REVISTA DE NUTRIÇÃO
Brazilian Journal of Nutrition

ORIGINAL

Nutritional Assessment

Editor
Kênia Mara Baiocchi de Carvalho

Conflict of interest
The authors declare that there are no conflict of interests.

Received
April 11, 2023

Final version
December 15, 2023

Approved
February 1, 2024

Attitude towards the healthy eating: Is it effective in diagnosis of COVID-19?

Atitude perante a alimentação saudável: é eficaz no diagnóstico da COVID-19?

Hacı Ömer Yılmaz[1], Çağdaş Salih Meriç[2], Mustafa Özgür[3]

[1] Bandırma Onyedi Eylül University, Faculty of Health Science, Department of Nutrition and Dietetics. Balıkesir, Türkiye. Correspondence to: HÖ YILMAZ. E-mail: <hcmrylmz@hotmail.com>.
[2] Gaziantep University, Faculty of Health Science, Department of Nutrition and Dietetics. Gaziantep, Türkiye.
[3] Burdur Mehmet Akif Ersoy University, Faculty of Health Science, Department of Nutrition and Dietetics. Burdur, Türkiye.

How to cite this article: HÖ Yılmaz, ÇS Meriç, M Özgür. Attitude towards the healthy eating: Is it effective in diagnosis of COVID-19?. Rev Nutr. 2024;37:e230057. https://doi.org/10.1590/1678-9865202437e230057

ABSTRACT

Objective
Healthy nutritional habits play a critical role in preventing many diseases, including infectious diseases. This study was planned and conducted to determine the protective measures, changes in eating habits, attitudes towards healthy nutrition of participants diagnosed with COVID-19 in during the pandemic.

Methods
873 university students included in the cross-sectional study. A web-based questionnaire was conducted to gather information about demographics, COVID-19 protective measures, eating habits and Attitude Scale for Healthy Nutrition to assess attitudes and thoughts about healthy eating among university students.

Results
The majority (63.9%) of the participants were not diagnosed with COVID-19. Although both groups paid similar attention to COVID-19 measures, diagnosed participants reported increased consumption of fruits, vegetables, eggs and nuts more than those undiagnosed during the COVID-19 pandemic. Undiagnosed participants had significantly higher scores for emotion related to nutrition, malnutrition and general health compared to diagnosed participants (p<0.05). An inverse and significant association was observed between the Attitude Scale Healthy Nutrition score and the COVID-19 diagnosis status. After full adjustments, participants in the high group of Attitude Scale Healthy Nutrition score group had lower odds of being diagnosed COVID-19 (Odds ratio: 0.80, 95% confidence interval: 0.53-1.19), than those in the low group.

Conclusion
The COVID-19 pandemic has caused changes in the eating habits of individuals. Whether or not to be diagnosed was observed as an effective factor in these changes. This study suggests that healthy eating habits and attitude towards healthy nutrition may be associated with the status of diagnosed COVID-19.

Keywords: Body mass index. COVID-19. Eating habits. Healthy nutrition.

RESUMO

Objetivo

Hábitos nutricionais saudáveis desempenham um papel crítico na prevenção de muitas doenças, incluindo doenças infecciosas. Este estudo foi planejado e conduzido para determinar as medidas de proteção, mudanças de hábitos alimentares, atitudes em relação à nutrição saudável dos participantes de acordo com o diagnóstico de COVID-19 durante a pandemia.

Métodos

O estudo transversal envolveu 873 estudantes universitários. A Escala de Atitude para Nutrição Saudável, hábitos alimentares, medidas de proteção contra COVID-19 e dados demográficos foram coletados por meio de um questionário baseado na web. O objetivo do questionário era coletar opiniões e percepções sobre alimentação saudável entre os estudantes universitários.

Resultados

A maioria dos participantes (63.9%) não tinha COVID-19. Embora ambos os grupos tenham prestado atenção semelhante às precauções contra a COVID-19, os participantes diagnosticados relataram que consumiram mais frutas, vegetais, ovos e nozes durante a pandemia do que os participantes não diagnosticados. Os níveis de emoção dos participantes não diagnosticados para nutrição, desnutrição e geral foram significativamente maiores do que os dos participantes diagnosticados ($p<0.05$). Existe uma correlação inversa e significativa entre o estado diagnosticado de COVID-19 e o escore da Attitude Scale Healthy Nutrition. Os participantes do grupo baixo de pontuação Attitude Scale Healthy Nutrition tiveram chances maiores de ter COVID-19 diagnosticado do que os participantes do grupo alto (razão de chance: 0.80, intervalo de confiança de 95%: 0.53-1.19) após ajustes completos.

Conclusão

A pandemia de COVID-19 provocou alterações nos hábitos alimentares dos indivíduos. O diagnóstico ou não foi observado como fator efetivo nessas alterações. De acordo com este estudo, existe uma correlação entre o diagnóstico de COVID-19 e hábitos alimentares saudáveis e pensamentos sobre nutrição saudável.

Palavras-chave: *Índice de massa corporal. COVID-19. Hábitos alimentares. Nutrição saudável.*

INTRODUCTION

The broad family of viruses known as Coronaviruses (Coronavirus-CoV) is dangerous to humans and is also found in several animal species, such as cats, camels, and bats. Animal coronaviruses evolve over time and can have the capacity to infect humans [1,2]. On January 13, 2020, the Ministry of Public Health of Thailand confirmed the first case of the novel coronavirus in the city of Wuhan, through laboratory testing [3]. The World Health Organization (WHO) designated the coronavirus-based disease COVID-19 on February 11, 2020 and on March 11, 2020, WHO declared the Coronavirus Disease 2019 (COVID-19) virus a pandemic [4]. In Türkiye, the first case was announced on March 11, 2020 [5].

