

# Analyses of food supplements intake behaviour in peri-pandemic period\*

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## Abstract

The aim of this study is to analyse “food supplements intake behaviour” in Turkey. To do this, we aimed to identify the behaviours and the motivations of supplementary food intakes in the pre and the peri-pandemic periods. In addition, we revealed income effects on food supplements intake behaviour in the pre-, and the peri-pandemic periods.

The data of the study consists of 311 individuals living in Turkey who were selected by snowball sampling. Data were collected via a virtual environment between May - June 2021. Descriptive statistics, parametric tests and concentration analyses were employed to reveal the potential motivations of the increase in food supplements intake in the peri-pandemic period. Parametric tests, concentration analysis, and logistic regressions were further performed to identify income effects on (i) food supplements taking behaviour and (ii) the increase in food supplements intake in the peri-pandemic period, respectively.

We found that almost half of the respondents took food supplements. In addition, health anxiety and Covid-19 fear levels were revealed to be increasingly effective on the intake of food supplements intake in the peri-pandemic period. Furthermore, income was identified as a determinant of food supplement intake in the pre-pandemic period while no income effects were observed on the increase of food supplement intakes in the peri-pandemic period. This might imply that food supplements could be considered as compulsory food during the pandemic. To clarify this issue, further research investigating income effects on the demand of food supplements in inflationary environment in peri-pandemic period is required.

**Keywords:** Food Supplementation, Peri-Pandemic Period, Health Anxiety, Fear of Covid-19, Covid-19

**JEL codes:** C01, C19, I10, I12

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## 1. INTRODUCTION

There has been an increase in food supplements intake in the last two decades in developed countries (Mishra & Potischman 2021). Several reasons for this increase have been reported so far including adopting a healthy lifestyle (Bailey et al. 2013), increasing elderly population (Cowan et al. 2018), and the tendency to self-medicate (Egan et al. 2011). It is widely suggested that individuals prefer to consume food supplements for various purposes such as strengthening immunity, being fit, improving health, relieving chronic pain and maintaining weight control (Kanak et al. 2021; Kaufman et al. 2002; Lee et al. 2000). It is understood that in addition to the use of food supplements for supporting dietary intake, they are also used with the motive of healing from a disease (Lordan 2021). Bailey et al. (2013) confirm that the main motivation of individuals using food supplements is to improve their general health status rather than supporting their nutrition.

The increase in the prevalence of food supplements intake in recent years (Cowan et al. 2018; Barnes et al. 2016) and the jump in their use during the Covid-19 pandemic have had an important impact on the sector (Food Supplementation and Nutrition Association 2020). Such increases have brought about the growth of the market as a consequence. The U.S. earned almost \$345 million from sales of food supplements in 2019. This amount enormously increased in 2020 since \$435 million worth food supplements sales were executed only in the first quarter of 2020 (Grebow 2021). This increase is also observed for Turkey. The total number of food supplements in Turkish market has increased by 34.3% to 80 million boxes where their value has reached to 2.87 billion Turkish Liras with 56.6% increase in 2020 (PIEA 2020). Due to this market size and growth, it is interesting to analyse food supplements intake behaviour in Turkey.

Increasing anxiety and fear during the Covid-19 pandemic has caused persistent changes to our daily lives. The change in nutritional habits and food preferences of individuals is counted as one of the important changes (Kaya et al. 2021). Increased anxiety in the lack of treatments for Covid-19 (WHO 2020; Colgecen and Colgecen 2020; Baykal 2020) led to attempts for protective and preventive measures with the aim to prevent the spread or mitigating the effects of the infection (Lake 2020; Salathé et al. 2020; WHO 2020). Owing to the concrete assessments towards the food supplements (Celik et al. 2021; de Faria Coelho-Ravagnani et al. 2021), it was identified that individuals had turned to food supplements to improve their immunity and/or to reduce the potential effects of the disease in case of infection in the peri-pandemic period (Hamulka et al. 2021).

