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The effect of the pandemic on food security and certain lifestyle factors: the sample of Istanbul

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Summary

This study aimed to determine the food security of adult individuals living in Istanbul during the pandemic and the factors affecting food security. The study included 842 adults aged 18–64 years. Sociodemographic, general health information, dietary habits, 24-hour dietary recall, food security status and sleep quality data of the participants were collected. Factors such as marital status, education level, health insurance, total household income, income status evaluated by the individual, the amount of monthly income allocated to food, changes in nutritional status and physical activity during the pandemic process and sleep quality were found to affect food security. The nutritional status of individuals with food insecurity changed negatively during the pandemic, and these individuals experienced worse sleep quality. The dietary carbohydrate and fat percentages, total fibre, soluble fibre, insoluble fibre, vitamin C, vitamin D, vitamin K, sodium, potassium and phosphorus amounts of the participants showed significant differences according to food security status. The risk of food insecurity was high during the pandemic, and lifestyle factors that are crucial for health, such as nutrition, sleep quality and physical activity, were negatively affected in individuals with food insecurity.

Keywords

food insecurity; COVID-19; food security; pandemic; nutrition in emergencies

The coronavirus disease (COVID-19), which constitutes the major public health threat of recent years, has been the deadliest pandemic since 1918–1919 [1–3]. In addition to the primary effects threatening public health, the pandemic has also increased the difficulties in meeting nutritional needs at the household level due to economic problems such as decreased employment [4]. It has caused food insecurity by putting countries that already have difficulties in meeting basic livelihoods in an even more difficult situation [5]. The FAO's definition of food security at the 1996 World Food Summit is as follows: „Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [6]. Food security consists of four bases: availability, accessibility, suitability and safety of food, and is ensured by the continuity of these four bases [6, 7]. Staying at home, quarantine, stopping production and transport activities, which are among the measures taken within the scope of the coronavirus pandemic, made it difficult to provide basic nutrients to those in need and negatively affected food security [5]. The Food and Agriculture Organization of the United Nations (FAO) warned during the COVID-19 period that the socio-economic disruptions associated with the pandemic could substantially increase food insecurity, particularly in developing countries [8]. According to statistics, it was found that household food insecurity in the United States increased from 11 % in 2018 to 38 % in March 2020. In addition, according to data from April 2020, 35 % of households with children under the age of 18 were found to be food insecure [9].

Food insecurity negatively affects lifestyle

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factors such as eating habits and sleep quality, and thus health, both in the short and long term [9]. While the relationship between food insecurity and health problems was accepted as an important issue before the pandemic, structural, social and economic inequalities continued with the pandemic, and even a significant part of the population was pushed from poverty to extreme poverty [10]. Although social isolation is the only way to stop the spread of the virus, unemployment problems resulting from the cessation of work life to a great extent may lead to negative economic, social, health and nutritional consequences in societies where social security is not provided [11]. Accordingly, the United Nations World Food Programme warned that pandemic-related disruptions to food systems and livelihoods could exacerbate malnutrition and hunger if mitigation measures were insufficient [8]. This study was conducted to evaluate the food insecurity and nutritional habits of adult individuals aged 18–64 years during the pandemic and the factors that may affect our lives in the future world.

MATERIALS AND METHODS

The research was conducted in Istanbul between July and September 2021. The population of the study consists of individuals living in 39 districts located in different development level groups (very high, high and medium level) in the province of Istanbul [12], which were determined according to the Socio-Economic Development Ranking of Districts (SEGE-2017) and the Human Development Index-Districts (HDI-D) 2017 of the Republic of Türkiye Ministry of Industry and Technology General Directorate of Development Agencies [12]. According to TURKSTAT data, it was determined that a total of 15 462 452 individuals lived in these districts [13]. Simple random sampling method, which is accepted as one of the probability-based sampling methods, was used in the selection of the sample. This method involves randomly selecting sampling units from the population list [14]. It was concluded that the sample size should be at least 384, calculated based on a population of 15 462 452 with a 95% confidence interval (95% *CI*) and a margin of error of 0.05.

A total of 842 adults aged 18–64 who gave voluntary consent to participate in the study were included. Potential participants were reached by the researchers among individuals living in districts of Istanbul with pre-determined socioeconomic development levels. Participation in the research was entirely voluntary. As the total number of individuals invited to participate in the study was not systematically recorded, the participation rate could not be calculated.

The study was conducted following ethical committee approval obtained from the Non-Interventional Research Ethics Committee of Biruni University on 16 June 2021. A data collection form consisting of five sections was administered to the participants included in the study. Data were collected using face-to-face interviews.

In the first part of the data collection form, there are 58 questions about demographic information, education and socioeconomic levels, general health status, eating habits and food accessibility of the participants.

The second part of the data collection form includes the 'Food Consumption Frequency' for these periods to examine the frequency of food consumption before and during the pandemic, and the '24-Hour Retrospective Food Consumption Record', which examines the food consumption one day before the questionnaire was applied.

