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Examining the nutritional habits of individuals with moderate and severe covid-19, evaluation of changing nutritional habits and physical activity behavior after covid-19.

Determination of changing eating habits with COVID-19

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Abstract: **Objective:** This research aimed to examine the eating habits of adult individuals infected with severe and moderate COVID-19 disease and to evaluate the changing eating habits and physical activity behaviors of post-COVID-19 individuals.

Methods: The cross-sectional study included 1340 people over the age of 18 and had a positive PCR test. The data was collected online with the ”Google Form”. The obtained data were analyzed with the statistical package program SPSS 25 (Statistical Package for Social Science). Data Mean±Standard Deviation and percentage distribution and the Chi-square test were used in its analysis. $p<0.05$ significance level was considered statistically significant.

Results: It was found that the food consumption of 66.7% of the participants did not change after infection. It has been concluded that individuals do not pay attention to healthy nutrition after infection.It was found that 71.1% of the individuals didn’t do regular physical activity and this situation didn’t change after COVID-19.

Conclusion: In line with the results obtained from the study, it is necessary to pay attention to the nutritional habits and physical activity status of individuals. Nutrition education should be provided by dietitians, accurate information should be provided by physical therapists to increase physical activity.

Keywords: COVID-19, Pandemic, Nutrition, Nutrition Habits

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INCTRODUCTION

COVID-19 (Coronavirus Disease-2019) is a serious public health problem caused by SARS-CoV-2. Cases of pneumonia have been recorded in the Chinese city of Wuhan, Hubei province in 2019 (1). The first cases in Turkey appeared on March 10, 2020. On the same date, it was declared a pandemic by the World Health Organization (WHO)(2, 3). COVID-19 has appeared asymptomatic or with symptoms such as cough, joint pain, fever and respiratory failure (4). Close contact (direct or indirect by touching the mouth, nose and eyes with the hands after touching the infected surface) and the droplet route (droplets thrown into the air during sneezing, coughing and speech) have been identified as the route of transmission of the disease(5). In order to prevent the transmission and spread of COVID-19, it is recommended to pay attention to hygiene conditions, wear a mask and act in accordance with social distancing rules(6). If infection transmission could not be prevented, treatment was carried out for the symptoms that occurred and it was aimed to prevent complications that may arise in this process. In addition, individuals have been encouraged to adopt a healthy lifestyle in order to strengthen their immune systems(7).

Within the scope of a healthy lifestyle; it has been proposed to implement an order in which an adequate level of sleep is provided, adequate and balanced nutrition is based, and a physically active life is adopted. It has been found that lifestyle changes are a factor that should be taken into account the predisposition to COVID-19 infection and the effect on the healing process(8). In order for individuals to prefer an active life, adults have been recommended at least 150-300 minutes of moderate-intensity or at least 75-150 minutes of intense physical activity per week(9). In addition, it has been stated that the sedentary lifestyle can be changed by simple changes such as providing transportation on foot and using stairs in daily life(10). The changing circadian rhythm and falling sleep quality of individuals have also negatively affected immunity, increasing the risk of COVID-19(11). It has been recommended that an adult should sleep for 7.5-8 hours in order to have an adequate sleep level(12). The nutrition model adopted on the basis of healthy nutrition and nutrient diversity by ensuring an adequate and balanced diet by taking the energy and nutrient elements needed by the body in sufficient quantities and in such a way that they are used appropriately has also become an important basis for a healthy lifestyle(13).