On the other hand, the debates about healing effects of food supplements still continue. Some clinical studies (Bae et al. 2022; Pedrosa et al. 2022) reported improving effects of food supplements on the severity of the disease and the length of hospital stays, while others (Chen et al. 2021; Rawat et al. 2021) did not observe any affirmative effects about either the Covid-19 infection or the healing process. Their definitive effects on Covid-19 have still been controversial, (Bae et al. 2022; Chen et al. 2021; Hamulka et al. 2021) therefore, studies that are more clinical are needed. Despite these controversial findings, it is clear that the use of food supplements has significantly increased for healing or preventing purposes in the peri-pandemic period (Mukattash et al. 2022). In the report published by the Food Supplementation and Nutrition Association (2020) in Turkey revealed that food supplements intake increased in the peri-pandemic period when vitamins C and D had the highest increase with the motivation of improving immunity. In addition, according to this report, 60% of the participants took food supplements. Hamulka et al. (2021) confirmed that there was an interest especially in vitamins C and D in the peri-pandemic period based on the analysis of the internet search engine data. In a study conducted in Sweden, Norway and Holland, half of the respondents revealed that they used supplements. Accordingly, frequently preferred supplements were Omega 3, 6 or 9 vitamin D and multivitamins (Kristoffersen et al. 2021). In another multinational Middle Eastern study, Mukattash et al. (2022) defined that 46.6% of the participants had supplements intake and the most preferred supplements were vitamin D (55.7%), vitamin C (77.8%) and zinc (42.9%). Kristoffersen et al. (2021) emphasized that the half of the participants were in middle-income while Mukattash et al. (2022) stated that 40.4% of the participants were employed individuals and 39.8% were students.

This study aims to analyse food supplements intake behaviour in Turkey. In this context, the behaviours and the motivations for supplementary food intakes in the pre-, and the peri-pandemic periods were identified. Such an identification is important since it is of great importance for public health that individuals consciously take food supplements and access them from reliable sources. In addition, we aim to reveal income effects on food supplements intake behaviour in the pre-, and the peri-pandemic periods. Revealing the income effects are crucial

in contributing and understanding the discussion of whether supplements are luxury goods before the pandemic, but whether they then turn into compulsory goods during the pandemic period.

The second part of the study presents methodology and data. In the third part of the study, research findings are included. In the fourth and fifth sections of the study, the discussion and conclusion sections are reported respectively.

## 2. DATA AND METHODOLOGY

### 2.1. Data

The data of 311 individuals living in Turkey were exploited. The data were collected through a virtual survey according to snowball sampling between May-June 2021 and contained information on food supplements intake of individuals in the pre-, and the peri-pandemic periods. In addition, health anxiety, fear of Covid-19, and attitudes of health nutrition of the individuals were questioned. To do this, the scales of health anxiety (Aydemir et al. 2013), the fear of Covid-19 (Bakioglu et al. 2020) and attitude scale of healthy nutrition (Tekkursun Demir et al. 2019) were employed respectively.

The Health Anxiety Scale is generated by Salkovskis et al. (2002) and validated by Aydemir et al. (2013). It consists of eighteen questions. It could take the values between 0 and 54 where the higher scores of the scale indicate higher levels of anxiety. The scale of Covid-19 fear is introduced by Ahorsu et al. (2020) and validated by Bakioglu et al. (2020). It consists of seven questions and can take the values between 7 and 35 where the higher scores of the scale indicate higher levels of anxiety. The Attitude Scale of Healthy Nutrition is introduced and validated by Tekkursun Demir and Cicioglu (2019) and the scale includes 21 questions taking the values between 21 and 105. The higher scores of the scale indicate higher levels of attitude towards healthy nutrition.

### 2.2. Methodology

Food supplements taking behaviours of individuals in the pre-, and the peri-pandemic periods were investigated in the study. While doing this, we further identified motivations of the increase in food supplements intake in the peri-pandemic period. To do these, descriptive statistics were initially presented. Subsequently, parametric tests and concentration analysis were employed in order to reveal the potential motivations of the increase in food supplements intake in the peri-pandemic period. Finally, parametric tests, concentration analysis, and logistic regressions were performed to identify income effects on (i) food supplements taking behaviour and (ii) the increase in food supplements intake in the peri-pandemic period.

The concentration index (CI) measures the magnitude of inequality. The CI ranges between -1 and 1; a negative value denotes the pro-poor inequality; whereas, a positive value indicates the opposite (pro-rich inequality). A zero value represents perfect equality (O'Donnell et al. 2006). In addition to the CI, the study-exploits the logistic regression design. The logit model with a cumulative distribution function could be calculated as following (Gujarati 2004: 595):

$$P_i = E(Y = 1 | X_i) = \vartheta(Z_i) = \frac{1}{1+e^{-Z_i}} \quad (1)$$

In Equation 1, the probability value for observation  $i$  when  $Y = 1$  is defined as  $P_i$  ( $P_i$  is defined as the probability of food supplement taking behaviour (FSTB), i.e.  $Y_{FSTB}=1$ ).  $E(Y = 1 | X_i)$  represents the expected value of  $Y_i = 1$  which is conditional on explanatory variable  $X_i$ .  $\vartheta$  shown in Equation 1 refers to the cumulative logistic distribution function.