In the third part of the data collection form, the Pittsburgh Sleep Quality Index (*PSQI*) was applied to evaluate sleep quality. The *PSQI* is a 19-item self-report scale that assesses sleep quality and sleep disturbance in the past month. Each item of the test is scored equally between 0 and 3.

The scale consists of 7 subscales assessing subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The total *PSQI* score, ranging from 0 to 21, is obtained by summing the scales. A total *PSQI* score greater than five indicates that the sleep quality of the individual is inadequate and shows that there is severe deterioration in at least two areas or moderate deterioration in three areas mentioned above. The validity and reliability of the scale were determined by Ağargün et al. in 1996 [15].

In the fourth part of the data collection form, the 'Coronavirus Anxiety Scale', which determines the anxiety level of individuals during the COVID-19 pandemic, was applied. The validity and reliability study of the scale was conducted by Biçer et al. in 2020 [16].

The fifth part of the data collection form includes the 'Household Food Accessibility' and the 'Families with Children' section, applied to families with children in order to evaluate the food security of the participants. The Household Food Accessibility form, developed by the United States Department of Agriculture (USDA), is an inexpensive and easy-to-implement method for accurately assessing the level of food insecurity, consisting of 18 questions. This method has

Tab. 1. Evaluation of demographic characteristics of participants.

Parameter	*n*	[%]
Sex		
Female	442	52.5
Male	400	47.5
Profession		
Unemployed	235	27.9
Retired	41	4.9
Housewife	158	18.8
Blue collar	179	21.3
White collar	229	27.2
Education level		
Primary education	190	22.6
High school	182	21.6
Bachelor's degree	470	55.8
Marital status		
Single	407	48.3
Married	435	51.7
Individuals living together		
Alone	66	7.8
With family	745	88.5
With friend(s)	27	3.2
In accommodation (dormitory, hotel, etc.)	4	0.5
District development levels		
Very high	273	32.4
High	268	31.8
Medium	301	35.7
Household total income		
Below minimum wage (< 2 826 TL)	66	7.8
2 826–4 999 TL	244	29.0
5 000–7 999 TL	348	41.3
8 000–14 999 TL	104	12.4
≥ 15 000 TL	80	9.5
Self-assessed income status		
Low	108	12.8
Medium	643	76.4
High	91	10.8
Health insurance		
No health insurance	102	12.1
Health insurance	740	87.9
Food security classification		
Food secure	142	16.9
Food security at risk	559	66.4
Food insecure	141	16.7
Presence of chronic disease		
No	227	27.0
Yes	615	73.0
Smoking status		
Non-smoker	547	65.0
Smoker	267	31.7
Ex-smoker	28	3.3
Alcohol consumption		
No	677	80.4
Yes	165	19.6
Pittsburgh sleep quality index classification		
Good sleep quality (score < 5)	390	46.3
Poor sleep quality (score ≥ 5)	452	53.7

n – number of participants, TL – Turkish lira.

been widely used in the USA since 1990. It is also a survey method that can be adapted to many countries with different social and cultural characteristics. Based on the data obtained as a result of this scale, households are classified as 'food secure', 'food insecure', 'food insecure at risk', 'food insecure not at the hunger line', 'food insecure with moderate hunger' and 'food insecure with severe hunger' [17–19]. In this study, scale scores were classified as 'food secure', 'food insecure' and 'food insecure at risk'.

Statistical analysis

In the evaluation of the data, the BeBiS (Nutrition Information System) 9.0 programme (BeBIS, Istanbul, Turkey) was used for the analysis of food consumption records. SPSS 15.0 (IBM, Armonk, New York, USA) and The jamovi Project (Sydney, Australia) statistical programmes were used to analyse other data. In the statistical analysis of the data, the number of units and percentage ratio were used for qualitative variables; mean and standard deviation parameters were used for quantitative parametric variables. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine whether the data were normally distributed. The chi-square test was used for qualitative variables, one-way analysis of variance (ANOVA) for parametric quantitative variables, and the Kruskal-Wallis H test for non-parametric quantitative variables. The Bonferroni corrected post-hoc test was applied to determine the sources of differences between the groups.

RESULTS AND DISCUSSION

The evaluation of the demographic characteristics of participants is shown in Tab. 1. The study was completed with a total of 842 individuals, including 442 women (52.5 %) and 400 men (47.5 %). The average age of the participants was 36.2 ± 13.4 years.

Tab. 2 contains information on the anthropometric measurements of the participants. These measurements are body weight, height, waist and hip circumference, neck circumference and upper arm circumference.

Tab. 3 shows a comparison of participants' responses to certain parameters related to their eating habits and food security during the pandemic, broken down by gender. Accordingly, it was found that there were statistically significant differences between genders in responses to parameters such as dietary status during the pandemic, physical activity, difficulty accessing food

Tab. 2. Anthropometric measurements of the participants.

