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## EXAMINING DIETARY PATTERNS AND CHANGES IN PHYSICAL ACTIVITY DURING THE PANDEMIC

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### **Abstract**

**Purpose:** Changes in the dietary habits of volunteer participants before, during and after the pandemic were examined.

**Materials and Methods:** The study included 1323 people between the ages of 18-65 and was a descriptive study. The survey was administered to individuals via Google Form Internet connection in 2021, 2022 and 2023. No name and surname information was requested from the participants. This survey was conducted in our country on retired, healthcare personnel, students and individuals with SSL. In the lower parts of the survey questions, explanations were made using the sampling method.

**Results:** When compared before and after the pandemic, a significant difference was found in the consumption of food supplements ( $p < 0.001$ ), functional foods ( $p < 0.001$ ), foods that strengthen the immune system ( $p < 0.001$ ) and probiotic-prebiotic ( $p < 0.001$ ) foods.

Physical activity levels decreased significantly from pre-pandemic to pandemic and post-pandemic. During the pandemic, consumption of all food groups increased significantly among healthcare workers, students and other groups (retired, unemployed, etc.). There was a significant difference in probiotic and functional food consumption between before and after the pandemic. Compared to before and after the pandemic, pre-probiotic use decreased from 59.30% to 40.70%. Functional food consumption decreased from 55.70% to 44.30%.

**Conclusion:** It is seen that the pandemic changed the dietary habits of individuals, but after the pandemic, individuals' interest in these foods decreased and they returned to their pre-pandemic diet.

**Keywords:** Covid-19, Nutritional Habits, Pandemic, Functional Food, Food supplement

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## **PANDEMİ SIRASINDA BESLENME ALIŞKANLIKLARININ VE FİZİKSEL AKTİVİTE DEĞİŞİKLİKLERİNİN İNCELENMESİ**

### **Öz**

**Amaç:** Gönüllü katılımcıların pandemi öncesinin, sürecinin ve sonrasındaki beslenme alışkanlıklarının değişiklikleri incelenmiştir.

**Gereç ve Yöntem:** Araştırmaya 18-65 yaş arasında 1323 kişi katıldı ve tanımlayıcı bir çalışmadır. Anket 2021, 2022 ve 2023 yıllarında Google Form İnternet bağlantısı aracılığıyla bireylere uygulanmıştır. Katılımcılardan isim ve soyisim bilgisi istenmemiştir. Ülkemizde emekli, sağlık personeli, öğrenci ve SGK'lı bireylere bu anket yapılmıştır. Anket sorularının alt kısımlarında örneklendirme yöntemiyle açıklamalar yapılmıştır.

**Bulgular:** Pandemi öncesi ve sonrası kıyaslandığında gıda takviyesi ( $p < 0,001$ ), fonksiyonel gıdalar ( $p < 0,001$ ), bağışıklık sistemini güçlendiren gıdalar ( $p < 0,001$ ) ve probiyotik -prebiyotik ( $p < 0,001$ ) besinlerin tüketiminde anlamlı bir fark bulunmuştur. Pandemi öncesinin pandemi sürecine ve pandemi sonrasına göre fiziksel aktivite düzeyleri anlamlı olarak düşmüştür. Pandemi sürecinde sağlık çalışanlarında, öğrencilerde ve diğer gruplarda (emekli, işsiz vb.) tüm besin gruplarının tüketimi anlamlı olarak artmıştır. Pandemi öncesi ve sonrası arasında probiyotik ve fonksiyonel gıda tüketiminde anlamlı bir fark vardı. Pandemi öncesi ve sonrası ile karşılaştırıldığında pre-probiyotik kullanımının %59,30'dan %40,70'e düştüğü belirlendi. Fonksiyonel gıda tüketimi ise %55,70'den %44,30'a düşmüştür.

**Sonuç:** Pandemi, bireylerin beslenme alışkanlıklarını değiştirdiği fakat pandemi sonrasında bireylerin bu besinlere olan ilgisinin azalıp pandemi öncesi beslenme tarzlarına dönüş yaptıkları görülmüştür.