$$Z_i = X\beta \quad (2)$$

$Z_i$  ranges from to ranges from 0 to 1. Furthermore,  $P_i$  is nonlinearly related to  $Z_i$ . The probability value for observation when the person is not taking food supplement ( $Y = 0$ ) could be expressed as below:

$$1 - P_i = E(Y = 0 | X_i) = \frac{1}{1 + e^{Z_i}} \quad (3)$$

where  $1 - P_i$  represents the probability of  $Y_{FSTB} = 0$ . The odds ratio could be derived from the ratio of Equations (1) and (3) in favour of food supplement taking behaviour.

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \quad (4)$$

Taking the natural logarithm of Equation (4), it is obtained the log of odds ratio. The natural logarithm of Equation 4 could simply be expressed:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = X\beta + u_i \quad (5)$$

In this way, the linear function of food supplement taking behaviour is achieved.

### 3. RESULTS

#### 3.1. Descriptive statistics

Table 1 reports descriptive statistics for the variables used in the study. Table 1 suggests that 45% of the respondents took food supplements in the peri-pandemic period. It was identified that regular food supplements taking rate was 32% in the pre-pandemic period (Table 1). This implies that food supplements taking behaviour has increased after the Covid-19 pandemic existed. This was confirmed since 34% of the respondents stated that their food supplements expenses increased during the pandemic. Almost 30% of the respondents spent up to 100 Turkish Liras for their food supplement intakes while approximately 30% spent more than 100 Turkish Liras on monthly basis. Vitamins were reported as the most taken food supplement since approximately 45% of the respondents state their intake. Further, D (45%) and C (37%) vitamins were the most taken vitamins, respectively. Besides, it was revealed that the intakes of D (32%) and C (27%) vitamins had the greatest increase in the peri-pandemic period.

Based on Table 1, one could clearly see that food supplements were mostly bought from pharmacies (65%) and e-commerce websites (35%). The participants mostly preferred the supplements if their practitioner (62%) and pharmacist (31%) recommend taking them. The respondents taking food supplements stated that they mostly took them for strengthening their immune systems (55%) or being more energetic (31%). As for the ones not taking food supplements, they reported that they did not use them mostly because (i) they were not in need (45%) or (ii) they tried to have a better dietary intake instead (35%). Almost half of the participants believed that food supplements could be harmful for their health. Interestingly, almost 70% of the participants did not know the licensing and supervisory authority for food supplements in Turkey.

**Table 1.** Descriptive Statistics

Variable	n	%	Variable	n	%	Variable	n	%
Taking food supplements in pre-pandemic period	99	31.8	Having the most expenditure in peri-pandemic period on	86	27.6	Reasons of taking food supplements	169	54.3
Taking food supplements in peri-pandemic period	142	45.6	<i>Vitamin C</i>	101	32.4	<i>Strengthening the immune system</i>		
Having more food supplements expenses in peri-pandemic period	108	34.7	<i>Vitamin D</i>	43	13.8	<i>Increasing the nutritional intake</i>	77	24.7
Average monthly expenditure on food supplements			<i>Omega 3-6-9</i>	43	13.8	<i>Preventing the diseases</i>	87	27.9
<i>None</i>	143	45.9	<i>Herbal tablets</i>	204	65.5	<i>Recovering faster</i>	68	21.8
<i>Up to 100 TL</i>	83	27.4	Places to buy food supplements			<i>Being more energetic</i>	97	31.1
<i>More than 100 TL</i>	85	27.3	<i>Pharmacies</i>	35	11.2	<i>Increasing intellectual performance</i>	52	16.7
Types of food supplements taken			<i>Markets</i>	110	35.3	Reasons of not taking food supplements		
<i>Vitamins</i>	148	47.5	<i>E-commerce websites</i>	12	3.8	<i>Not in need</i>	82	45.8
<i>Minerals</i>	62	20	<i>Cosmeceutical markets</i>	96	30.8	<i>Trying to have better dietary intake instead</i>	65	35.2
<i>Herbal tablets</i>	51	16.4	Factors playing role on the preference			<i>Unable to afford</i>	24	13.4
<i>Probiotics</i>	36	11.5	<i>Advertisements</i>	21	6.7	Believes food supplements can be harmful	161	51.7
<i>Bee products</i>	44	14.1	<i>Recommendation of a friend</i>	85	27.3	Licensing and supervisory authority		
Types of vitamins taken			<i>Previous experiences</i>	114	36.6	<i>Ministry of Agriculture and Forestry</i>	98	31.5
<i>Vitamin A</i>	45	14.4	<i>Recommendation of the practitioner</i>	194	62.3	<i>Ministry of Health</i>	172	55.3
<i>Vitamin B</i>	83	26.7	<i>Recommendation of the pharmacist</i>	97	31.1	<i>Do not know</i>	39	12.5
<i>Vitamin C</i>	117	37.6	<i>Price</i>	46	14.7			
<i>Vitamin D</i>	151	48.5						
<i>Vitamin E</i>	47	15.1						
<i>Vitamin K</i>	32	10.2						