	Female		Male	
	Mean	*SD*	Mean	*SD*
Body weight [kg]	66.8	12.1	81.5	11.6
Height [cm]	164.0	6.4	177.0	7.1
Body mass index [kg·m^{-2}]	25.1	4.8	26.1	3.4
Waist circumference [cm]	81.0	12.9	93.9	10.9
Hip circumference [cm]	102.0	9.9	103.0	8.1
Neck circumference [cm]	33.1	3.2	37.7	3.7
Mid upper arm circumference [cm]	29.3	4.6	33.0	4.5

SD – standard deviation.

Tab. 3. The gender differences in the responses to the conditions related to nutritional habits and food security in the pandemic.

	Female		Male		χ^2	*p*
	n	[%]	*n*	[%]		
How has your diet changed since the pandemic began?						
My nutritional status has improved	96	21.7	82	20.5		
My nutritional status has deteriorated	141	31.9	97	24.3	7.76	0.021
There has been no change in my nutritional status	205	46.4	221	55.3		
How has your physical activity changed since the pandemic began?						
My activity has increased	59	13.3	45	11.3		
My activity has decreased	284	64.3	231	57.8	8.07	0.018
No change	99	22.4	124	31.0		
Compared to the pre-pandemic period, were you able to access fresh food during the pandemic?						
Yes	297	67.2	263	65.9		
No	27	6.1	30	7.5	0.67	0.716
Sometimes	118	26.7	106	26.6		
Did you experience any difficulties in accessing food or shopping for food during the pandemic compared to before the pandemic?						
Yes	30	6.8	53	13.3		
No	306	69.2	261	65.3	9.96	0.007
Sometimes	106	24.0	86	21.5		
Compared to before the pandemic, is your income during the pandemic sufficient to eat a healthy diet?						
Yes	328	74.2	292	73		
No	46	10.4	65	16.3	8.90	0.012
Sometimes	68	15.4	43	10.8		
Did you ever worry that you would not be able to obtain sufficient food due to a lack of money or other resources during the pandemic?						
Yes	44	10.0	46	11.5		
No	300	67.9	286	71.5	3.71	0.156
Sometimes	98	22.2	68	17.0		
Did you ever go without healthy and nutritious food due to a lack of money or other resources during the pandemic?						
Yes	33	7.5	23	5.8		
No	354	80.1	333	83.3	1.56	0.459
Sometimes	55	12.4	44	11		
Did you ever have to skip meals due to a lack of money or other resources during the pandemic?						
Yes	23	5.2	21	5.3		
No	396	89.6	353	88.3	0.65	0.723
Sometimes	23	5.2	26	6.5		

Tab. 3. *continued*

	Female		Male		χ^2	*p*
	n	[%]	*n*	[%]		
Did you run out of food in your household due to a lack of money or other resources during the pandemic?						
Yes	33	7.5	24	6.0		
No	363	82.1	330	82.5	0.90	0.638
Sometimes	46	10.4	46	11.5		
Did you ever go without eating during the pandemic because you didn't have enough money or other resources, even though you were hungry?						
Yes	8	1.8	9	2.3		
No	413	93.4	368	92.0	0.65	0.723
Sometimes	21	4.8	23	5.8		
How would you assess your appetite during the pandemic compared to before the pandemic?						
My appetite has increased	174	39.4	119	29.8		
My appetite has decreased	49	11.1	45	11.3	9.06	0.011
No change	219	49.5	236	59.0		
Have there been any changes to your online food orders during the pandemic?						
Increased	125	28.8	148	37.5		
Decreased	104	24.0	62	15.7	11.80	0.003
No change	205	47.2	185	46.8		
Have you noticed any changes in your online grocery shopping during the pandemic?						
Increased	232	53.0	204	51.6		
Decreased	12	2.7	14	3.5	0.51	0.774
No change	194	44.3	177	44.8		
Did you experience any changes in the frequency of eating out during the pandemic?						
Increased	20	4.5	19	4.8		
Decreased	315	71.3	284	71.0	1.13	0.769
No change	107	24.2	96	24.0		

n – number of participants. χ^2 – chi-square, *p* – statistical significance ($p < 0.05$ is judged as significant).

or shopping for food, whether income was sufficient for adequate and healthy nutrition, appetite status, and online food ordering ($p < 0.05$).

Tab. 4 evaluates the factors affecting food security. Accordingly, it was determined that marital status, education level, health insurance, total household income, the individual's assessed income status, the amount of monthly income allocated to food, changes in nutrition and physical activity status during the pandemic, and sleep quality showed significant differences according to food security levels ($p < 0.05$).

Tab. 5 and Tab. 6 show the energy and nutrient consumption records of participants according to their food security status in both men and women, separately. Accordingly, it was found that the percentage of energy derived from carbohydrates and fats, total fibre, soluble fibre, insoluble fibre, vitamin C, vitamin D, and vitamin K, sodium, potassium, and phosphorus intake showed significant differences according to food security levels ($p < 0.05$).