According to reports, COVID-19 and the Severe Acute Respiratory Syndrome (SARS) coronavirus share 70% of their genomes. Symptoms of COVID-19 include breathlessness, a persistent fever, and a dry cough. The virus is particularly widespread in older persons with weakened immune systems, as well as in those with kidney disease, cancer, compromised immune systems, and other diseases. In affected individuals , it can lead to fatal respiratory failures such pneumonia [6]. Due to clinical studies carried out during previous outbreaks, it has been determined that the N95 mask may offer protection against respiratory tract infections, although it is unclear which of the existing protective materials can provide effective protection in the care and treatment of patients during the early stages of the COVID-19 epidemic [7]. On the other hand, it is recommended to adopt and maintain healthy eating habits during this time, as well as the use of personal protective equipment [8].

Sufficient and well-balanced nutrition is crucial for maintaining health. Adequate and balanced nutrition refers to the intake of energy, macro and micronutrients soluble and insoluble fibers that the individual require in according to their age and gender [9]. Malnutrition encompasses the intake of any nutrient in excess, deficiency, or insufficient amounts. Obesity, often referred to as the disease of the century and is especially prevalent in developed nations, arises from excessive nutritional intake and sedentary behavior [10]. Obesity, characterized by excessive fat mass, impacts various endocrine systems and contributes to the development of several clinical conditions, including cancer, diabetes, hypertension, and cardiovascular disease [11]. In fact, a meta-analysis has shown that overweight and face a higher risk of hospitalization due to COVID-19 and have higher mortality rates, especially among those with obesity [12]. Malnutrition is prevalent in undeveloped nations due to challenges in accessing nutritious food and the scarcity of food sources posing a significant threat to the lives of children in these communities. Malnourished individuals are more susceptible to infectious diseases, ue to weakened immune systems, increasing their risk of chronic illnesses. Additionally, malnourished individuals experience serious health complications resulting from infectious diseases [13].

Optimal nutrition plays a crucial role in supporting immune system functions across all stages of life, from infancy to old age. Foods rich in vitamins such as retinol and carotenoids, ascorbic acid and tocopherols, as well as minerals like selenium, zinc, copper, iron and bioactive compounds with antioxidant properties are known to provide protection against infectious diseases [14,15]. However, myokines released from muscles with regular physical activity also exhibit protective effects against infections [16,17]. For this reason, health authorities have developed nutritional recommendations and guidelines to address the COVID-19 pandemic [18-20].

The Turkish Dietetic Association has emphasized that during the pandemic period, it is advisable to increase the consumption of vegetables and fruits, included legumes in daily meals, eat fish twice a week, and limit the consumption of processed food or packaged food [21]. Despite these recommendations, studies conducted in different countries during the lockdown period have revealed the development of negative eating habits, including increased consumption of sugary drinks, processed packaged products and snack items [22]. According to a cohort study, hospital mortality and COVID-19-related mechanical ventilation were significantly higher in people with malnutrition [23]. Similarly, adequate and balanced nutrition, as well as a positive attitude toward healthy eating have been shown to significantly improve weight control, eating habits and stress management during the COVID-19 pandemic, according to a study of Attitude Scale for Healthy Nutrition (ASHN) in Türkiye [24]. This study aimed to determine the protective measures, changes in eating habits, and attitudes towards healthy nutrition of participants according to diagnosed with COVID-19 during the pandemic. The main hypothesis of the study was recognized as "Healthy eating habits show protective properties in individuals who contract COVID-19" for this reason.

METHODS

Study population and sample

This is a cross-sectional and analytical study of websurvey type, conducted on undergraduates of health science students at Gümüşhane, Gaziantep and Burdur Mehmet Akif Ersoy universities in Türkiye. For the sample size, a formula was used considering infinite populations. Only students who attended the mentioned universities, were at least 19 years old, in good mental health, and did not have any dietary restrictions caused on by any diseases were included in the study. The

following factors were taken into account: 50% prevalence, 5% error, deff=2, and 20% addition to account for potential losses. Thus, a sample of at least 420 students was selected, and a total of 873 students replied to the survey. Prior to the survey, participants were asked whether they voluntarily agreed to participate in the study or not. The survey was only completed by thosewho agreed to be included in the study. After collecting the survey data, participants who were outside the specified age range and provided irrelevant answers to the questions were excluded from the study. The nutritional habits of students the during the COVID-19 outbreak were assessed using structured online (Google Forms) questionnaires from March to July 2022, during a period of partial restriction (involving requirements for social distancing, online education, mandatory mask usage, restrictions on public organizations, etc.). The questionnaires were designed to be anonymous to ensure the confidentiality and reliability of thr data. The students who took part in the study were not retested; instead, their responses were used to understand their previous experiences with contracting COVID-19.

Rating instruments

The study instrument consisted of a structured questionnaire that collected demographic information, including gender, age, self reported weight and height, income, and measures taken to protect against COVID-19 (such as getting vaccinated, mask usage etc.). Additionally, the questionnaire assessed general nutritional habits and changes in nutritional habits during thr COVID-19 pandemic. Body Mass Index (BMI) was calculated by dividing weight (in kilograms) by the square of height (BMI=weight/height^2). The BMI values of the participants were categorized into three categories based on the WHO classification including underweight (BMI <18.5 kg/m^2), normal (18.5-24.9 kg/m^2), and overweight/obese (BMI ≥25.0 kg/m^2) [25]. Moreover, participants responded to the 21-item ASHN to assess their attitudes and thoughts about healthy eating. The ASHN includes four subscales. These scales are referred to as Information on Nutrition (IN), Emotion for Nutrition (EN), Positive Nutrition (PN) and Malnutrition (MP). The ratings of the positive items in the scale are "Strongly Disagree", "Disagree", "Undecided", "Agree", "Strongly Agree". Positive attitude items; 1, 2, 3, 4, 5 and negative attitude items were scored as 5, 4, 3, 2 and 1 respectively. The total score ranges from 21 to 105. Participants from ASHN are described as having an attitude towards healthy eating with 21 points very low, 23-42 points low, 43-63 points medium, 64-84 points high, and 85-105 points ideally high. The Turkish validity and reliability of the scale was performed [26]. The ASHN is a well-validated screening instrument, and it has demonstrated excellent internal consistency (Cronbach's α = 0.90).