### 3.2. Motivations of the increase in the peri-pandemic period

As it is previously mentioned, food supplements intake had increased in the peri-pandemic period. In this section, the motivations of such increase were examined. In this context, we endeavoured to figure out the effects of health anxiety, the fear of Covid-19 and healthier nutrition.

#### *i. Reliabilities and Correlations of the Scales*

Before investigating the motivations for increased food supplements intake in the peri-pandemic period, the reliabilities and the correlations of the scales employed in the study were tested. Accordingly, Cronbach's Alpha scores which are a measure of internal consistency related to a set of items were calculated as 0.86, 0.88, 0.83 for Health Anxiety Scale-HAS (Aydemir et al. 2013), The Fear of Covid-19 Scale-SCF (Bakioğlu et al. 2020) and Attitude Scale for Healthy Nutrition-ASHN (Demir & Cicioğlu 2019), respectively. Accordingly, it was understood that all the scales employed were reliable as a reliability coefficient of 0.70 or higher is considered "acceptable" in most social science research situations. Additionally, the correlations between the scales were calculated and there appeared no strong correlations between the scales.

**Table 2.** Cronbach's Alphas and Correlation Coefficients

Scales	Cronbach's Alpha	HAS	SCF	ASHN
HAS	0.86	1		
SCF	0.88	0.469 (0.00)	1	
ASHN	0.83	-0.101 (0.090)	-0.209 (0.000)	1

**Note:** p values are in parentheses.

#### *ii. Health anxiety effect*

To explore the potential effect of health anxiety on the increase in food supplements intake in the peri-pandemic period, the health anxiety levels of the individuals (i) those take food supplements on regular basis in the pre-, and the peri-pandemic periods and (ii) those had never taken food supplements with (iii) those took food supplements in the peri-pandemic period were compared. Accordingly, health anxiety levels of the individuals were on food supplements in the peri-pandemic period were higher than (i) those taking supplements on regular basis in the pre-, and peri-pandemic period and (ii) those never took food supplements. The findings are presented in Table 3. As recommended by Greene (2018, 261), the skewness and kurtosis values were compared to 0.0 and 3.0, respectively, for the normal distribution. As a result of the normality control, it was determined that the dependent variable had a normal distribution, thus t test was performed.

In addition, we identified the concentration of the individuals who started to take food supplements in the peri-pandemic period among the participants ranked according to their level of health anxiety. Positive value of the concentration coefficient (0.112) suggested that those individuals started to take food supplements in peri-pandemic period are more concentrated among those with higher health anxiety levels. The magnitude of the coefficient reflects the skewness of their distribution among the participants. On the other hand, no skewed distributions of those taking food supplements in the pre- and the peri- pandemic periods (-0.041) and those never take food supplements (-0.047). The findings imply that increased food supplements intake in peri-pandemic period may be related to higher anxiety levels of the individuals those started to take food supplements in peri-pandemic period.

**Table 3.** Results of t-tests and Concentration Coefficients for Health Anxiety

Health Anxiety Comparison	The individuals taking food supplements regularly in pre and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	15.240	6.519	61	16.942	8.107	-	-	-	140	-1.386 (0.084)
2.	-	-	-	61	16.942	8.107	151	15.431	7.285	210	-1.323 (0.093)
Concentration Coefficients		-0.041 (0.450)			0.112 (0.099)			-0.047 (0.152)			

**Note:** p values are in parentheses. n donates number of observations; SD refers to standard deviation. t represents t statistic and df is the degree of freedom.