Budiawati et al. [20] sought to determine and analyse the relationship between food security and various dimensions during the COVID-19 period, and to examine the coping strategies adopted by three different food security groups in Banten province, Indonesia. Variables such as the age of the family head, the number of family members in the household, and the Food Consumption Score were identified to have a significant effect with a 95% *CI*. Meanwhile, the education level of the family head was the only independent variable found to have a significant effect at the 90% *CI*. In the current study, it was determined that marital status, education level, health insurance, total household income, the individual's assessed income status, the amount of monthly income allocated to food, changes in nutrition and physical activity status during the pandemic, and sleep quality showed significant differences according to food security levels ($p < 0.05$). Accordingly, it was determined that individuals with food insecurity were more likely to be married compared to those

Tab. 4. Assessment of factors affecting food security.

	Food security		At risk of food insecurity		Food insecurity		χ_A^2	*p*
	n	[%]	*n*	[%]	*n*	[%]		
Gender								
Female	75	52.8	297	53.1	70	49.6	0.56	0.757
Male	67	47.2	262	46.9	71	50.4		
District development levels								
Very high	47	33.1	183	32.7	43	30.5	1.18	0.882
High	46	32.4	180	32.2	42	29.8		
Medium	49	34.5	196	35.1	56	39.7		
Marital status								
Single	81	57.0	277	49.6	49	34.8	15.10	< 0.001*
Married	61	43.0	282	50.4	92	65.2		
Education level								
Elementary school	28	19.7	114	20.4	48	34.0	16.80	0.002*
High school	24	16.9	127	22.7	31	22.0		
University	90	63.4	318	56.9	62	44.0		
Health insurance								
I have health insurance	134	94.4	479	85.7	127	90.1	8.77	0.012*
I have no health insurance	8	5.6	80	14.3	14	9.9		
Total household income								
Below minimum wage (< 2 826 TL)	9	6.3	24	4.3	33	23.4	126.60	< 0.001*
2 826–4 999 TL	32	22.5	144	25.8	68	48.2		
5 000–7 999 TL	60	42.3	253	45.3	35	24.8		
8 000–14 999 TL	14	9.9	86	15.4	4	2.8		
≥ 15 000 TL	27	19.0	52	9.3	1	0.7		
Assessment of an individual's income status								
Low	7	4.9	47	8.4	54	38.3	107.10	< 0.001*
Medium	110	77.5	451	80.7	82	58.2		
High	25	17.6	61	10.9	5	3.5		
How do you assess the amount of your monthly income allocated to food?								
Very adequate	41	28.9	128	22.9	6	4.3	204.50	< 0.001*
Adequate	79	55.6	301	53.8	35	24.8		
Medium	20	14.1	112	20.0	54	38.3		
Insufficient	1	0.7	18	3.2	37	26.2		
Very insufficient	1	0.7	0	0.0	9	6.4		
How has your diet changed since the pandemic began?								
Changed for the better	33	23.2	125	22.4	20	14.2	13.80	0.008*
Changed for the worse	38	26.8	143	25.6	57	40.4		
No change	71	50.0	291	52.1	64	45.4		
How has your physical activity changed since the pandemic began?								
My activity has increased	30	21.1	60	10.7	14	9.9	13.80	0.008*
My activity has decreased	81	57.0	341	61.0	93	66.0		
No change.	31	21.8	158	28.3	34	24.1		
Pittsburgh sleep quality index								
Good sleep quality (score < 5)	63	44.4	282	50.4	45	31.9	15.80	< 0.001*
Bad sleep quality (score ≥ 5)	79	55.6	277	49.6	96	68.1		
	Mean ± *SD*		**Mean ± *SD***		**Mean ± *SD***		χ_B^2	*p*
Coronavirus anxiety scale	1.098 ± 2.118		0.802 ± 1.774		1.357 ± 2.432		9.819	0.005*

n – number of participants. χ_A^2 – chi-square test, χ_B^2 – Kruskal Wallis test, *p* – statistical significance ($p < 0.05$ is judged as significant, asterisk indicates that a post hoc test with Bonferroni correction was performed), *SD* – standard deviation, TL – Turkish lira.

Tab. 5. Evaluation of food consumption record data according to food security levels in females.