Data analysis

All data analyses were conducted using the IBM®SPSS® version 25 for Windows (SPSS Inc., Chicago, IL). Continuous variables were expressed as Means (x), Standard Deviation (SD) and categorical variables as percentages. Variables were assessed for normality of distribution and skewed variables were normalize as appropriate. To determine the significance among variables, independent t-test was performed for continuous variables, and a Chi-squared test was performed for categorical variables. Unadjusted and multivariable-adjusted binary logistic regression models were used to calculate Odds Ratios (OR) and 95% Confidence Interval (CI) for the association among tertiles of ASHN score and diagnosed COVID-19 status (yes (+)/no (-)). Multicollinearity testing can be done by looking at value of Variance Inflation Factors (VIF) and Tolerance. If VIF <10

and value of Tolerance >0.10, then not multicollinearity. Conversely, if the value of VIF >10 and the value of Tolerance <0.10, then there is multicollinearity [27]. Covariates included in multivariable-adjusted models were variables that significantly differed among tertiles of ASHN groups. Age (continuous), BMI (continuous), getting a COVID-19 test (yes/no), positive COVID-19 relatives (yes (+)/no (-)) were controlled for in the multivariable-adjusted model. For all analyses, p value of <0.05 was considered significant.

The study was approved by the Ethics Committee of Gümüşhane University Scientific Research and Publication approved this study (Protocol nº E-95674917-108.99-81066; Date: 23/02/2022). All participants voluntarily provided informed consent to participate in the study after being informed about its purpose. The procedures of this study complied with the provisions of the Declaration of Helsinki regarding research on human participants.

RESULTS

The study included volunteer students aged 19-year and older from universities in Gümüşhane, Gaziantep, and Burdur Mehmet Akif Ersoy; and the results were disseminated. The mean age and BMI of the participants were 20.8±1.4 year and 23.5±4.7 kg/m^2, respectively. 72.5% of the participants reported that they had never smoked, 81.1% had never consumed alcohol, and 63.9% had never been diagnosed with COVID-19 (Table 1).

Table 1 – Sociodemographic characteristics.

Age and anthropometric measures of individuals	χ	SD
Age (years)	20.8	1.4
Body weight (kg)	65.2	14.6
Height (cm)	166.4	7.9
Body Mass Index (kg/m^2)	23.5	4.7
Characteristics of individuals	n	%
Gender		
Male	162	18.6
Female	711	81.4
Body Mass Index group		
Underweight	48	5.5
Normal	549	62.9
Overweight/Obese	276	31.6
Income (monthly)		
Less than my expenses	390	44.7
Equal to my expenses	309	35.4
More than my expenses	174	19.9
Do you smoke?		
Yes	192	22.0
No	633	72.5
Quit	48	5.5
Do you consume alcohol?		
Yes	150	17.2
No	708	81.1
Quit	15	1.7
Have you been diagnosed with COVID-19(+)?		
Yes	315	36.1
No	558	63.9
Total	873	100.0

Note: *Mean (χ); SD: Standard Deviation values are given.

According to Table 2, the vaccination rate among participants not diagnosed with COVID-19 (95.2%) was significantly higher than those who diagnosed (90.5%) (p<0.05). The mean number of vaccinations among participants diagnosed with COVID-19 was 2.2±1.0, while among undiagnosed participants, it was 2.4±0.8 (p<0.05). Participants not diagnosed with COVID-19 reported significantly greater adherence to cleaning and hygiene protocols to those diagnosed (p<0.05). Participants diagnosed with COVID-19 warned people around them to risk of COVID-19 significantly more than those who were not diagnosed (p<0.05).

Table 2 – Measures taken to protect against COVID-19.

1 of 2

Measures	Diagnosed COVID-19						χ^2	p
	Yes		No		Total			
	n	%	n	%	n	%		
Have you had the COVID-19 vaccine?								
Yes	285	90.5(-)	531	95.2(+)	816	93.5	7.242	**0.006**
No	30	9.5(+)	27	4.8(-)	57	6.5		
Total number of vaccines (X±SD)	2.2±1.0		2.4±0.8		2.3±0.9		t**:-2.851	**0.004**
Do you suspect that you have COVID-19 and give a test?								
Yes	270	85.7(+)	201	36.0(-)	471	54.0	200.124	**<0.001**
No	45	14.3(-)	357	64.0(+)	402	46.0		
Has anyone in your close circle (family, relative or friend) been diagnosed with COVID-19?								
Yes	306	97.1(+)	486	87.1(-)	792	90.7	24.140	**<0.001**
No	9	2.9(-)	72	12.9(+)	81	9.3		
State of compliance with COVID-19 measures								
I wore a mask.								
Yes	264	83.8	480	86.0	744	85.2		
No	6	1.9	6	1.1	12	1.4	1.411	0.494
Partially	45	14.3	72	12.9	117	13.4		
I observed social distancing								
Yes	216	68.6	393	70.4	609	69.8		
No	9	2.9	21	3.8	30	3.4	1.155	0.561
Partially	90	28.6	144	25.8	234	26.8		
I paid attention to the rules of cleanliness and hygiene								
Yes	273	86.7(-)	507	90.9(+)	780	89.3		
No	3	1.0	-	-	3	0.3	7.762	**0.021**
Partially	39	12.4(+)	51	9.1(-)	90	10.3		
I did not attend collective organizations (weddings, concerts, trips, etc.)								
Yes	123	39.0	225	40.3	348	39.9		
No	30	9.5	66	11.8	96	11.0	1.579	0.454
Partially	162	51.4	267	47.8	429	49.1		
I did not use public transportation								
Yes	96	30.5	174	31.2	270	30.9		
No	111	35.2	216	38.7	327	37.5	1.792	0.408
Partially	108	34.3	168	30.1	276	31.6		
I followed the news about COVID-19								
Yes	198	62.9	375	67.2	573	65.6		
No	15	4.8	24	4.3	39	4.5	1.693	0.429
Partially	102	32.4	159	28.5	261	29.9		
I followed the daily number of COVID-19 cases, tests and deaths								
Yes	141	44.8	276	49.5	417	47.8		
No	57	18.1	69	12.4	126	14.4	5.567	0.062
Partially	117	37.1	213	38.2	330	37.8		
I warned those around me (mother, father and friend, etc.) about COVID-19								
Yes	252	80.0(+)	399	71.5(-)	651	74.6	8.870	**0.010**
No	15	4.8	27	4.8	42	4.8		
Partially	48	15.2(-)	132	23.7(+)	180	20.6		

Table 2 – Measures taken to protect against COVID-19.