**Anahtar Kelimeler:** Covid-19, Beslenme Alışkanlıkları, Pandemi, Fonksiyonel Gıda, Gıda Takviyesi.

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### **Introduction**

Coronavirus (COVID-19) is a disease that affects the world. Effects of COVID-19 such as fever, trouble breathing, lung infection, and pandemic symptoms have appeared (Adhikari et al., 2020). It causes a life-threatening danger in individuals with the effect of these symptoms (Casella et al., 2020). All countries have decided to combat this pandemic. First of all, it has

started to struggle with two methods. Social isolation was intended to prevent the epidemic among healthy individuals (Parmet & Sinha, 2020). World Health Organization (WHO) has emphasized the importance of healthy nutrition other than these methods. For this reason, he drew attention to the importance of individual protection and healthy nutrition (World Health Organization, 2020).

The importance of a healthy and balanced diet was explained to individuals, and society was informed (World Health Organization, 2020). During situations with increased requirements (e.g., infection, stress, and pollution), the immune system is activated and thus increases the energy demand. The immune system weakens if it cannot meet the need (Zhang & Liu, 2020). It was emphasized that those who survived the disease during the pandemic period had weak immune systems (Dilber & Dilber, 2020). In this process, individuals are advised to consume diets rich in antioxidants, flavonoids, vitamins, fruits and vegetables, dietary fiber, protein, and other nutrients. Additionally, WHO; stated that smoking, drinking alcohol, eating rich in excess carbohydrates and saturated fats and an unbalanced diet negatively affect the immune system. On the other hand, the public has long been informed that such diets will cause obesity, diabetes, and cardiovascular disorders. It has been stated that these diseases are the riskiest groups during the pandemic (Ito et al., 2003).

During the pandemic, individuals were asked to consider these warnings. Studies have emphasized that a healthy diet will also have a positive effect on overcoming this disease (Dilber & Dilber, 2020). Additionally, it has been stated that physical activity and staying away from stress will affect the strengthening of the immune system (Naja & Hamadeh, 2020). In this process, quarantines, and strict measures taken by countries to prevent the epidemic create unwanted stress in society (Brooks et al., 2020). Pandemic; forced changes in the life flow of individuals such as economy, education, social relations, and communication. It can be said that this change in daily life creates stress in a large part of society (Tang et al., 2020).

In a study, it was observed that the level of physical activity decreased significantly and there was an increase in the time spent sitting during the day. A decrease in physical activity primarily poses the risk of obesity. In the research, In the studies warned that people should engage in physical activity at home and make sure that energy intake is equal to energy expenditure (Dilber & Dilber, 2020; Korkut Gençalp, 2020).

It is aimed to examine the status of the volunteer participants in their eating habits during and after the pandemic and the changes in their daily lives in this study.

## **Materials and Methods**

### **Study Type**

This cross-sectional study is a survey conducted with people between the ages of 18-65. The study consists of individuals in Turkey and Turkish society. Information was obtained from volunteer individuals three times by survey method between March-April 2021, February-March 2022, and April 2023, and these three periods were named Group1 (G1), Group2 (G2), and Group3 (G3.), respectively.

### **Study Group**

While G1 and G2 were asked questions about the pre-pandemic and post-pandemic periods, G3 was asked questions about the pandemic period and post-pandemic period. 1323 people participated in the online survey.

### **Procedures**

The online survey method was used to deliver and fill out the survey to individuals via the Google Form Internet tool. Since data confidentiality was important during the preparation of the survey, name-surname/identification number information was not requested. Age information was not asked in detail (day/month/year), but only in years (e.g. 22). The survey consists of two parts. The first part consists of social-demographic questions. In the second part, it is aimed to determine the effect of the pandemic on the nutritional habits, physical activities, and behavior styles of individuals. Yes/No options were determined for the survey questions.

Height and body weight measurements are based on the declaration. Body mass index (BMI) was calculated by dividing body weight (in kilograms) by the square of height (in meters) (Cesur et al., 2022).

This questionnaire does not include socio-demographic questions and consists of 10 questions. The reliability level of these questions was calculated over 88 participants before the research started and the result was categorized as "very reliable" (Cronbach's alpha=0.797).

### Statistical Analysis

Statistical analysis was performed with SPSS version 22 program. The suitability of variables to normal distribution was examined using analytical methods (Kolmogorov-Smirnov / Shapiro-Wilk tests). Descriptive statistics were done by giving percentile values for normally distributed variables. McNemar analyzed the dependent groups between continuous variables. The chi-square test was used for independent groups. Values with a p-value less than 0.05 were considered statistically significant and OpenEpi Version 3.01 software was used for power analysis. As a result of the power analysis, it was found sufficient that at least 385 people participated.