Parameter	Food Insecurity		At risk of food insecurity		Food security		Test		*p*
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Type	Value	
Energy [kcal]	1 491.8	1 399.0	1 359.3	510.2	1 229.6	379.1	*F*	2.454	0.087
Energy [kJ]	6 242.0	5 853.6	5 687.4	2 134.7	5 144.8	1 586.3			
Carbohydrate [g]	165.60	65.50	146.90	66.53	136.70	44.50	*F*	1.418	0.243
Carbohydrate [%]	43.3	9.2	44.0	10.5	40.9	11.0	*F*	2.821	0.061
Protein [g]	58.67	23.96	54.07	24.02	52.44	16.86	*F*	1.509	0.222
Protein [%]	18.0	4.9	16.8	4.7	18.0	6.3	*F*	3.118	0.045
Fat [g]	56.97	21.45	59.49	26.77	56.96	19.75	*F*	0.500	0.607
Fat [%]	38.6	8.8	39.3	9.8	41.9	9.6	χ^2	4.323	0.115
Omega-3 [g]	1.430	1.131	1.537	1.530	1.513	1.358	χ^2	0.352	0.839
Omega-6 [g]	7.370	5.102	8.080	6.208	8.246	6.322	χ^2	1.125	0.570
Soluble fibre [g]	5.993	3.584	5.684	3.440	4.350	2.006	χ^2	8.803	0.012
Insoluble fibre [g]	12.170	7.603	11.880	9.255	8.839	4.301	χ^2	9.137	0.010
Total fibre [g]	19.630	12.990	17.700	8.996	14.050	6.049	χ^2	7.298	0.026
Vitamin B1 [mg]	0.798	0.424	0.786	0.629	1.677	8.476	χ^2	1.185	0.553
Vitamin B2 [mg]	1.755	3.475	1.170	0.518	1.111	0.362	χ^2	1.226	0.542
Vitamin B3 [mg]	14.340	8.791	14.950	9.326	12.910	8.560	χ^2	4.350	0.114
Vitamin B5 [mg]	4.911	9.258	3.982	2.270	3.985	3.563	χ^2	0.685	0.710
Vitamin B6 [mg]	1.120	1.259	1.064	0.512	0.949	0.383	χ^2	2.485	0.289
Vitamin B9 [mg]	229.3	110.9	238.8	126.9	207.4	198.7	χ^2	2.414	0.299
Vitamin B12 [mg]	3.300	1.928	4.136	3.909	3.526	1.865	χ^2	0.432	0.806
Vitamin C [mg]	59.370	40.080	79.690	54.670	69.800	44.350	χ^2	9.058	0.011
Vitamin A [μg]	759.900	682.500	909.400	838.400	728.800	444.500	*F*	2.443	0.088
Vitamin D [μg]	5.665	11.000	3.280	6.589	5.369	8.168	χ^2	6.423	0.040
Vitamin E [mg]	8.588	7.124	9.065	6.540	8.338	6.623	χ^2	4.451	0.108
Vitamin K [μg]	103.800	26.800	119.200	18.950	87.380	26.430	χ^2	1.219	0.544
Calcium [mg]	543.5	250.7	635.7	301.8	549.1	189.4	*F*	2.796	0.062
Iron [mg]	8.301	4.445	8.647	4.945	7.574	2.288	χ^2	1.053	0.591
Magnesium [mg]	219.8	127.3	228.7	110.3	191.1	72.77	χ^2	5.515	0.063
Sodium [mg]	3 121.2	1 163.9	2 773.7	1 436.6	2 282.3	1 012.7	*F*	4.264	0.015
Potassium [mg]	1 858.8	889.1	2 057.0	1 205.0	1 607.4	681.8	*F*	4.860	0.008
Phosporus [mg]	912.1	444.4	917.8	411.8	814.6	277.1	*F*	4.093	0.017
Zinc [mg]	7.874	3.915	8.283	3.828	7.462	2.855	*F*	2.912	0.055
Selenium [μg]	18.54	9.73	13.76	4.02	20.31	9.70	χ^2	3.635	0.162

SD – standard deviation, *F* – ANOVA test (between-groups degress of freedom $df_1 = 2$, within-groups degrees of freedom $df_2 = 439$), χ^2 – Kruskal Wallis test, *p* – statistical significance ($p < 0.05$ is judged as significant.

with food security and those at risk of food insecurity ($p < 0.05$). Compared to individuals with food insecurity risk and food security, individuals with food insecurity were found to have a higher rate of primary school graduates and a lower rate of university graduates ($p < 0.05$). Based on this information, when considering educational level in parallel with the parameters examined in the above study affecting food insecurity, it can be said that individuals with low educational levels are at higher risk of food insecurity, which is to be expected. The food consumption score in the relevant study (high scores indicate adequate access to nutritious and varied foods) was found to have a significant effect on food security; however, in the current study, men and women who consumed certain nutrients (men – carbohydrates, soluble fibre and vitamin K; women – soluble fibre, insoluble fibre, total fibre, sodium, potassium, phosphorus, vitamin C, vitamin D) less frequently on a daily basis were found to be in the food-insecure group. Only among men, the percentage of energy derived from fat per day was significantly higher in the food-secure group compared to the

Tab. 6. Evaluation of food consumption record data according to food security levels in males.