Measures	Diagnosed COVID-19						χ^2	*p*
	Yes		No		Total			
	n	%	n	%	n	%		
I have not been in closed environments for a long time								
Yes	171	54.3	270	48.4	441	50.5		
No	21	6.7	60	10.8	81	9.3	5.174	0.069
Partially	123	39.0	228	40.9	351	40.2		
I paid attention to a healthy, adequate and balanced diet								
Yes	180	57.1	327	58.6	507	58.1		
No	15	4.8	21	3.8	36	4.1	0.572	0.751
Partially	120	38.1	210	37.6	330	37.8		
Total	315	100.0	558	100.0	873	100.0		

Note: *Chi-squared test was performed for categorical variables; ***t* value: Independent t-test was performed. Residual analysis: (+) Significant association; (-) Negative significant association. Bold text indicates statistical significance.

The general eating habits of individuals with and without a diagnosis of COVID-19 were compared (Table 3). A higher proportion of individuals without a diagnosis reported healthier eating habits. While, 38.8% of those who consumed three main meals per day were diagnosed with COVID-19, whereas 61.2% were not. Similarly only 26.7% of individuals who never consumed snacks received a diagnosis, while 73.3% did not. Additionally, 33.6% of individuals who skip meals received a diagnosis, compared to 39.1% who did not skip meals, Participants often cited lack of hungry as the reasonfor skipping meals. It has been shown that people without a diagnosis of the COVID-19 pandemic are more compatible with the recommended daily intake quantities of food groups. The prevalence of undiagnosed individuals was higher across all groups, although there was no significant difference in adherence to the daily recommended consumption of dairy products, meat products, vegetables and fruits, or nuts, between those who have been diagnosed and those who have not. However, individuals who consumed 5 portions of grain per day (diagnosed yes: 35.8%, diagnosed no: 64.2%) and 3 portions of legumes per day (diagnosed yes: 29.6%, diagnosed no: 70.4%) exhibited higher rates of being undiagnosed.

The majority of individuals did not alter their eating habits during the pandemic. However, there was a noticeable difference between individuals with and without a diagnosis of COVID-19 in terms of their fruit, egg, and alcohol intake during the pandemic period (Table 4). While diagnosed with COVID-19 did not increase their fruit and egg consumption, they were observed toconsume less than the recommended daily portions (Table 3).

The mean scores for EN (Diagnosed COVID-19; Yes:16.7±4.8 and No: 17.5±4.7), MP (Diagnosed COVID-19; Yes: 17.0±4.5 and No:17.7±4.3) and ASHN (Diagnosed COVID-19; Yes:70.1±11.3 and No:72.3±12.0) were found significantly higher in the non-diagnosed COVID-19 compared with diagnosed group ($p<0.05$). Although, the mean scores of IN (Diagnosed COVID-19; Yes:19.4±6.1 and No:19.9±6.3) and PN (Diagnosed COVID-19; Yes: 16.9±5.0 and No:17.0±5.5) in the non-diagnosed group were higher than those in the other group, none of these differences were statistically significant.

The correlation between the attitude towards healthy nutrition and the status of diagnosed COVID-19 is shown in Table 5. We observed a significant negative correlation between ASHN score and diagnosed COVID-19 in the unadjusted model (OR:0.64, 95% CI: 0.45-0.91, $p<0.05$) and model 1 (OR: 0.65, 95% CI: 0.46-0.92, $p<0.05$); however, there is no significance in model 3 (OR: 0.80, 95% CI: 0.53-1.19, $p>0.05$). As a result of logistic regression analysis, it was revealed that a higher attitude towards healthy nutrition was correlated with a decreased risk of diagnosing COVID-19.

Table 3 – General eating habits and daily consumption food groups of participants during the COVID-19 period.

Eating habits	Diagnosed COVID-19				χ^2	*p*
	Yes		No			
	n	%	n	%		
General eating habits						
Daily main meal						
2	174	34.1	336	65.9	2.053	0.087
3	141	38.8	222	61.2		
Daily snack meal						
No	36	26.7(+)	99	73.3(-)	20.322	**<0.001**
1	90	34.1	174	65.9		
2	162	43.9	207	56.1		
3	27	25.7(-)	78	74.3(+)		
Skipping meal						
Yes	147	33.6	249	62.9	1.626	0.444
No	54	39.1	84	60.9		
Sometimes	114	33.6	225	66.4		
Reason skipping meal						
Not skipping	57	37.3	96	62.7	2.050	0.728
Lack of appetite	90	34.9	168	65.1		
Unsuitable environment	45	31.9	96	68.1		
Lack of time	111	38.1	180	61.9		
Weight loss	12	40.0	18	60.0		
Eating outside the home						
Yes	180	35.3	330	64.7	5.071	0.080
No	18	54.5	15	45.5		
Sometimes	117	35.5	213	64.5		
Daily consumption of food groups during the COVID-19 period						
Diary products (3 serving/d)						
Yes	93	39.2	144	60.8	1.570	0.457
No	96	34.0	186	66.0		
Partly	126	35.6	228	64.4		
Meat (1,5 serving/d)						
Yes	93	36.5	162	63.5	0.605	0.749
No	69	33.8	135	66.2		
Partly	153	37.0	261	63.0		
Grains (5 serving/d)						
Yes	171	35.8	306	64.2	7.749	**0.019**
No	63	45.7	75	54.3		
Partly	81	31.4	177	68.6		
Pulses/legumes (3 serving/d)						
Yes	96	29.6(-)	228	70.4(+)	10.271	**0.006**
No	66	43.1	87	56.9		
Partly	153	38.6(+)	243	61.4(-)		
Vegatables (3 serving/d)						
Yes	144	38.1	234	61.9	1.429	0.486
No	48	36.4	84	63.6		
Partly	123	33.9	240	66.1		
Fruits (2 serving/d)						
Yes	153	33.6	303	66.4	5.031	0.082
No	42	33.3	84	66.7		
Partly	120	41.2	171	58.8		
Nuts (0,5 serving/d)						
Yes	90	34.9	168	65.1	3.106	0.217
No	63	31.8	135	68.2		
Partly	162	38.8	255	61.2		
Total	315	100.0	558	100.0		

Note: Chi-squared test was performed for categorical variables. Row percentage is given Residual analysis: (+) Significant association; (-) Negative significant association. Bold text indicates statistical significance.