As a healthy nutrition model, the ”Four-Leaf Clover” model and the ”Healthy Eating Plate” model were presented as examples for individuals(13). In addition, for the COVID-19 period, the World Health Organization (WHO) has recommended the consumption of protein-containing foods such as meat-eggs-milk, fruits and vegetables, cereals and legumes, foods that are low in fat, salt and sugar content and a diet rich in unsaturated fatty acids every day. In order to minimize the loss of vitamins, he recommended not cooking fruits and vegetables, limiting the amount of caffeine consumed, and not consuming foods with high fat and sugar content(14). The Turkish Dietitians Association (TDD), has proposed to model the Healthy Eating Plate based on adequate and balanced nutrition. It has been reported that the consumption of vegetables and fruits ,which are quite rich in vitamins and minerals, should be according to the season, should be eating fish on two days of the week, and quality protein sources and legumes should be included in the nutrition stroy every day. During this period, limiting sugar and sugary foods that raise blood sugar rapidly, products and breads prepared with white flour, excessively salty and fatty foods and alcohol consumption were indicate(15). On the other hand, the Food and Agriculture Organization(FAO) drew attention to the consumption of vegetables and fruits with a rich content of vitamins, minerals and fiber. Whole grains and oil seeds, which have a healthy fat content, supported immunity due to the unsaturated fatty acid content. It also recommended that the fat, sugar and salt content of foods be examined, that these nutrients be limited when making choices, that regular water consumption be abundant and

alcohol consumption be moderate. FAO also puts food safety at the forefront in the declaretion it has issued. In order to ensure food safety, clean use of the environment in which food is prepared and cooked, separate cooking and storage of raw and cooked foods, clean water use, cooking and storage of foods at a safe and appropriate temperature were also mentioned(16).

The aim of this study is to evaluate the changing eating habits and physical activity behaviors of adult individuals infected with severe and modarete COVID-19 disease after COVID-19.

METHODS

The study was conducted as a cross-sectional research. This study was conducted with 1340 volunteer participants aged 18 years and older who were exposed to COVID-19 infection living in any province of Turkey. When including participants in the study, having experienced COVID-19 infection at least once was considered sufficient. The study was conducted between May 2022 and February 2023. Consent was obtained from the participants that they were volunteers. For this study, permission was obtained from the …….. University Non-Interventional Clinical Research Ethics Committee dated 01.06.2022 and numbered 2022/964. An online questionnaire prepared by the researcher was sent to the participants who volunteered. The survey which it is concent of questions with sociodemographic characteristics of individuals (age, sex, occupation, etc.), anthropometric measurements (body weight(kg) and height(m)), changing eating habits and physical activity status were questioned. The survey forms were completed online in accordance with the personal statements of the participants. Based on the data from the study assessing the relationship between changing eating habits and physicial activity during the COVID-19 pandemic, the sample size (power analysis) required to achieve a 95% confidence interval and 80% power was calculated to be at least 1252 participants. The study was completed with 1340 volunteer participants.

Statistical analysis

The data obtained as a result of the research were analyzed using the statistical package program SPSS 25 (Statistical Package for Social Science). In the analysis of the study data, percentile, mean, lower value, upper value, standard deviation were used. The Chi-square test was applied in the data analysis. A p-value <0.05 was considered statistically significant.

RESULTS

The demographic characteristics of the individuals who have undergone COVID-19 are given in Table 1. Among the participants, 60.4% are women (n=810) and 39.4% are men (n=530). The average age of the participants is 35.15 ± 11.97 years, with an age range of 18 to 85 years. A statistically significant difference was found between sex and age. (p<0,001) Of the individuals included in the study, 60.9% are married, while 39.1% are single. A statistically significant difference was not found between marital status and sex. (p=0,440) While 17.8% of the participants have graduate postgraduate degree, 59% of them are university graduates. Individuals with a high school education level accounted for 17.8% of the participants, while individuals with an primary-secondary school education accounted for 5.4%.A statistically significant difference was found between educational status and sex. (p<0,001) The study participants include 297 individuals with chronic diseases, while 1,043 individuals do not have any chronic diseases. A statistically significant difference was not found between chronic illness status and sex. (p=0,159)

TABLE 1. Demographic characteristics of the participants								
		Female(n=810)		Male (n=530)		Total(n=1340)		P*
		n	%	n	%	n	%	0,001
Age	18-24	144	17,8	81	15,3	225	16,8	
	25-64	660	81,5	431	81,3	1091	81,4	
	65 and 65+	6	0,7	18	3,4	24	1,8	
Marital status	Married	500	61,7	316	59,6	816	60,9	0,440
	Single	310	38,3	214	40,4	524	39,1	
Educational status	Primary/Secondary School	33	4,1	40	7,5	73	5,4	<0,001
	High School	117	14,4	122	23	239	17,8	
	University	505	62,3	285	53,8	790	59	
	Postgraduate Studies	155	19,1	83	15,7	238	17,8	
Chronic illness status	No chronic illness	190	23,5	107	20,2	297	22,2	0,159
	Has a chronic illness	620	76,5	423	79,8	1043	77,8	