Parameter	Food Insecurity		At risk of food insecurity		Food security		Test		*p*
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Type	Value	
Energy [kcal]	1 687.1	668.5	1 712.2	591.5	1 948.2	565.3	F	1.613	0.201
Energy [kJ]	7 059.2	2 797.0	7 163.9	2 475.2	8 151.3	8 641.5			0.201
Carbohydrate [g]	186.90	85.78	188.70	82.08	172.30	70.40	*F*	1.103	0.333
Carbohydrate [%]	45.3	9.9	44.0	10.2	41.0	11.1	*F*	3.219	0.041
Protein [g]	66.48	31.12	72.79	29.49	72.26	28.76	*F*	1.285	0.278
Protein [%]	16.1	4.6	17.7	5.2	17.6	5.5	*F*	2.887	0.057
Fat [g]	69.57	32.30	73.13	30.69	79.53	32.65	*F*	1.819	0.163
Fat [%]	37.5	9.2	38.3	9.0	41.3	9.4	χ^2	12.510	0.008
Omega-3 [g]	1.507	0.881	2.180	3.082	1.904	1.496	χ^2	0.305	0.245
Omega-6 [g]	9.057	7.336	10.530	6.978	11.560	8.362	χ^2	3.779	0.119
Soluble fibre [g]	6.781	3.750	6.868	3.867	5.225	2.708	χ^2	19.630	0.004
Insoluble fibre [g]	12.180	5.765	13.040	6.901	11.380	5.855	χ^2	11.690	0.173
Total fibre [g]	19.73	8.47	20.32	10.02	17.51	8.23	χ^2	12.170	0.121
Vitamin B1 [mg]	0.840	0.423	0.974	0.642	0.814	0.347	χ^2	2.684	0.111
Vitamin B2 [mg]	1.410	0.900	1.879	5.845	1.357	0.610	χ^2	1.350	0.152
Vitamin B3 [mg]	17.30	11.06	20.58	11.96	18.52	11.01	χ^2	7.510	0.071
Vitamin B5 [mg]	4.475	1.846	5.173	3.046	4.654	2.505	χ^2	3.269	0.071
Vitamin B6 [mg]	1.193	0.528	1.307	0.722	1.203	0.558	χ^2	2.964	0.557
Vitamin B9 [mg]	268.2	108.5	272.4	142.3	243.1	107.3	χ^2	4.683	0.230
Vitamin B12 [mg]	4.960	6.902	7.155	22.440	5.203	3.189	χ^2	2.731	0.177
Vitamin C [mg]	87.91	59.44	78.27	66.58	79.87	65.21	χ^2	0.845	0.213
Vitamin A (μg)	890.1	588.1	1 007.0	432.8	802.8	479.5	*F*	0.912	0.403
Vitamin D (μg)	4.153	7.650	5.247	8.797	6.051	10.550	χ^2	8.301	0.150
Vitamin E [mg]	10.390	8.905	10.690	7.545	10.690	7.800	χ^2	3.662	0.587
Vitamin K [μg]	172.700	23.930	125.100	28.040	82.570	8.122	χ^2	3.789	0.010
Calcium [mg]	653.9	285.8	687.5	300.2	732.0	320.8	*F*	1.839	0.160
Iron [mg]	10.060	5.099	15.310	7.279	9.827	4.254	χ^2	1.501	0.653
Magnesium [mg]	252.90	124.50	255.70	109.10	252.10	96.65	χ^2	4.757	0.681
Sodium [mg]	3 371.2	1 495.5	3 398.3	2 918.1	3 343.3	1 518.2	*F*	0.283	0.754
Potassium [mg]	2 079.7	715.8	2 196.1	932.2	2 170.8	696.3	*F*	1.318	0.269
Phosporus [mg]	1 049.9	463.6	1 144.5	455.9	1 093.8	410.5	*F*	1.841	0.160
Zinc [mg]	9.846	4.533	10.290	4.343	11.360	4.792	*F*	1.309	0.271
Selenium (μg)	18.92	11.80	21.12	9.75	20.98	13.50	χ^2	1.284	0.409

SD – standard deviation, *F* – ANOVA test (between-groups degress of freedom $df_1 = 2$, within-groups degrees of freedom $df_2 = 397$), χ^2 – Kruskal Wallis test, *p* – statistical significance ($p < 0.05$ is judged as significant.

food-insecure group ($p > 0.05$). This finding does not show high consistency with the related study, and it also contradicts the expectation that macro and micro nutrient consumption would be lower in the food-insecure group. These differences may be due to the fact that responses to 24-hour recall dietary intake are based on individual self-reporting and therefore may not be entirely accurate, leading to recall bias, the inclusion of individuals who adopt a dietary pattern that artificially increases the intake of certain nutrients by relying on inexpensive, fortified staple foods (e.g., bread, cereals, legumes) in food-insecure individuals, and the fact that food-secure individuals may have consumed more ultra-processed foods with lower fibre and mineral content.

Lewis et al. [21] conducted a cross-sectional study to identify the characteristics of individuals coping with the 2019 coronavirus pandemic among adults living in New York and to assess the relationship between these factors and the risk of food insecurity. They found that 38.5 % of the sample experienced food insecurity after the pandemic. They found that having generalised anxiety is

a risk factor for food insecurity, independent of demographic characteristics. FITZPATRICK et al. [4] conducted a study to examine the intersection of social vulnerability, risk, and their effects on individual food insecurity probabilities during the COVID-19 pandemic. They found that individuals who were socially vulnerable, fearful, in poorer health, and exhibited higher levels of depressive and anxiety symptoms were more likely to experience food insecurity. Similarly, in the current study, it was determined that individuals with food insecurity had higher anxiety scores compared to those at risk of food insecurity ($p < 0.05$).