Table 4 – Changes in the consumption of food groups of participants during the COVID-19 period.

Changes in the consumption of food groups	Diagnosed COVID-19						χ^2	*p*
	Yes		No		Total			
	n	%	n	%	n	%		
Dairy product								
Increased	49	15.5	80	14.3	129	14.8	1.647	0.447
Not changed	251	79.7	460	82.4	711	81.4		
Decreased	15	4.8	18	3.3	33	3.8		
Fruit								
Increased	135	42.9(+)	156	28.0(-)	291	33.3	21.886	**<0.001**
Not changed	171	54.2(-)	369	66.1(+)	540	61.9		
Decreased	9	2.9	33	5.9	42	4.8		
Vegatable								
Increased	99	31.4	135	24.2	234	26.8	5.629	0.059
Not changed	210	66.7	408	73.1	618	70.8		
Decreased	6	1.9	15	2.7	21	2.4		
Meat								
Increased	44	14.0	73	13.1	117	13.4	0.193	0.922
Not changed	244	77.5	434	77.8	678	77.7		
Decreased	27	8.5	51	9.1	78	8.9		
Pulses /Legumes								
Increased	40	12.7	74	13.3	114	13.1	0.194	0.900
Not changed	263	83.5	460	82.4	723	82.8		
Decreased	12	3.8	24	4.3	36	4.1		
Grains								
Increased	38	12.0	91	16.3	129	14.8	3.250	0.196
Not changed	256	81.3	437	78.3	693	79.4		
Decreased	21	6.7	30	5.4	51	5.8		
Egg								
Increased	86	27.3(+)	110	19.7(-)	196	22.5	6.691	**0.036**
Not changed	204	64.8(-)	397	71.1(+)	601	68.8		
Decreased	25	7.9	51	9.1	76	8.7		
Snacks								
Increased	95	30.2	184	33.0	279	32.0	1.290	0.530
Not changed	142	45.0	230	41.2	372	42.6		
Decreased	78	24.8	144	25.8	222	25.4		
Beverage								
Increased	79	25.1	140	25.1	219	25.1	4.941	0.084
Not changed	174	55.2	273	48.9	447	51.2		
Decreased	62	19.7	145	26.0	207	23.7		
Fat								
Increased	17	5.4	34	6.1	51	5.8	0.581	0.772
Not changed	247	78.4	425	76.2	672	77.0		
Decreased	51	16.2	99	17.7	150	17.2		
Oils								
Increased	21	6.7	48	8.6	69	7.9	3.729	0.153
Not changed	276	87.6	462	82.8	738	84.5		
Decreased	18	5.7	48	8.6	66	7.6		
Nuts								
Increased	71	22.5	103	18.5	174	19.9	2.168	0.340
Not changed	220	69.8	413	74.0	633	72.5		
Decreased	24	7.6	42	7.5	66	7.6		
Alcohol*								
Increased	12	3.8	18	3.2	30	3.4	11.752	**0.008**
Not changed	206	65.4(-)	424	76.0(+)	630	72.2		
Decreased	79	25.1(+)	92	16.5(-)	171	19.6		
Total	315	100.0	558	100.0	873	100.0		

Note: Chi-squared test was performed for categorical variables.*42 participants did not mark the question. Column percentage is given Residual analysis: (+) Significant association; (-) Negative significant association. Bold text indicates statistical significance.

Table 5 – Unadjusted and multivariable-adjusted odds ratios and 95% CI for diagnosed COVID-19 across tertiles of Attitude Scale for Healthy Nutrition.

Attitude Healthy Nutrition Score	Unadjusted		Model 1		Model 2	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Tertile 1 (Low)	1 (Reference)		1 (Reference)		1 (Reference)	
Tertile 2 (Moderate)	0.99 (0.71-1.38)	0.957	0.97 (0.69-1.36)	0.888	0.94 (0.64-1.38)	0.758
Tertile 3 (High)	0.64 (0.45-0.91)	**0.012***	0.65 (0.46-0.92)	**0.017***	0.80 (0.53-1.19)	0.269

Note: *Indicates a tendency ($p<0.05$) to be statistically different. Binary logistic regression analysis was used. Values were found to be statistically significant were indicated in bold. Data are presented as OR (95% CI). Total Attitude Scale for Healthy Nutrition score values were stratified by three groups. Reference group refers to that within the same comparative group. Model 1: Adjusted for age and BMI. Model 2: Model 1 + adjusted for getting COVID-19 test (yes/no), positive relatives COVID-19 (yes/no), COVID-19 vaccine (yes/no). Low group (n)=297, Moderate group (n)=290, High group (n)=286.

DISCUSSION

The COVID-19 infection still continues as a public health problem, showing its effect all over the worldwide and spreading rapidly through droplet transmission. The present study aimed to evaluate the nutritional habits of individuals diagnosed with COVID-19 and without.