***p<0,05 is considered statistically significant. *Chi-square test was used**

The change in body weight of participants after contracting COVID-19 is shown in Table 2. Among the participants who reported an increase in body weight, 218 (73.6%) were women and 78 (26.4%) were men. Among those who reported a decrease in body weight, 199 (63.2%) were women and 116 (36.8%) were men. Those who reported no change in body weight included 393 (53.9%) women and 336 (46.1%) men. When the data were examined, a statistically significant difference was found between sex and the change in body weight after COVID-19 infection ($p < 0.001$).

TABLE 2. Body weight change of participants after COVID-19 infection								
		Increased		Decreased		Unchanged		p*
		n	%	n	%	n	%	
Sex	Female	218	73,6	199	63,2	393	53,9	<0,001
	Male	78	26,4	116	36,8	336	46,1	

***p<0,05 is considered statistically significant. *Chi-square test was used**

In addition to nutrition habits, the study also investigates the physical activity habits of the participants. The distribution of the obtained data by sex is presented in Table 3. Among the participants, 953 (71.1%) do not engage in regular physical activity or sports and prefer a sedentary lifestyle.

When examining the number of meals consumed daily, the majority of participants (25.6%) followed a routine of 2 main meals and 1 snack. The least common choice, with 2.1%, was eating only one meal a day. A total of 62 participants (4.6%) preferred the Mediterranean diet structure, consisting of 3 main meals and 3 snacks. The majority of female participants (25.9%) preferred 2 main meals and 1 snack, while the majority of male participants (28.3%) preferred 3 main meals. The other most commonly preferred meal patterns were: 2 main meals (21%) and 3 main meals (20.1%). Those who preferred 3 main meals and 2 snacks made up 10.1% of the participants, while those who preferred 2 main meals and 2 snacks accounted for 16.5% of the participants.

TABLE 3. Physical activity and eating habits accord to sex							
		Female(n=810)		Male (n=530)		Total(n=1340)	
		n	%	n	%	n	%
Regular physical activity/ sports participation status	Yes	206	25,4	181	34,2	387	28,9
	No	604	74,6	349	65,,8	953	71,1
The number of daily meals	3 main meals + 3 snacks	45	5,6	17	3,2	62	4,6
	3 main meals + 2 snacks	87	10,7	48	9,1	135	10,1
	3 main meals	120	14,8	150	28,3	270	20,1
	2 main meals + 2 snacks	158	19,5	63	11,9	221	16,5
	2 main meals + 1 snack	210	25,9	133	25,1	343	25,6
	2 main meals	176	21,7	105	19,8	281	21
	1 main meal	14	1,7	14	2,6	28	2,1

The changes in food consumption among participants after contracting COVID-19 are presented in Table 4. Among those whose food consumption increased, 198 (73.6%) were women and 71 (26.4%) were men. Among those whose food consumption decreased, 113 (63.8%) were women and 64 (36.2%) were men. Among those whose food consumption remained unchanged, 499 (55.8%) were women and 395 (44.2%) were men. When examining the data, a statistically significant difference was found between sex and food consumption ($p < 0.001$).

Regarding marital status, among those whose food consumption increased, 147 (54.6%) were married and 122 (45.4%) were single. Among those whose food consumption decreased, 94 (53.1%) were married and 83 (46.9%) were single. Among those whose food consumption remained unchanged, 575 (64.3%) were married and 319 (35.7%) were single. A statistically significant difference was found between marital status and food consumption ($p = 0.001$).