ZHANG et al. [22] conducted a study to assess food insecurity among households in Wuhan, China, during the COVID-19 pandemic and to investigate the determining factors. The Household Food Insecurity Access Scale Score (HFIASS) was used to measure food insecurity. The results showed that the average HFIASS score was 9.42, and more than 50 % of households had an HFIASS score below 9. Compared to normal conditions, quarantine measures were found to have a significant negative impact on household food security.

OWENS et al. [23] used a multi-step approach that included a 2-question Food Adequacy Screening Tool and a 6-question USDA Food Security Survey Module (FSSM) in a study to assess the prevalence and determinants of food insecurity among university students during the COVID-19 pandemic. According to the study results, 34.5 % of participants were classified as food insecure in the past 30 days, with the strongest determinants of food insecurity being changes in current living arrangements (odds ratio $OR = 2.70$, 95% CI: 2.47, 2.95), being placed on unpaid leave ($OR = 3.22$, 95% CI: 2.86, 3.64), being laid off ($OR = 4.07$, 95% CI: 3.55, 4.66), or losing a part-time job due to the COVID-19 pandemic ($OR = 5.73$, 95% CI: 5.09, 6.46) [24]. In the current study, according to the Household Food Accessibility form data, it was determined that 66.4 % of participants were at risk of food insecurity, 16.7 % were food insecure, and only 16.9 % were food secure. Individuals at risk of food insecurity reported having lower levels of health security compared to those with food security and those experiencing food insecurity ($p < 0.05$). Individuals experiencing food insecurity rated their income status as low at a higher rate and as moderate and high at a lower rate compared to those at risk of food insecurity and those with food security ($p < 0.05$). Compared to individuals at risk of food insecurity and those with food security, individuals with food insecurity rated the amount of their monthly income allocated to food as moderate, insufficient, and very insufficient at a higher rate; and as sufficient and very sufficient at a lower rate ($p < 0.05$). Since these situations arose due to the effects of unemployment and financial difficulties experienced during the quarantine period, it can be said that the quarantine measures had a negative impact on household food security in the current study.

MUI et al. [24] conducted a study to investigate the acquisition and mobility experiences of individuals experiencing food insecurity in urban areas during the first months of the COVID-19 pandemic. They found that food acquisition barriers were significantly more prevalent among adults experiencing food insecurity in urban areas compared to those in suburban and rural areas, along with changes in employment status (34.2 %; 95% CI: 27.2 %, 41.1 %; $P < 0.0001$), and limited food availability at retailers (38.8 %; 95% CI: 31.7 %, 45.9 %; $P < 0.001$). In rural areas, adults without food security primarily obtain food for their households from supermarkets (61.5 %; 95% CI: 50.4 %, 72.5 %; $P < 0.05$), while locally sourced foods were less commonly available among food-insecure adults in rural areas (6.9 %; 95% CI: 0.0 %, 13.0 %) compared to urban areas (19.8 %; 95% CI: 14.3 %, 25.4 %; $P < 0.01$). In the current study, 6.8 % of women reported experiencing difficulties in accessing food during the pandemic, while this rate was 13.3 % among men. 28.8 % of women and 37.5 % of men reported an increase in online food orders during the pandemic. Additionally, 24 % of women and 15.7 % of men reported a decrease in online food orders during the pandemic. No statistically significant differences were found between groups categorised by district development levels in terms of food security ($p > 0.05$).

LAUREN et al. [25] conducted a cross-sectional study to examine the relationship between household food insecurity risk and sociodemographic and mental health characteristics during the COVID-19 pandemic. Forty-one percent of participants were identified as being at risk of food insecurity after COVID-19, and 55 % of these individuals were women. In a multivariate analysis, race, income, relationship status, living situation, anxiety, and depression were found to be significantly associated with the risk of food insecurity. Participants with an annual income less then 100 000 USD and those living with children or others were found to have a significantly higher likelihood of being at risk of food insecurity. Individuals at risk of food insecurity were 2.60 times (95% CI: 1.91, 3.55) more likely to screen positive for anxiety and 1.71 times (95% CI: 1.21, 2.42)

more likely to screen positive for depression. SINGH et al. [26] in a study that aimed to examine food insecurity among disadvantaged communities and people living in low-income households in Nepal's 2nd Region during the COVID-19 pandemic, stated that families with low socioeconomic backgrounds and disadvantaged communities such as daily wage earners and those dependent on remittances experienced increased food insecurity during the COVID-19 outbreak, and reported that these groups used different coping strategies to meet their food needs during the outbreak. In the current study, individuals with food insecurity had a higher proportion of household total income below the minimum wage (< 2 825.9 TL) and in the 2 825.9–5 000 TL income bracket compared to individuals at risk of food insecurity and those with food security. Additionally, individuals experiencing food insecurity are less likely to have income levels of 5 000 TL and above ($p < 0.05$). Individuals experiencing food insecurity are more likely to assess their income status as low, and less likely to assess it as moderate or high, compared to those at risk of food insecurity and those with food security ($p < 0.05$). Compared to those at risk of food insecurity and those with food security, individuals with food insecurity assessed the portion of their monthly income allocated to food as moderate, insufficient, and very insufficient at a higher rate; and as sufficient and very sufficient at a lower rate ($p < 0.05$). Additionally, the study found that individuals experiencing food insecurity had significantly higher Coronavirus Anxiety Scale scores compared to other groups. These findings, consistent with the literature, indicate that low income level and anxiety are parameters that also have significant effects on food insecurity.