### iii. The fear of Covid-19 effect

For identifying the potential effects of the fear of Covid-19, the fear levels of the individuals (i) those took food supplements on regular basis in the pre-, and peri-pandemic period and (ii) those had never taken food supplements with (iii) those started to take food supplements in peri-pandemic period were compared. Accordingly, the fear levels of those started to take food supplements in the peri-pandemic period were higher than those already taking food supplements regularly in the pre-, and peri-pandemic period. On the other hand, there seems no statistical differences between the fear levels of the individuals who started to take food supplements in the peri-pandemic period and those never take food supplements.

In addition, to reveal the concentration of the individuals who started to take food supplements in the peri-pandemic period among the participants ranked according to their level of Covid-19 fear. Accordingly, a positive value of concentration coefficient depicts that the individuals started to take food supplements in the peri-pandemic period were more concentrated among the individuals with higher levels of Covid-19 fear. These might imply that increased food supplement intake in the peri-pandemic period may be related to higher levels of Covid-19 fear of the individuals started to take food supplements in the peri-pandemic period.

Apart from these, we checked whether the individuals taking food supplements regularly in the pre-, and the peri-pandemic periods were not afraid of the spread. To understand this, the distributions of those taking food supplements regularly in the pre-, and peri-pandemic periods among the participants who were already ranked according to their levels of the Covid-19 fear were examined. Accordingly, no statistically significant results were observed.

**Table 4.** Results of t tests and Concentration Coefficients for the Fear of Covid-19

Fear of Covid-19 Comparison	The individuals taking food supplements regularly in pre and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	13.654	6.283	61	15.901	6.697	-	-	-	140	-2.050 (0.021)
2.	-	-	-	61	15.901	6.697	151	14.642	6.690	210	-1.240 (0.108)
Concentration Coefficients		-0.066 (0.239)			0.140 (0.042)			0.011 (0.659)			

**Note:** p values are in parentheses. n donates number of observations; SD refers to standard deviation. t represents t statistic and df is the degree of freedom.

#### iv. Healthier nutrition effect

As for distinguishing the potential effects of the attitudes of healthier nutrition, we compared the health nutrition scores of the individuals (i) those take food supplements on regular basis in the pre- and the peri-pandemic periods and (ii) those never had taken food supplements with (iii) those started to take food supplements in the peri-pandemic period. Accordingly, healthy nutrition scores of those started to take food supplements in the peri-pandemic period were lower than those taking food supplements regularly in the pre-, and the peri-pandemic periods. In contrast, their healthy nutrition scores were higher compared to those who have never taken any food supplements.

Additionally, the concentration analysis suggests that the individuals taking food supplements on regular basis in the pre-, and peri-pandemic-periods were more concentrated among the individuals with higher healthy nutrition scores when the participants were ranked according to their healthy nutrition scores. On the contrary, the individuals who have never taken food supplements were more concentrated among the individuals with lower healthy nutrition scores in the same ranking. Unfortunately, no significant results-were observed for the individuals starting to take food supplements in the peri-pandemic period. This might imply that those individuals who started to take food supplements in the peri-pandemic period may not be concentrated among certain parts of the participants ranked according to their healthy nutritional scores.

Although the concentration coefficient is lack of its statistical significance, the increased in food supplement intake in the peri-pandemic period might relate to healthy nutrition knowledge of individuals who started to take food supplements in the peri-pandemic period. Owing to their level of knowledge regarding healthy nutrition, they might desire to have healthier dietary intakes than they used to have in the pre-pandemic period in order to strengthen their immune systems. Therefore, their desire to have healthier nutrition may explain the increases in food supplement intakes in the peri-pandemic period.

**Table 5.** t-tests' Results and Concentration Coefficients for Healthy Nutrition Scores

Healthy Nutrition Score Comparison	The individuals taking food supplements regularly in pre and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	80.074	10.574	61	76.524	9.895	-	-	-	140	2.035 (0.021)
2.	-	-	-	61	76.524	9.895	151	72.649	12.183	210	2.206 (0.028)
Concentration Coefficients		0.201 (0.000)			0.010 (0.914)			-0.145 (0.000)			

**Note:** p values are in parentheses. n donates number of observations; SD refers to standard deviation.

t represents t statistic and df is the degree of freedom.

### 3.3. Income effect on food supplements intake

The income effect on food supplements taking behaviour was further examined. To do this, the income levels of those taking food supplements regularly in the pre-, and peri-pandemic periods and of those never had taken food supplements were compared. Then, the concentration analysis was employed to identify where they were concentrated among the participants ranked according to their income levels. Finally, logistic regressions were performed to reveal the income effect on food supplement intake behaviour.