As for education level, among those whose food consumption increased, 10 (3.7%) had completed elementary/secondary school, 37 (13.8%) were high school graduates, 168 (62.5%) had a university degree, and 54 (20.1%) had a postgraduate degree. Among those whose food consumption decreased, 17 (9.6%) had completed elementary/secondary school, 31 (17.5%) were high school graduates, 98 (55.4%) had a university degree, and 31 (17.5%) had a postgraduate degree. Among those whose food consumption remained unchanged, 46 (5.1%) had completed elementary/secondary school, 171 (19.1%) were high school graduates, 524 (58.6%) had a university degree, and 153 (17.1%) had a postgraduate degree. No statistically significant difference was found between education level and food consumption ($p = 0.052$).

Regarding chronic diseases, 65 individuals (24.2%) whose food consumption increased reported having a chronic illness, while 204 (75.8%) did not. Among those whose food consumption decreased, 43 (24.3%) had a chronic illness and 134 (75.7%) did not. Among those whose food consumption remained unchanged, 189 (21.1%) had a chronic illness and 705 (78.9%) did not. No statistically significant difference was found between food consumption and the presence of chronic diseases ($p = 0.436$).

TABLE 4. Changes in food consumption after contracting COVID-19 based on descriptive characteristics								
		Increased		Decreased		Unchanged		p*
		n	%	n	%	n	%	
Sex	Female	198	73,6	113	63,8	499	55,8	<0,001
	Male	71	26,4	64	36,2	395	44,2	
Marital status	Married	147	54,6	94	53,1	575	64,3	0,001
	Single	122	45,4	83	46,9	319	35,7	
Educational status	Primary/Secondary School	10	3,7	17	9,6	46	5,1	0,052
	High School	37	13,8	31	17,5	171	19,1	
	University	168	62,5	98	55,4	524	58,6	
	Postgraduate Studies	54	20,1	31	17,5	153	17,1	
Chronic illness status	No chronic illness	65	24,2	43	24,3	189	21,1	0,436
	Has a chronic illness	204	75,8	134	75,7	705	78,9	

***p<0,05 is considered statistically significant. *Chi-square test was used**

The changes in physical activity/sport status of participants after COVID-19 are presented in Table 5. Among individuals whose physical activity/sport status increased, 51 (60%) were women and 34 (40%) were men. Among those whose physical activity/sport status decreased, 166 (69.5%) were women and 73 (30.5%) were men. Among those whose physical activity/sport status remained unchanged, 593 (58.4%) were women and 423 (41.6%) were men. Upon analysis, no statistically significant difference was found between sex and physical activity/sport status ($p = 0.007$).

Regarding marital status, among those whose physical activity/sport status increased, 37 (43.5%) were married and 48 (56.5%) were single. Among those whose physical activity/sport status decreased, 130 (54.4%) were married and 109 (45.6%) were single. Among those whose physical activity/sport status remained unchanged, 649 (63.9%) were married and 367 (36.1%) were single. A statistically significant difference was found between marital status and physical activity/sport status ($p < 0.001$).

In terms of education level, among those whose physical activity/sport status increased, 4 (4.7%) had completed elementary/secondary school, 10 (11.8%) were high school graduates, 50 (58.8%) had a university degree, and 21 (24.7%) had a postgraduate degree. Among those whose physical activity/sport status decreased, 5 (2.1%) had completed elementary/secondary school, 33 (13.8%) were high school graduates, 150 (62.8%) had a university degree, and 51 (21.3%) had a postgraduate degree. Among those whose physical activity/sport status remained unchanged, 64 (6.3%) had completed elementary or middle school, 196 (19.3%) were high school graduates, 590 (58.1%) had a university degree, and 166 (16.3%) had a postgraduate degree. No statistically significant difference was found between education level and physical activity/sport status ($p = 0.009$).

Regarding chronic diseases, among those whose physical activity/sport status increased, 15 (17.6%) had a chronic illness and 70 (82.4%) did not. Among those whose physical activity/sport status decreased, 72 (30.1%) had a chronic illness and 167 (69.9%) did not. Among those whose physical activity/sport status remained unchanged, 210 (20.7%) had a chronic illness and 806 (79.3%) did not. A statistically significant difference was found between physical activity/sport status and the presence of chronic diseases ($p = 0.005$).