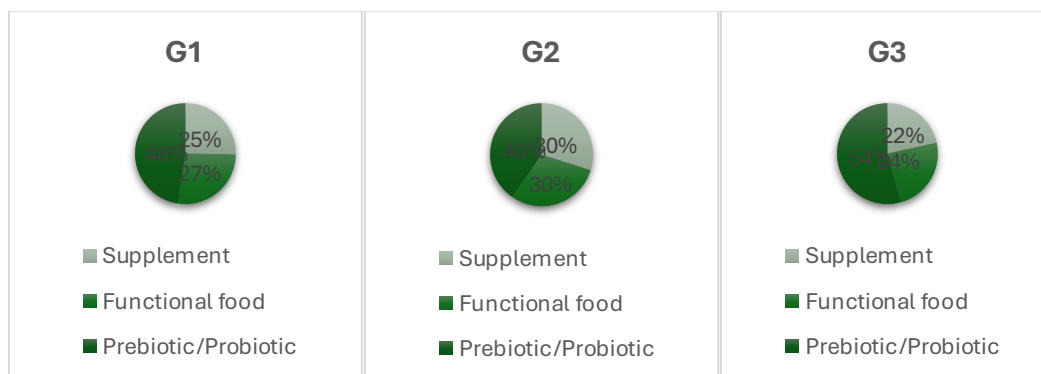
### Ethical Considerations

All participants were informed of the study and completed a consent form. This cross-sectional study was taken from Kastamonu University's Nonclinical Research Ethics Committee on Humans (10.03.2021-Number of meetings =3, Decision =6). The study was conducted per the ethical standards in the Declaration of Helsinki.

### Results

This study was carried out in a certain period (2021, 2022, and 2023) in three separate years. Therefore, groups representing each period were formed (G1, G2, and G3). The study consisted of 1323 people in total, with G1=472, G2=390, and G3=461.

**Figure 1:** Food supplements, functional food, and pre-pro biotics use preferences of the groups.



Nutrient supplement use increased from 25% to 30% in the G1 to G2 and decreased to 22% in the G3. Consumption of functional foods increased from 27% to 30% in G1 to G and decreased

in G3 (24%). It was observed that while the use of pre-probiotics was 48% in G1, it decreased to 40% in G2 and again increased to 54% in G3 (Figure 1).

1323 people participated in the study. 63.10% of them are women. Just over half of the respondents (55.40%) are married. The participation rate of individuals between the ages of 51 and 65 in the survey is low. The proportion of young people in other age groups is higher. 19.00% of the study group consists of health workers, 12.80% SSI employees, 22.10% civil servants, the majority (33%) university students, and 13.10% other (workers, housewives, retired, etc.).

**Table 1:** Social-Demographic Characteristics.

	N	%
<b>Age classification</b>		
18-25	529	40.00
26-35	368	27.80
36-50	334	25.20
51-65	92	7.00
Total	1323	100
<b>Gender</b>		
Male	520	39.30
Female	803	60.70
Total	1323	100
<b>BMI classification</b>		
Underweight (< 18.5)	81	6.10
Normal weight (18.5–24.9)	709	53.60
Overweight (25.0–29.9)	383	28.90
Obesity ( $\geq$ 30.0)	150	11.30

Total	1323	100
Do you have a chronic disease?		
No	1075	81.30
Diabetes mellitus	98	7.40
Metabolic disease	150	11.30
Total	1323	100
What Is your employment status?		
Healthcare worker	252	19.00
Social Security Institution (SSI)	170	12.80
Government Official	292	22.10
University student	436	33.00
Other (retired, housewife, unemployed)	173	13.10
Total	1323	100
Incentive status for not smoking during the pandemic		
Yes	289	21.90
No	436	33.00
I've never smoked	597	45.20
Total	1322	100
Are functional foods a healthy product		
Yes	688	52
No	635	48
Total	1323	100

81.30% of the participants did not have chronic diseases. 53.60% of individuals are normal weight, 28.90% are overweight, 11.30% are obese and 6.10% are underweight. During the pandemic, 21.90% of people use cigarettes and 52% think that functional foods are healthy (Table 1).