Income levels of the individuals taking food supplements regularly in the pre-, and peri-pandemic periods had significantly higher levels of monthly income than those never take food supplements (Table 7). The concentration analysis confirmed that the individuals taking food supplements regularly in the pre-, and peri-pandemic periods were more concentrated among the participants with higher income levels whereas the individuals never had taken food supplements were concentrated among the participants with relatively low-income levels. The findings implied that there might be some impacts of income on food supplements taking behaviour. To identify the effect a binary logit model where the outcome variable is binary indicating whether the individual takes food supplements



regularly in the pre-, and peri-pandemic periods was established. Then the marginal effects of the income on the status of regular food supplements intake was calculated. The results suggest that one unit increase of 'Income/1000 TL' variable implies 1000 TL increase in the monthly income of the family. The estimation results depict that ₺ 1000 TL increase in monthly income is associated with almost 2% increase in food supplements taking behaviour on regular basis. This result confirms that the individuals with higher level of income have higher probability of taking food supplements on regular basis and income may play a role on food supplements taking behaviour.

**Table 6.** t-test Result and Concentration Coefficients for Income – Food Supplement Taking Behaviour

Income	The individuals taking food supplements regularly in pre and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	9331.625	7192.615	-	-	-	151	6647.567	4994.413	150	-3.313 (0.000)
Concentration Coefficients		0.156 (0.000)						-0.108 (0.000)			

**Note:** p values are in parentheses. n donates number of observations; SD refers to standard deviation.

t represents t statistic and df is the degree of freedom.

**Table 7.** Logistic Regression for Income Effect on Food Supplement Taking Behaviour

Income	The individuals taking food supplements regularly in pre and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	9331.625	7192.615	-	-	-	151	6647.567	4994.413	150	-3.313 (0.000)
Concentration Coefficients		0.156 (0.000)						-0.108 (0.000)			

**Note:** p values are in parentheses. Standard errors are in brackets. ME represents marginal effects and LR is likelihood ratio statistic<sup>1</sup>.

In addition to these, the effects of income on the increases in food supplements intakes in the peri-pandemic period was investigated. To understand this, the income levels of those started to take food supplements in the peri-pandemic period with the income levels of those already taking food supplements regularly in the pre-, and the peri-pandemic periods and of those never take food supplements were compared. Subsequently, the concentration analysis was exploited to find out where the individuals who started to take food supplements in the pre-, and peri-pandemic periods were concentrated among the participants ranked according to their income levels. Finally, logistic regressions were employed to identify whether there were any income effects on the increase in food supplement intakes in the peri-pandemic period.

Accordingly, it was revealed that the individuals started to take food supplements in peri-pandemic period have higher income levels than the individuals had never taken food supplements (Table 8). In contrast, they had lower levels of income compared to the individuals already taking food supplements in the pre-, and peri-pandemic period. However, the concentration analysis indicates that the individuals who started to take food supplements in peri-pandemic period were not concentrated among certain parts of the participants those were ranked according to their monthly income levels. The findings imply that the increase in the intakes of food supplements in the peri-pandemic period may not be associated with their income levels. To understand this, a binary logit model where the outcome variable indicates whether an individual started to take food supplements in the peri-pandemic period was estimated. Then the marginal effects of the income on the status of regular food supplements intake were calculated. No significant impacts of income were observed on the outcome variable which is an indicator of whether an individual started to take food supplements in peri-pandemic period. This result confirms that income does not have any significant impacts on starting to take food supplements in peri-pandemic period. The finding

strengthens the arguments of that food supplements might be perceived as a necessity good in the peri-pandemic period.

**Table 8.** t-tests' Results and Concentration Coefficient for Income – Increase in Food Supplement Intake

5	The individuals taking food supplements regularly in pre- and peri-pandemic period			The individuals started to take food supplements in peri-pandemic period			The individuals never take food supplements			df	t
	n	Mean	SD	n	Mean	SD	n	Mean	SD		
1.	81	9331.625	7192.615	61	7745.61	4971.446	-	-	-	137	1.4559 (0.027)
2.	-	-	-	61	7745.61	4971.446	151	6647.567	4994.413	207	-1.4325 (0.077)
Concentration Coefficient					0.069 (0.103)						

**Note:** p values are in parentheses. n donates number of observations; SD refers to standard deviation. t represents t statistic and df is the degree of freedom.

**Table 9.** Logistic Regression for Income Effect on the Increase in Food Supplement Intake

	Coefficient	ME
(Income)/1000TL	0.039 (0.104) [0.039]	0.007 (0.110)
Constant	-1.328 (0,000) [0.318]	
Number of Obs.	227	
LR	1.84 (0.000)	
Pseudo R2	0.007	

**Note:** p values are in parentheses. Standard errors are in brackets. ME represents marginal effects and LR is likelihood ratio statistic.