TABLE 5. Changes in physical activity/sport status after contracting COVID-19 based on descriptive characteristics.

		Increased		Decreased		Unchanged		p*
		n	%	n	%	n	%	
Sex	Female	51	60	166	69,5	593	58,4	0,007
	Male	34	40	73	30,5	423	41,6	
Marital status	Married	37	43,5	130	54,4	649	63,9	<0,001
	Single	48	56,5	109	45,6	367	36,1	
Educational status	Primary/Secondary School	4	4,7	5	2,1	64	6,3	0,009
	High School	10	11,8	33	13,8	196	19,3	
	University	50	58,8	150	62,8	590	58,1	
	Postgraduate Studies	21	24,7	51	21,3	166	16,3	
Chronic illness status	No chronic illness	15	17,6	72	30,1	210	20,7	0,005
	Has a chronic illness	70	82,4	167	69,9	806	79,3	

***p<0,05 is considered statistically significant. *Chi-square test was used**

The changes in dietary habits of participants after COVID-19 are presented in Table 6. Among individuals who started eating more healthily, 325 (58.6%) were women and 485 (61.8%) were men. Among those who did not pay attention to healthy eating, 230 (41.4%) were women and 300 (38.2%) were men. The data indicate that there was no statistically significant difference between sex and the preference for healthy eating after COVID-19 (p = 0.234).

Regarding marital status, among those who started eating more healthily, 348 (62.7%) were married and 207 (37.3%) were single. Among those who did not pay attention to healthy eating, 468 (59.6%) were married and 317 (40.4%) were single. The data show that there was no statistically significant difference between marital status and the preference for healthy eating after COVID-19 (p = 0.256).

In terms of education level, among those who started eating more healthily, 38 person (6.8%) had completed elementary/secondary school, 82 person (14.8%) were high school graduates, 320 (57.7%) had a university degree, and 115 (20.7%) had a postgraduate degree. Among those who did not pay attention to healthy eating, 35 (4.5%) had completed elementary or middle school, 157 (20%) were high school graduates, 470 (59.9%) had a university degree, and 123 (15.7%) had a postgraduate degree. A statistically significant difference was found between education level and the preference for healthy eating after COVID-19 (p = 0.003).

Regarding chronic diseases, among those who started eating more healthily, 137 (24.7%) had a chronic illness, and 418 (75.3%) did not. Among those who did not pay attention to healthy eating, 160 (20.4%) had a chronic illness, and 625 (79.6%) did not. The data indicate that there was no statistically significant difference between having a chronic illness and the preference for healthy eating after COVID-19 (p = 0.071).

TABLE 6. Changes in nutritional status after contracting COVID-19 based on descriptive characteristics						
		I started eating more healthily.		I didn't pay attention to healthy eating.		p*
		n	%	n	%	
Sex	Female	325	58,6	230	41,4	0,234
	Male	485	61,8	300	38,2	
Marital status	Married	348	62,7	468	59,6	0,256
	Single	207	37,3	317	40,4	
Educational status	Primary/Secondary School	38	6,8	35	4,5	0,003
	High School	82	14,8	157	20	
	University	320	57,7	470	59,9	
	Postgraduate Studies	115	20,7	123	15,7	
Chronic illness status	No chronic illness	137	24,7	160	20,4	0,071
	Has a chronic illness	418	75,3	625	79,6	

***p<0,05 is considered statistically significant. *Chi-square test was used**

DISCUSSION

COVID-19 is a serious public health problem that surrounds the whole world. Various measures are being taken to prevent the transmission and spread of infection. These measures have led to lifestyle changes among individuals, changes in physical activity behaviors and eating habits have been observed.