**Table 2:** To examine the status of nutritional habits and physical activity

Group	The nutrient items before the pandemic	During the pandemic		Total (n)	P-Value
		Evet (n)	Hayır (n)		
Have you consumed any food supplement	Yes	193	33	226	< 0.001
	No	197	439	636	
Total		390	472	862	
Have you been in physical activity more than one time a week	Yes	180	237	417	0.001
	No	143	302	445	
Total		323	539	862	
Have you consumed functional foods	Yes	273	44	317	< 0.001
	No	129	416	545	
Total		402	460	862	
Have you consumed any prebiotic and probiotic products	Yes	502	22	524	< 0.001
	No	123	214	337	
Total		625	236	861	
Have you consumed any nutrients to strengthen your immune system	Yes	551	39	590	< 0.001
	No	131	141	272	
Total		682	180	862	

\*McNemar's Chi-Square test was used,  $p < 0,05$  was considered significant



A comparison was made regarding the consumption of products before and after the pandemic, and a significant difference was observed in functional food intake, food supplements, functional foods, immune-boosting foods, and probiotic-prebiotic products. In addition, there is a significant decrease in the physical activity status of individuals (Table 2).

**Table 3:** Comparing pre-pro biotics, supplement, and functional food consumption before and during the pandemic.

Working Area		Prebiotic and Probiotic Consumption				Food Supplement Consumption			Functional Food Consumption				
		Before the pandemic	During the pandemic		Total	p	During the pandemic		Total	p	During the pandemic		
			Yes	No			Yes	No			Yes	No	
Healthcare worker	Yes	79	4	83	<0.001	49	11	60	<0.001	60	10	70	<0.001
	No	52	54	106		57	72	129		51	68	119	
	Total	131	58	189		106	83	189		111	78	189	
Social Security Institution (SSI)	Yes	64	4	68	0.077	21	3	24	<0.001	30	8	38	0.648
	No	12	35	47		19	73	92		11	67	78	
	Total	76	39	115		40	76	116		41	75	116	
Government Official	Yes	102	8	110	0.076	38	5	43	<0.001	45	9	54	0.405

	No	18	4	59		42	84	126		14	101	115	
	Total	12	4	169		60	89	169		59	110	169	
University Students	Yes	19	4	198	<0.001	60	9	69	<0.001	97	13	110	<0.001
	No	24	6	84		58	15	213		37	135	172	
	Total	21	6	282		11	16	282		134	148	282	
Others (retired, housewives, unemployed)	Yes	63	2	65	<0.001	25	5	30	0.002	41	4	45	0.012
	No	17	2	41		21	55	76		16	45	61	
	Total	80	2	106		46	60	106		57	49	106	

\*McNemar's Chi-Square test was used,  $p < 0,05$  was considered significant

When the pre-pandemic and during-pandemic conditions were compared, there was a significant increase in the use of prebiotic-probiotics, food supplements, and functional foods in healthcare workers, students, and other groups compared to the pre-pandemic period. While there was a significant increase in the use of food supplements in the SSI and civil servant groups, there was no significant difference in the consumption of pre-probiotic and functional food (Table 3).

**Table 4:** Comparison of pre-probiotic, nutritional supplement, and functional food consumption in the study areas before and during the pandemic.

Working Area	Prebiotic and Probiotic Consumption	
	During the pandemic	Before the pandemic

	Yes	No	p	Yes	No	p
Healthcare worker	131	58	0.122	83	106	< 0.001
Social Security Institution (SSI)	76	39		68	47	
Government Official	120	49		110	59	
University Students	218	64		198	84	
Others (retired, housewives, unemployed)	80	26		65	41	
Working Area	Food Supplement Consumption					
	During the pandemic			Before the pandemic		
	Yes	No	p	Yes	No	p
Healthcare worker	106	83		60	129	
Social Security Institution (SSI)	40	76		24	92	
Government Official	80	89		43	126	

University Students	118	164		69	213	
Others (retired, housewives, unemployed)	46	60		30	76	
			0.003			0.235
Working Area	Functional Food Consumption					
	During the pandemic			Before the pandemic		
	Yes	No	p	Yes	No	p
Healthcare worker	111	78		70	119	
Social Security Institution (SSI)	41	75		38	78	
Government Official	59	110		54	115	
University Students	134	148		110	172	
Others (retired, housewives, unemployed)	57	49		45	61	
			< 0.001			0.334

\*Chi-Square test was used,  $p < 0,05$  was considered significant

There was a significant difference between the pre-pandemic working areas in the use of prebiotics and probiotics. Considering the consumption of nutritional supplements and functional foods, there was a significant difference between the working areas during the pandemic process, but no difference was observed before the pandemic (Table 4).