During the COVID-19 pandemic, the high frequency of hospital admissions among obese individuals and the more severe course of COVID-19 in this population highlight a bidirectional relationship. Obesity predisposes individuals to a higher risk of contracting the disease and can also exacerbate the severity of the infection. In this regard, the presence of obesity is a condition that warrants considerationin both infected patients and healthy individuals. Given the strong correlation between obesity and nutrition dietary practices assume significance in the context of COVID-19, not only for the treatment of the disease but also for its prevention [28,29]. The mean BMI of the participants 23.5±4.7 kg/m^2 and 63.9% reported no history of COVID-19 diagnosis. The classification of most of students as "normal" according to BMI along with a high rate COVID-19-free individuals; may be attributed to the predominant inclusion of students from the Faculty of Health Sciences. As future healthcare professionals, these students likely possess knowledge about the appropriate management of the COVID-19 pandemic, both through their academic coursework and practical experiences in healthcare settings. The preventive measures to avoid infection include maintaining personalpersonal hygiene, adhering tosocial distance rule and ensuring food hygiene. It was observed that participants who had not been diagnosed with COVID-19 declared that they paid significantly more attention to cleaning and hygiene rules than those who were diagnosed ($p<0.05$). The increased adherence to social distance guidelines was also linked to a higher adherence to personal cleanliness practices and support for government-ordered political initiatives relating to COVID-19. These findings are related to previous international research where sociodemographic variables were used to explain whether social-distancing policies are followed or intended to be followed in various countries [30-32]. According to previous studies that are consistent with this research, younger individuals are less likely to adhere to social distance rules [30,33]. Participants diagnosed with COVID-19 warned others about therisk of of contracting the COVID-19 significantly more than those who were not diagnosed ($p<0.05$). In this study, participants' concerns about COVID-19 tended to express more concern about the potential negative outcomes of infection compared to those who were not diagnosed. This result is consistent with the higher expectation of reinfection among those diagnosed with COVID-19, indicating that the lack of knowledge and experience about the disease may lead to underestimation of its potential harmful effects. It be noted that, in addition to medical treatment, underlying factors such as obesity pose risks for COVID-19 infections. A strong immune system can be considered an important factor in the prevention of this disease. Strengthening the immune system is possible with adequate and balanced nutrition [34].

The psychological state created by the pandemic and its restrictions has significantly influenced individuals' dietary habits, leading to decreased physical activity levels, increased food intake, and a greater tendency toward obesity [35].

During this period, it is essential to pay attention to food selection, food hygiene and food safety should be ensured, physical activity, increased and ideal body weight should be maintained. It is crucial to maintain optimal health status to mitigate the risk of COVID-19 infection, which poses a widespread threat to public health and has a high transmission rate [36,37].

Retinol, ascorbic acid, tocopherols, antioxidant-effective minerals, and other bioactive ingredients should be included in the diet for infectious diseases [38]. These nutrients are recommended in the dietary guidelines of various countries for individuals of all ages and genders [39,40]. Studies have shown that individuals with obesity, malnutrition, and the elderly have a poorer prognosis during the COVID-19 pandemic [39]. In a study conducted by Kahrıman et al. [41], 59.9% of participants (n=182) who consumed three meals per day contracted COVID-19, while 25.8% who consumed two meals per day, and 9.3% who consumed one meal per day. They were found to consume four meals a day, with 4.9% eating five or more (p<0.05). According to Gürel and Ok [42], 76.6% of students eat two snacks daily, whereas 26.5% only eat one. However, 25.7% of individuals who consumed 3 snacks each day received a diagnosis (p<0.05). There was no significant difference between the percentage of people who skip meals (33.6%), those who don't skip meals (39.1%), and those who occasionally skip meals (33.6%) (p>0.05). According to Gürel and Ok [42], during the pandemic, 45.0% of people skipped meals, compared to 19.2% who did not. The participants listed not feeling hungry as one of their excuses for skipping meals. It has been shown that individuals without a diagnosis of COVID-19 are more likely to adhere to the recommended daily intake of food groups.

Kahrıman et al. [41] found that the participants increased their usage of nutritional supplements, onion, garlic, and oilseeds containing bioactive components, and these nutritional supplements the highest throughout the pandemic period. Tuna [43] determined that during the pandemic period, people drank more tea, coffee, and instant grapes as snacks. Home cooking, fruit, meat, and meat products were among the foods that health professionals increased their consumption in the same study. It has also been demonstrated that participants consume fewer packaged, already-made goods, such as cakes, pastries, and cookies. The duration of staying at home and the restrictions during the lockdown period during the pandemic both impact on people's food patterns. Jia et al. [44] reported that there was a decrease in the consumption of vegetables, fruits, poultry, milk, and dairy products and an increase in the consumption of wheat products and canned goods among a large cohort of participants in China during the COVID-19 pandemic. The attitude towards healthy nutrition significantly impacts individual's nutrition knowledge and behaviors. In other words, a positive attitude towards healthy nutrition may indicate higher nutritional knowledge and more positive eating habits [45]. However, there is limited research on whether a major public health emergency, such as the epidemic of COVID-19 infection, will affect people's attitude healthy nutrition. Most studies in the literature are related to the nutritional behavior changes during the pandemic period or the clinical nutritional status of the patients diagnosed with COVID-19. In this sense, the present study is the first research to investigate the relationship between attitude healthy nutrition and COVID-19 diagnosis.

The relationship between nutrition and the immune system is well established, and considerable attention is being directed towards its role in combating COVID-19 [46]. While healthy eating habits are not a direct treatment for COVID-19, healthy eating habits tend to improve immune system function and result in a reduced risk of COVID-19 infection and better recovery in those who have

been infected [47]. As a result in a study observed that the Mediterranean diet, one of the healthy dietary patterns, adherence was negatively associated with both COVID-19 cases and related deaths and that the relationship remained when adjusted for well-being factors [48]. According to the findings of the present study, it was determined that individuals who were not diagnosed with COVID-19 had more positive attitudes towards healthy nutrition compared to others. Additionally, this result was corroborated by the analyses presented in Table 5. In summary, a high attitude towards healthy nutrition in individuals is associated with a lowerrisk of being diagnosed with COVID-19. This result can be attributed to the fact that healthy nutrition and behaviors decrease the risk of infection by bolstering the immune system.