## 4. DISCUSSION

The COVID-19 pandemic has significantly affected the lifestyles of individuals all over the world including the changes in their health-related and nutritional behaviours. In Turkey, the use of food supplements has increased in the peri-pandemic period (Food Supplementation and Nutrition Association 2020). Therefore, this study aims to identify food supplements intake behaviour and its motivations in the pre-and peri-pandemic period in Turkey.

This study revealed that 45% of the participants took food supplements in the peri-pandemic period where the rate of taking food supplements on regular basis was found to be 32% before the pandemic. This finding confirms that the food supplements taking behaviour has increased after the Covid-19 pandemic emerged in Turkey. This result is in line with the previous studies (Food Supplementation and Nutrition Association 2020; PIEA 2020; Mohsen et al. 2021; Zhao et al. 2020; Hamulka et al. 2020; Sami et al. 2021; Altun et al. 2020; Dost et al. 2021; Karapinar 2021; Aydin, 2021; Tolun & Bulut 2021; Demir et al. 2021). This outcome was underpinned as 34% of the respondents reported that their expenses for the food supplements had increased in the peri-pandemic period. Since Turkey has experienced an inflationary conjuncture in the peri-pandemic period, such an increase in the expenses may owe to the increases in the price levels of the food supplements. Therefore, future studies clarifying inflation effects on the market of food supplements in the peri-pandemic period will contribute to the literature. Therefore, it would be possible to understand whether taking food supplements for strengthening immunity in the peri-pandemic period is perceived as a mandatory need or not.

Since approximately 45% of the participants reported their vitamin intake, vitamins were the most common food

supplement in peri-pandemic period. This finding is in line with the results of Lam et al. (2021) examining the take of traditional, complementary, and integrative medicine in Hong Kong in peri-pandemic period. It is also consistent with the results of Ozenoglu et al. (2021) stating the changes in nutritional habits and lifestyle in Turkey in peri-pandemic period. It was identified that vitamins D (45%) and C (37%) were the most taken vitamins, respectively. Further, it is revealed that the highest increase in the peri-pandemic period is in the intake of vitamins D (32%) and C (27%). These confirm the literature listing mostly took vitamins in different populations (Alyami et al. 2020; Tuncer et al. 2020; Demir et al. 2021).

It is understood that individuals mostly prefer food supplements when practitioners (62%) and pharmacists (31%) recommend taking them where Choi (2019) suggests that the nutritional values on the package (48.0%) and other people's recommendations (28.7%) are the major factors in choosing supplements in South Korea. Additionally, it was detected that the supplements were mostly purchased from pharmacies (65%) and e-commerce sites (35%). This is in line with the studies suggesting that supplements are mostly purchased from pharmacies (Al Tamimi 2019; del Balzo et al. 2014; Samar 2021; Ozbekler 2019), and those suggesting that they are mostly purchased from e-commerce (Demir et al. 2021; Baltacıoğlu 2019). Conversely, in the study of Kobayashi et al. (2017), the participants state that although they obtain the information about supplements from the internet, they generally purchase the supplements from pharmacies.

Those who did not take supplements reported that they had not use them mostly because they did not need it (45%) or because they tried to have better dietary intake instead (35%). However, their healthy eating scores and of those who started taking food supplements during the pandemic period were lower than those who took regular food supplements before and during the pandemic. The literature is consistent with the current findings (Altun et al. 2020; Demirel 2021).

Surprisingly, almost half of the respondents believed that food supplements could be harmful to their health. Nevertheless, the previous literature suggests that most of individuals believed that food supplements could be beneficial for their health (Mohsen et al. 2021; Kanak et al. 2021; Cavdar et al. 2018). The reasons for the difference between previous studies and the current study might be the factors including sample characteristics (socioeconomic characteristics), the timing of the studies, and the perspectives of the populations on the supplementary food intakes.

It was identified that the Covid-19 fear levels of those who started taking food supplements in the peri-pandemic period were higher than those taking food supplements on regular basis even before the pandemic. This is confirmed since the individuals started to take food supplements in peri-pandemic period are more concentrated among higher fear levels of Covid-19. This might imply that increased food supplement intake in peri-pandemic period could be associated with higher fear levels of Covid-19 of the individuals. Previous literature (Alyami et al. 2020) affirms that food supplements are taken to prevent disease and reduce the risk of being infected. Similarly, Hwang et al. (2020) stated that individuals take food supplements when infectious diseases threaten. On the other hand, Polatcan and Kaptangil (2021) detect no significant relationship between the take of food supplements and the anxiety of being infected.

