming the data, the relationship between sleeping patterns and age was checked using ANOVA; because the normality assumption was violated. The log transformation was used, and P-value = 0.0002, which indicated a difference. So Tukey HSD was utilized to find the pairwise differences. The tabled shows the significant differences after back-transformation using exponential function was applied. We can see that the groups which increased their sleeping hours tend to have a younger mean of age for all significant pairwise comparisons.

COVID-19 crisis may have influenced eating, physical activity, and other weight-related lifestyle behaviors, and Jordanian citizens may be disproportionately affected.

Jordanians' eating habits have been altered dramatically as a result of the COVID-19 epidemic. Although certain positive behaviors increased, such as consuming home-cooked meals, the quality and the quantity of the food were compromised. During the COVID-19 epidemic, food quality and quantity become worse.

Consequently, public health officials must focus on nutrition awareness by suggesting healthy food choices and nutritious substitutes throughout pandemics, especially in lockdown conditions.

It is strongly recommended that individuals improve their physical activity, get enough sleep, and avoid eating energy-dense 'junk' food, leading to weight gain and COVID-19 vulnerability.

Appendix A: Lifestyle-related behavior questionnaire

Instruction: For question numbers 1-21, select one of the following options as a response: (5) Significantly increased (4) Slightly increased (3) Grossly similar (2) Slightly decreased (1) Significantly decreased

S. No.	Questions (items)
10	During the COVID pandemic, how have your weight changed?
11	Have you ever had COVID-19?
12	During the COVID pandemic, how has your probability of skipping one of the main meals (breakfast/lunch/dinner) changed?
13	During the COVID pandemic, how has your habit of snacking between meals changed?
14	During the COVID pandemic, how has your quantity/portions of meals and snacks changed?
15	During the COVID pandemic, how has your daily intake of fruits and vegetables changed?

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16 During the COVID pandemic, how has your intake of a balanced diet (including healthy ingredients such as whole wheat, pulses, eggs, legumes, nuts, fruits, and vegetables) changed?

17 During the COVID pandemic, how has your consumption of junk food/fast food changed?

18 During the COVID pandemic, how has your consumption of fried food changed?

19 During the COVID pandemic, how has your intake of sugar-sweetened beverages (carbonated soft drinks, sugar-sweetened juices) changed?

20 During the COVID pandemic, how has your consumption of sweets/candies/chocolate changed?

21 During the COVID pandemic, how has your participation in cooking new/traditional recipes changed?

22 During the COVID pandemic, how has your consumption of unhealthy food changed when you are bored or stressed, or upset?

23 During the COVID pandemic, how has your intake of immunity-boosting foods (lemon, turmeric, garlic, green leafy vegetables, and citrus fruits) in the diet changed?

24 During the COVID pandemic, how has your intake of nutrition supplements to boost immunity changed?

25 During the COVID pandemic, how has the support of your family and friends in eating healthy changed?

26 During the COVID pandemic, how has your interest in learning healthy eating tips from the media (newspaper articles/magazines blogs/videos/T.V. shows/text messages) changed?

27 During the COVID pandemic, how has your participation in aerobic exercise changed?

28 During the COVID pandemic, how has your participation in leisure and household chores changed?

29 During the COVID pandemic, how has your sitting and screen time changed?

30 During the COVID pandemic, how have your hours of sleep changed?

31 During the COVID pandemic, how have your stress and anxiety levels changed?

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