**Table 5:** Before the pandemic and during the pandemic assessment of G1 and G2.

	During the pandemic			p <sup>a</sup>	Before the pandemic			p <sup>b</sup>	p <sup>c</sup>	p <sup>d</sup>
	Yes	No	Total		Yes	No	Total			
G1	184	288	472	< 0.001	93	379	472	< 0.001	< 0.001	< 0.001
G2	206	184	390		133	257	390			
	During the pandemic			0.002	Before the pandemic			0.181	0.081	< 0.001
	Yes	No	Total		Yes	No	Total			
G1	197	275	472	0.434	183	289	472			
G2	205	185	390		134	256	390			
	During the pandemic			0.434	Before the pandemic					
	Yes	No	Total		Yes	No	Total			

G1	347	124	471		328	143	472			
G2	278	112	390		196	194	390			
								< 0.001	0.008	< 0.001

G1: Group1, G2: Group2. During the pandemic G1-G2 ( $p^a$ ), before the pandemic G1-G2 ( $p^b$ ), during the pandemic and before the pandemic G1 ( $p^c$ ), during the pandemic and before the pandemic G2-G2 ( $p^d$ )

A significant difference was observed between G1 and G2 for all food groups (pre-pro biotic, nutritional supplement, functional food) during the pandemic process. When we look at the pre-pandemic period, there was a significant difference between G1 and G2 in nutritional supplement and prebiotic-probiotic consumption, but there was no significant difference in functional food consumption. When the pre-pandemic and pandemic periods of G1 were compared within themselves, a significant difference was found in the consumption of nutritional supplements and pre-probiotics. When the pre-pandemic and pandemic process of G2 was examined within itself, a significant difference was observed in all food groups (Table 5).

**Table 6:** Change in pre-pro biotic, nutritional supplement, functional food consumption, and physical activity status before and after the pandemic.

Time	Prebiotic and Probiotic Consumption				Food Supplement Consumption				Functional Food Consumption				Physical Activity			
	Y es	N o	Tot al	p	Y es	N o	Tot al	p	Y es	N o	Tot al	p	Y es	N o	Tot al	p
Before the pandemic	52 4	33 7	86 1		22 6	63 6	86 2		31 7	54 5	86 2		41 7	44 5	86 2	

After the pande mic	36 0	10 1	46 1	<0.0 01	11 0	35 1	46 1	0.3 48	25 2	20 9	46 1	<0.0 01	16 9	29 2	46 1	<0.0 01
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\*McNemar's Chi-Square test was used,  $p < 0,05$  was considered significant

There was a significant difference in pre-pro biotic and functional food consumption between pre-pandemic and post-pandemic. It was determined that the use of pre-probiotics decreased from 59.30% to 40.70% when compared before and after the pandemic. Functional food consumption also fell from 55.70% to 44.30%. Physical activity levels decreased significantly after the pandemic. There was no significant difference in dietary supplement intake (Table 6).

## Discussion

The results of the study showed that there was a decrease in individuals' physical activity levels during and after the pandemic. Also, eating habits have changed. While there was a significant increase in the consumption of food supplements, functional foods, immune-boosting foods, and probiotic-prebiotic products during the pandemic process, pre-probiotic consumption and functional food consumption decreased after the pandemic compared to the pre-pandemic period, and there was no significant difference in nutritional supplements. Nutrient supplement use increased from 25% to 30% in the G1 to G2 and decreased to 22% in the G3. Consumption of functional foods was almost similar in G1 and G2 but decreased in G3 (24%). It was observed that while the use of pre-probiotics was 48% in G1, it decreased to 40% in G2 and again increased to 54% in G3. In addition, when the conditions before and during the pandemic were compared, there was a significant increase in the use of prebiotic-probiotics, food supplements, and functional foods in health workers, students, and other groups compared to the pre-pandemic period.