Although the concentration coefficient was not statistically significant, the increase in food supplement intake during the peri-pandemic period could be related to the healthy nutrition knowledge of individuals who started to take food supplements in the peri-pandemic period. Due to their knowledge of healthy diet, they may desire to have a healthier diet than before in order to strengthen their immune systems. Thus, the demand for a healthier diet may explain the increases in food supplement intake in the peri-pandemic period. This finding is compatible with Al Tamimi (2019) while it is inconsistent with the Ruiz-Roso et al. (2020), Mattioli et al. (2020), and Sidor & Rzymiski (2020). The reasons for the similar or different results between these studies and the current study may be (i) cultural differences, (ii) time difference, (iii) perspective on the disease, (iv) nutritional characteristics of the society.

It is revealed that the income levels of the individuals taking food supplements regularly in pre-and peri-pandemic periods are significantly higher than those who did not take any food supplements. The findings imply that income may have some effect on food supplement-taking behaviour. We estimate that an increase of 1000 TL in monthly income is associated with 2% increase in food supplements taking behaviour. We believe that this result may be

due to the increasing accessibility to nutritional supplements as the income level rises. Our findings are consistent with the previous literature reporting income effects on the take of food supplements (Gong et al.2018; Alwafaz et al. 2021; Mestaghanmi et al. 2021; Demir et al. 2021; Demirel 2021). However, this effect may change or disappear in an inflationary environment. Therefore, the studies examining food supplements taking behaviour in inflationary conjuncture may contribute to the literature about the demand for food supplements.

In addition to these, we investigated the effects of income on the increases in food supplements intake in peri-pandemic period. It has been revealed that the income levels of individuals who started to take food supplements during the pandemic period were higher than those who did not take any food supplements. In contrast, they had lower income levels than individuals who were already taking food supplements before and during the pandemic. However, the concentration analysis shows that individuals who started taking food supplements during the pandemic period were not concentrated among certain segments of the participants, ranked by their monthly income level. The finding implies that the increase in food supplement purchases during the pandemic may not be associated with the income levels. This result is similar to the previous studies in the literature (Tolun & Bulut 2021).

This finding strengthens the arguments that food supplements could be perceived as a compulsory need during the pandemic period. To clarify this, the studies investigating income effects in details are required to be carried out in an inflationary environment during the pandemic period. The data used in this study were collected before the prices of the supplements were increased. With the approvals of the studies conducted on supplementary food demand after the prices have increased, it could be alleged that food supplements are perceived as a compulsory need in the pandemic, so people buy them regardless of their income.

## 5. CONCLUSION

As a result, approximately half of the participants were found to take food supplements which seemed to be related to the Covid-19 pandemic. Among these people, the intake of vitamins C and D had been increased during the pandemic at most, respectively. It is expressed that the participants purchase the supplements when it is suggested by practitioners or pharmacists. This purchase is made from pharmacies and e-commerce sites in order to strengthen the immune system. This result revealed that the participants are sensitive to their health especially in the peri-pandemic period. It also shows their propensity to trust suppliers as well as experts.

It is understood that health anxiety and Covid-19 fear levels are increasingly effective on the take of food supplements. When the income effect on food supplement intake was examined, it has been revealed that income is a determinant of food supplement intake. Finally, it is important to note that the study deals with the decisions just before the increases in the prices of food supplements in Turkey. The current claim could be justified once the studies conducted on the demand of supplementary foods and income effects after prices have increased confirm.

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### Conflict of Interest

All authors declare that there is no conflict of interest.

### Author contribution

All authors contributed to the study's conception and design. Data processing and analysis were performed by all. The first draft of the manuscript was written by Merve Ebrar Yılmaz, Havvana Degerli and, Hakan Degerli and all authors commented on previous versions of the manuscript. Hasan Giray Ankara revised the paper before submission. All authors read and approved the final manuscript.

### **Ethical approval**

This study was ethically approved by the Scientific Research Projects unit of the University of Health Sciences with the registration number 21/586 on 17.09.2021.

### **Submission Declaration Statement**

This study was previously presented as an abstract at 4nd International 14th National Congress on Health and Hospital.

### **Endnotes**

1 LR (likelihood ratio statistic), which is the equivalent of the F test in the linear regression model.

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