WITKOWIAK et al. [27] conducted a cross-sectional study to examine the impact of the COVID-19 pandemic on food insecurity and lifestyle behaviours among university students, collecting data through an online survey. According to the study results, 34.7 % of participants experienced food insecurity, with 9.5 % experiencing severe levels. In terms of sleep, students in Cyprus showed the lowest quality, and reduced food insecurity was significantly associated with physical activity (the adjusted regression coefficient beta –0.171, 95% *CI*: –0.313, –0.029), but not with sleep or diet ($p < 0.05$). In the current study, based on data from the Household Food Accessibility form, it was determined that 66.4 % of participants were at risk of food insecurity, 16.7 % were food insecure, and only 16.9 % were food secure. The study evaluated factors affecting food security. Accordingly, it was determined that marital status, education level, health insurance, total household income, the individual's assessed income status, the amount of monthly income allocated to food, changes in nutrition and physical activity status during the pandemic, and sleep quality showed significant differences according to food security levels ($p < 0.05$). Individuals with food security reported a greater increase in physical activity levels during the pandemic compared to those without food security or at risk of food insecurity ($p < 0.05$). It was found that individuals with food insecurity had a higher rate of poor sleep quality and a lower rate of good sleep quality compared to individuals at risk of food insecurity ($p < 0.05$). Individuals with food insecurity reported a greater increase in negative changes in their nutritional status during the pandemic compared to individuals with food security and those at risk of food insecurity ($p < 0.05$). It has been observed that men with food security have a lower percentage of energy derived from carbohydrates and a higher percentage derived from fat, as well as lower intake of soluble fibre and vitamin K, compared to those without food security ($p < 0.05$). Women with food security were found to have lower intakes of soluble fibre, insoluble fibre, total fibre, sodium, potassium, and phosphorus compared to those without food security ($p < 0.05$). Vitamin C intake was found to be lower in individuals without food security. Vitamin D intake was found to be lower in those at risk of food insecurity ($p < 0.05$). Consistent with the study described above, the current study also highlights the finding that food insecurity is associated with reduced physical activity. While the aforementioned study found no significant relationship between sleep and nutrition, our study found that food insecurity is associated with poor sleep quality. When comparing individuals categorised according to food insecurity among women and men, it was observed that both women and men in food-insecure groups consumed certain nutrients less. Interpretations regarding the possible reasons for this low consumption are discussed in the seventh paragraph of the discussion and conclusion section.

CONCLUSIONS

The results of this cross-sectional study, conducted to determine food security during the COVID-19 pandemic and the factors affecting it, show that a large proportion of participants were at risk of food insecurity during the pandemic and that there were significant individual and life factors affecting food security. The study results

indicate that there are many common factors affecting food insecurity (income level, household size, living in rural or urban areas, etc.), and that when examined in terms of food insecurity, there are differences in people's lifestyle factors (physical activity, sleep patterns, anxiety levels, etc.). It cannot be said that the studies are fully consistent with the literature due to reasons such as the inclusion of different cultures, differences in population characteristics, differences in data collection methods, and the use of self-reported statements. Limitations of the study include the fact that the data was collected in 2021, that the population consists of people living in one country, and that some data are based on personal statements, which increases the margin of error (24-hour recall method). The fact that the research sample is limited to Istanbul Province restricts the generalisability of the findings to the entire population of Türkiye. However, the fact that the sample consists of districts with varying levels of socioeconomic development and its heterogeneous structure in terms of age, gender, and education level indicates that the study has a certain representativeness for the urban population when conducted on a large sample; these are also the strengths of the study. The results of this study can be framed not only as a retrospective report on the COVID-19 pandemic but also as a baseline dataset for understanding food security in cities during times of crisis and for developing potential measures. The findings highlighting the relationship between food insecurity and socio-economic and lifestyle factors provide a reference point, particularly for large cities where this interaction occurs more frequently. Therefore, this study has the potential to guide the improvement of nutrition policies in future crises. The inclusion of participants on a voluntary basis and the failure to record the total number of individuals invited prevented the calculation of the participation rate. This should be considered a limitation in terms of the generalisability of the results.

A review of the literature shows that in emergencies such as pandemics, societies face the risk of food insecurity on a global scale. It is a social necessity for national leaders to take measures related to individual, social, and especially economic factors that affect food security. Furthermore, cross-cultural studies that provide broader data related to food insecurity are needed in order to take measures against food insecurity in disaster situations.

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