Cihan and Pirinççi (2020) stated in their study that young people are physically affected by the pandemic and tend to be inactivity, their quality of life is adversely affected, and there is an increase in the probability of them falling into depression. Changing diet and physical activity with the effect of this process can lead to other diseases such as obesity and diabetes in

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individuals (Bousquet et al., 2020). Since the course of COVID-19 disease varies in individuals with chronic diseases, careful follow-up is recommended (Sandalcı et al., 2020). It is recommended that individuals who are malnourished with nutrients consume supplements. The majority of those who used nutritional supplements (75.80%) and herbal products (86.20%) during the pandemic stated that they used these products to protect themselves from COVID-19 and to strengthen their immune systems (Kamarlı altun et al., 2022). When the literature is examined, it is seen that the nutrition and lifestyle habits of individuals have changed during the pandemic process, similar to the results of this study (Balanzá-Martínez et al., 2021). COVID-19 has increased interest in nutritional supplements, functional foods, and immune-boosting foods (Aysin & Urhan, 2021). In a similar study, it was observed that 46.1% of individuals consumed herbal medicines and 34.9% of them consumed functional foods during the pandemic to protect themselves from COVID-19 (Wróbel et al., 2021). In a study conducted in Poland, it was stated that the participants' interest in functional food and dietary supplements increased (Doğan et al., 2023). In this study, a significant increase was observed in functional food, food supplements, immune-boosting foods, and probiotic-prebiotic products compared to the pre-pandemic period.

It has been reported in studies that healthcare workers are mostly conscious of using nutritional support (Demir et al., 2021). In this study, health workers, students, and other groups were found to be conscious about nutritional supplements.

Many similar studies show a decrease in physical activity during the quarantine period (Puścion-Jakubik et al., 2021). In a study conducted by Souza et al., it was found that the physical activity levels of individuals decreased compared to the pre-quarantine period (Souza et al., 2022). In addition, changes in physical activity and changes in food consumption affect the body weight of individuals in this process. Most of the studies in the literature show that there is an increase in the body weight of individuals during the pandemic. And they cover more than 30% of the total study population (Cheikh Ismail et al., 2021). In the study conducted by Flanagan et al., 27.30% of individuals reported weight gain, while 17.30% reported weight loss (Flanagan et al., 2021). The prevalence of weight gain during the pandemic may increase diseases associated with weight gain (Bousquet et al., 2020). In a study conducted during the pandemic, a survey was conducted between vaccinated athletes and non-vaccinated athletes. The results showed that the physical activity levels of non-vaccinated athletes exceeded those



of their vaccinated counterparts. It was also noted that vaccinated athletes exhibited better eating habits (Ashouri et al., 2023). During the pandemic, physical activity levels of individuals decreased compared to the pre-pandemic period. In the post-pandemic period, it was observed that it was lower than before the pandemic and there was a negative trend in terms of physical activity.

As a result, individuals should be made aware of changes in their quality of life and nutritional habits in this process against a possible pandemic. In addition, when the literature was examined, we could not find a study conducted after the pandemic, although studies evaluating the pre-pandemic and its process were included. However, post-pandemic studies are important to examine the changes in individuals and habits of the pandemic process. Therefore, we think that more such studies are needed. The main limitation of this study is that data such as weight and height were evaluated with a self-reported questionnaire. No measurements were taken from individuals before and during the pandemic. This can lead to incorrect reporting of data.

### **Conclusions**

It has been observed that individuals have changed their eating habits during the pandemic process, preferred products that strengthen the immune system, and showed more interest in nutritional supplements and functional foods. However, it can be said that after the pandemic, individuals' interest in these foods decreased and they returned to their pre-pandemic diet. In addition, it was observed that physical activity, which decreased during the pandemic process, decreased further in the post-pandemic period. For this reason, despite a possible pandemic situation, individuals should be made aware of their nutritional habits and physical activity and their sustainability should be ensured. In the face of events such as epidemics that will be experienced worldwide, societies should be consciously guided and permanence should be ensured. For this reason, it is recommended that countries have strategic plans within the framework of similar events and consciously guide the public. In this process, it is thought that the struggle of diseases such as epidemics will be difficult again in the future if nutritional habits and physical activity are misdirected or if the persistence does not continue even if they are directed correctly.

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