The limitations of this study are that the student population participating in the study was limited to three universities, having only participants who can access the internet, the number of students participating in the study and the absence of food consumption records were not taken with the retrospective recall method. Collecting data within a limited timeframe due to restrictions on social activities during the global epidemic and the uncertainty surrounding the duration of these measures is also undesirable. Despite these limitations, it is believed that presenting the relationship between the COVID-19 pandemic and eating habits would provide valuable insights to the literature.

CONCLUSION

Overall, the present study revealed significant changes in the eating habits of participants due to the COVID-19 pandemic. Notably, individuals diagnosed with COVID-19 showed higher consumption of fruits, vegetables, eggs, and nuts compared to those without the diagnosis. Moreover, it is speculated that individuals with COVID-19 exhibit even greater emphasis on healthy eating habits following theirillness. However, healthy eating habits play a critical role not only in the period of illness but also in the lifetime. Moreover, the attitude towards healthy eating is higher in undiagnosed participants, may indicate the protectiveness of healthy nutrition against COVID-19. A positive attitude towards healthy eating can lead to favorable changes changes in the eating habits of individuals and may reduce the risk of disease. Therefore, from a public health perspective, efforts should be directed towards educating individuals about healthy nutrition and promoting positive behavioral changes for primary and secondary prevention of non-communicable and communicable diseases, including infectious diseases.

REFERENCES

1. Fung TS, Liu DX. Human coronavirus: Host-pathogen interaction. Annu Rev Microbiol. 2019;73:529-57.
2. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nat. 2020;579(7798):270-3.
3. Du Z, Wang L, Cauchemez S, Xu X, Wang X, Cowling BJ, et al. Risk for Transportation of Coronavirus Disease from Wuhan to Other Cities in China. Emerg Infect Dis. 2020;26(5):1049.
4. World Health Organization. Coronavirus disease (COVID-19) pandemic [Internet]. Geneve: Organization; 2019 [cited 2023 Jan. 10]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019
5. Şahin M. Impact of weather on COVID-19 pandemic in Türkiye. Sci Total Environ. 2020;728:138810.
6. Stein RA. COVID-19: Risk groups, mechanistic insights and challenges. Int J Clin Pract 2020;74(8):e13512.
7. Liu M, Cheng SZ, Xu KW, Yang Y, Zhu QT, Zhang H, et al. Use of personal protective equipment against coronavirus disease 2019 by healthcare professionals in Wuhan, China: Cross sectional study. BMJ. 2020;369.
8. Al-Domi H, AL-Dalaeen A, AL-Rosan S, Batarseh N, Nawaiseh H. Healthy nutritional behavior during COVID-19 lockdown: A cross-sectional study. Clin Nutr Espen. 2021;42:132.

9. Aune D, Giovannucci E, Boffetta P, Fadnes LT, Keum NN, Norat T, et al. Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose-response meta-analysis of prospective studies. Int J Epidemiol. 2017;46(3):1029-56.
10. World Health Organization. Obesity and overweight [Internet]. Geneve: Organization; 2021 [cited 2022 Nov. 28]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
11. Schetz M, De Jong A, Deane AM, Druml W, Hemelaar P, Pelosi P, et al. Obesity in the critically ill: A narrative review. Intensive Care Med. 2019;45(6):757-69.
12. Sawadogo W, Tsegaye M, Gizaw A, Adera T. Overweight and obesity as risk factors for COVID-19-associated hospitalisations and death: Systematic review and meta-analysis. BMJ Nutr Prev Health. 2022;19;5(1):10-18.
13. Grey K, Gonzales GB, Abera M, Lelijveld N, Thompson D, Berhane M, et al. Severe malnutrition or famine exposure in childhood and cardiometabolic non-communicable disease later in life: A systematic review. BMJ Glob Heal. 2021;6(3):e003161.
14. Ahmed MH, Hassan A, Molnár J. The Role of Micronutrients to Support Immunity for COVID-19 Prevention. Rev Bras Farmacogn. 2021;31(4):361-74.
15. Trujillo-Mayol I, Guerra-Valle M, Casas-Forero N, Sobral MMC, Viegas O, Alarcón-Enos J, et al. Western Dietary Pattern Antioxidant Intakes and Oxidative Stress: Importance During the SARS-CoV-2/COVID-19 Pandemic. Adv Nutr. 2021;12(3):670-81.
16. Lombardo M, Feraco A, Bellia C, Prisco L, D'ippolito I, Padua E, et al. Influence of Nutritional Status and Physical Exercise on Immune Response in Metabolic Syndrome. Nutrients. 2022;14(10):2054.
17. Simpson RJ, Pawelec G. Is mechanical loading essential for exercise to preserve the aging immune system? Immun Ageing. 2021;18(1):1-3.
18. De Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FLFZ, Prado CMM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. Nutr Rev. 2021;79(4):382-93.
19. Hinkelmann JV, Oliveira NA, Marcato DF, Costa ARRO, Ferreira AM, Tomaz M, et al. Protocol Nutritional support protocol for patients with COVID-19. Clinical Nutrition ESPEN. 2022;49:544-50.
20. Alencar ES, Muniz LSS, Holanda JLG, Oliveira BDD, Carvalho MCF, Leitão AMM, et al. Enteral nutritional support for patients hospitalized with COVID-19: Results from the first wave in a public hospital. Nutrition. 2022;94:111512.
21. Turkish Dietetic Association. COVID 19 Nutritional guidelines [Internet]. Anakara: Association; 2022 [cited 2022 Nov 29]. Available from: https://www.tdd.org.tr/Haberler/tabid/21021/articleType/ArticleView/articleId/56328/COVID-19-Beslenme-Onerileri.aspx
22. Scapaticci S, Neri CR, Marseglia GL, Staiano A, Chiarelli F, Verduci E. The impact of the COVID-19 pandemic on lifestyle behaviors in children and adolescents: An international overview. Ital J Pediatr. 2022;48(1):1-17.
23. Mohammadi P, Varpaei HA, Mohammadi M, Rahimi M, Orandi A. Evaluation of the relationship between nutritional status of COVID-19 patients admitted to the ICU and patients' prognosis: A Cohort study. J Nutr Metab. 2022;2022:5016649.
24. Özenoğlu A, Çevik E, Çolak H, Altıntaş T, Alakuş K. Changes in nutrition and lifestyle habits during the COVID-19 pandemic in Turkey and the effects of healthy eating attitudes. Med J Nutrition Metab. 2021;14(3):325-41.
25. World Health Organization. Nutrition – Body mass index (BMI) – Related indicators. Geneve: Organization; 2020 [cited 2022 Nov 30] Available from: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/body-mass-index
26. Tekkurşun Demir G, Cicioğlu Hİ. Sağlıklı Beslenmeye İlişkin Tutum Ölçeği (SBİTÖ): Geçerlik ve güvenirlik çalışması. Gaziantep Üniversitesi Spor Bilim Derg. 2019;4(2):256-74.
27. Shrestha, N. Detecting multicollinearity in regression analysis. Am J Appl Math Stat. 2020;8(2):39-42.
28. Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, et al. Features of 20 133 UK patients in hospital with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol: Prospective observational cohort study. BMJ. 2020;369:m1985.
29. Luzi L, Radaelli MG. Influenza and obesity: Its odd relationship and the lessons for COVID-19 pandemic. Acta Diabetol. 2020;57(6):759-64.