Changes in body weight have been observed in individuals based on their altered eating habits after contracting COVID-19. A study conducted by Di Renzo and et al, which included 3,533 participants, found that 48.6% of the participants experienced an increase in body weight(17). A study conducted with 150 participants with type 2 diabetes reported a 19% increase in body weight due to changes in eating habits(18). A comprehensive study conducted in Turkey examining changes in eating habits due to pandemic restrictions found that 38% of participants experienced an increase in body weight(19) As a result of the study, it is believed that there was no change in the participants' body weight, considering that the group involved had a high level of education and a high level of awareness, which is thought to be inconsistent with the literature. A significant relationship was found between body weight change and sex (p<0.001), with a higher proportion of women experiencing an increase in body weight.

Due to the increase in time spent at home, particularly in the kitchen, as part of COVID-19 measures, food consumption has also been affected. In a study by Ersoy and Pınar, which examined food consumption during the quarantine period, it was found that 70.4% of individuals increased their food consumption(20). The level of immunity is important to fight COVID-19 infection. Adequate and balanced nutrition, which supports immunity and forms the basis of a healthy diet. In order to achieve an adequate and balanced diet, a person should take the appropriate amount of nutrients at the appropriate time for himself. A meal plan with correctly determined timing and portion sizes should be implemented to achieve this. A study has found that there was a reduction in the number of meals after the pandemic (21). As a result of the study conducted by Ammar and et al, it was found that individuals lost control of eating and there was an increase in the number of meals (22). Although food consumption did not change in the study, there was no statistically significant difference between educational status (p=0.052) and chronic disease (p=0.436). However, differences were found in the changes in food consumption of individuals during this period depending on sex (p<0.001) and marital

status (p=0.001). Upon examining the data, it was found that married individuals and women increased their food consumption more than single individuals and men, respectively. This may be attributed to the possibility that married individuals and women tend to lead a more regular lifestyle.

During the COVID-19 pandemic, it was recommended to avoid a sedentary lifestyle, with exercises to be performed at home (30 minutes per day of moderate-intensity or 20 minutes per day of vigorous-intensity) (23). The study conducted by Özenoğlu and colleagues found a decrease in the participants' physical activity levels (19). As a result of a systematic review, the common finding among the 66 studies examined was a decrease in physical activity levels (24). A study conducted with university students found an increase in physical activity levels (25). Upon examining the study, a significant difference was found between physical activity levels and all parameters. Among individuals with changes in physical activity/sport status, women showed a greater decrease in physical activity/sport compared to men (p=0.008), and married individuals showed a greater decrease compared to single individuals (p<0.001) As education level increased, individuals' participation in physical activity/sport decreased. Among individuals with changes in physical activity/sport status, those without chronic diseases showed a greater increase in physical activity/sport compared to those with chronic diseases (p=0.005).

In a study conducted in Italy, it was found that 37.4% of the 3,533 participants preferred healthier foods, while 35.8% preferred less healthy foods (17). Another study conducted in Mexico reported that 37.2% of the participants exhibited less healthy eating behaviors (26). In this study conducted in Turkey, participants reported adopting less healthy eating habits. However, no statistically significant differences were found between changing eating habits and sex (p=0.234), marital status (p=0.256), and the presence of chronic diseases (p=0.071). However, a significant difference was found between changing eating habits and education level (p=0.003). As education level increased, less attention was paid to healthy eating. Additionally, differences in individuals' income levels may have influenced their access to healthy foods.

Limitations of study

This study was conducted online, and individuals' self-reports were considered accurate. Therefore, effects such as information and recall biases may occur, and participants may have provided inaccurate responses. Additionally, the condition of individuals who have experienced multiple COVID-19 infections was not assessed.

CONCLUSION

It has been observed that COVID-19 infection has both direct and indirect effects on individuals' lifestyles. The measures taken against the infection have had an impact on individuals' eating habits and physical activity levels. This study, which analyzes the changes in eating habits and physical activity behaviors of individuals who have contracted COVID-19, found that participants did not pay attention to healthy eating and physical activity after the infection. The effects of regular physical activity on health preservation and enhancement have been clinically proven. To help individuals minimize these negative effects and increase their awareness, nutrition education could be provided by dietitians, and education on physical activity behaviors could be organized by physiotherapists. Further research in this area could be conducted. This would be beneficial for gaining more knowledge and increasing awareness regarding preventive measures for future epidemic diseases.

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