30. Xu X, Chew KA, Xu X, Wu Z, Xiao X, Yang Q. Demographic and social correlates and indicators for behavioural compliance with personal protection among Chinese community-dwellers during COVID-19: A cross-sectional study. BMJ Open. 2021;11(1):e041453.

31. Smith PH, Branscum PW. Feasibility, Utility, and Limitations of a Rapid Community Behavioral Diagnosis for Social Distancing During the 2020 Coronavirus Pandemic. 2020;35(1):77-83.

32. Uddin S, Imam T, Khushi M, Khan A, Ali M. How did socio-demographic status and personal attributes influence compliance to COVID-19 preventive behaviours during the early outbreak in Japan? Lessons for pandemic management. Pers Individ Dif. 2021;175:110692.

33. Margraf J, Brailovskaia J, Schneider S. Behavioral measures to fight COVID-19: An 8-country study of perceived usefulness, adherence and their predictors. Plos One. 2020;15(12):e0243523.

34. De Bandt JP, Monin C. Obesity, Nutrients and the Immune System in the Era of COVID-19. Nutrients. 2021;13(2):1-14.

35. Di Renzo L, Gualtieri P, Cinelli G, Bigioni G, Soldati L, Attinà A, et al. Psychological Aspects and Eating Habits during COVID-19 Home Confinement: Results of EHLC-COVID-19 Italian Online Survey. Nutrients. 2020;12(7):1-14.

36. Calder PC. Nutrition and immunity: Lessons for COVID-19. Nutr Diabetes. 2021;11(1):1-8.

37. Ceylan Z, Meral R, Cetinkaya T. Relevance of SARS-CoV-2 in food safety and food hygiene: potential preventive measures, suggestions and nanotechnological approaches. Virusdisease. 2020;31(2):154-60.

38. Turkish Ministry of Health. Turkey Nutrition Guidelines 2015 [Internet]. Ankara: Turkish Ministry of Health; 2016. [cited 29 Nov 2022]. Available from: https://dosyasb.saglik.gov.tr/Eklenti/10915,tuber-turkiye-beslenme-rehberipdf.pdf

39. US Department of Agriculture, US Department of Health and Human Services. Dietary Guidelines for Americans – 2015-2020 [Internet]. Washington: US; 2015 [cited 2022 Nov 30]. Available from: https://health.gov/sites/default/files/2019-09/2015-2020_Dietary_Guidelines.pdf

40. Mentella MC, Scaldaferri F, Gasbarrini A, Miggiano GAD. The Role of Nutrition in the COVID-19 Pandemic. Nutrients. 13(4):1093.

41. Kahrıman HE, Çoşkun F, Yılmaz F. Nutritional habits during the COVID-19 pandemic in the Thrace Region and the relationship between some habits and catch COVID-19. J Hum Sci. 2022;19(2):162-84.

42. Gürel S, Ok AM. COVID-19 Salgın Sürecinin, Sağlık Eğitimi Alan Öğrencilerin Beslenme Alışkanlıkları, Fiziksel Aktivite ve Vücut Ağırlıkları Üzerine Etkisinin Saptanması. BÜSBİD. 2021;6:1-15.

43. Tuna B. COVID-19 salgını sürecinde sağlık çalışanlarının beslenme alışkanlıkları değişimi [tesis]. Bursa: Bursa Uludağ University; 2022.

44. Jia P, Liu L, Xie X, Yuan C, Chen H, Guo B, et al. Changes in dietary patterns among youths in China during COVID-19 epidemic: The COVID-19 impact on lifestyle change survey (COINLICS). Appetite. 2021;158:105015.

45. Luo Y, Chen L, Xu F, Gao X, Han D, Na L. Investigation on knowledge, attitudes and practices about food safety and nutrition in the China during the epidemic of corona virus disease 2019. Public Heal Nutr. 2021;24(2):267-74.

46. Iddir M, Brito A, Dingeo G, Del Campo SSF, Samouda H, La Frano MR, et al. Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis. Nutrients. 2020;12(6):1562.

47. Cereda E, Clavé P, Collins PF, Holdoway A, Wischmeyer PE. Recovery Focused Nutritional Therapy across the Continuum of Care: Learning from COVID-19. Nutrients. 2021;13(9):3293.

48. Greene MW, Roberts AP, Frugé AD. Negative Association Between Mediterranean Diet Adherence and COVID-19 Cases and Related Deaths in Spain and 23 OECD Countries: An Ecological Study. Front Nutr. 2021;5;8:74.

ACKNOWLEDGEMENT

We extend our gratitude to all the students who generously volunteered to participate in this study and took the time to complete the questionnaire. We also express our appreciation to the universities where the research was carried out for their support and cooperation.

CONTRIBUTORS

During the preparation of the study, all authors contributed equally to its development.