The determination of fermented food awareness and the effect of the COVID-19 pandemic period on fermented food consumption in Türkiye

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Abstract. The COVID-19 pandemic highlighted the need of creating a strong immune system while dealing with viral illnesses. Nutrition has a crucial role in immune system control. Fermented food products, which are important in nutrition, can also strengthen the immune system. In this study, we investigated the determination of the knowledge level of consumers about fermented foods as well as the effect of the COVID-19 pandemic on fermented food consumption. The data obtained from the online surveys was conducted with 600 consumers in Türkiye. The surveys were repeated twice, in the first year and the second year of COVID-19. Binary logit model was used to analyse the data. According to the results, 88% of the consumers had sufficient information about COVID-19. In the first year of COVID-19, it was determined that the state of having knowledge about fermented foods was affected by gender and education, and in the second year, it was affected by gender and age. Consumers who increased their consumption of fermented foods increased their consumption of yogurt, cheese, butter, boza, and sausage in the first year of COVID-19 compared to the second year. In the second year of COVID-19, they increased their consumption of kefir, shalgam, tarhana, and pickles compared to the first year. The results will contribute to the prevention of disease by raising awareness about fermented food consumption in the COVID-19 pandemic and will provide resources for relevant stakeholders.

Key words: COVID-19, fermented foods, consumption, nutrition

Introduction

Coronavirus disease, as known COVID-19, was declared a global epidemic by the World Health Organization. The disease quickly spread and turned into a major global epidemic, causing death many people around the World (1-3). It continues to spread by mutation (4). The incubation period of the COVID-19 disease ranges from 2 to 14 days after infection (5). Patients show different symptoms relied on the age of the patient such as fever, dry cough, muscle pain, fatigue, and diarrhea (6). Experts stated that the immune system is very important in preventing coronavirus. In this context, adequate sleep, regular exercise, a balanced diet and avoiding stress play an important role in strengthening the immune system (7). COVID-19's involvement in the gastrointestinal tract, as well as the respiratory system, is important for the close relationship of the virus to the immune system (8). Balanced nutrition is of great importance for the prevention and treatment of viral infections (9). Fermented and probiotic foods are important for a balanced diet and described as foods and beverages produced through controlled microbial growth, and the transform of

food components through enzymatic process (10). However, all fermented food should not be considered as probiotic. According to the International Scientific Association of Probiotics and Prebiotics (ISAPP); fermented foods and beverages are sometimes referred to as "probiotic foods" or "probiotic-containing foods (11). But, microdiversity of fermented foods is also valuable. Thus, having a larger number of microbial species enhances the chances of having microorganisms and biochemical reactions that are beneficial to health. Antiviral activity has been demonstrated in both probiotic cultures and their metabolites of fermented foods, against upper respiratory tract and gastrointestinal viral infections (12). Moreover, bioactive components produced and made bioavailable through fermentation include phenolic compounds, which may act as natural antioxidants and immune modulators (13-15). Fermented products have features; antimicrobial (16-19), antihypertensive (20, 21), antioxidant, lowering cholesterol (22), providing intestinal detoxification associated with the development of colon cancer and supporting the immune system (23, 24). Because of the mentioned features, interest in the consumption of fermented foods and beverages has increased in the world in recent years. It is remarkable that fermented foods are frequent consumption in Asia countries, the death rate due to COVID-19 is very low (25).

The purpose of this research is to determine whether there is an effect of the COVID-19 pandemic on fermented food consumption and the knowledge level of consumers about fermented food in during COVID-19. In addition, it is to raise awareness by the consumption of fermented foods by taking beneficial ingredients into the body and helping them in the prevention or treatment process from COVID-19.

Material and method

The main material of this research constitutes of data obtained from surveys filled online with 600 consumers. Survey questions were prepared by the researchers. The survey is to represent consumers in Türkiye, people aged 15 and over were provided to fill in the questionnaire. Simple random sampling method was used to determine the sample volume. Since the number of universe units is over 10000, the following formula was used (26).

$$n = p.q.z^2/d^2$$

p: the possibility of consumers in the universe consuming fermented food (0.5), **q(1-p):** the possibility that consumers in the universe do not consume fermented food (0.5), **z:**1.96, **d**: sampling error (0.04)

The surveys were repeated twice, in the first year and the second year of COVID-19. The first year of COVID-19 includes information between March 2020 and February 2021, and the second year of COVID-19 includes information between March 2021 and February 2022. The surveys were conducted online and 600 surveys were evaluated with the different individuals, 300 in the first year and 300 in the second year. In the analysis of the data, descriptive statistics (percent, mean, and standard deviation), chi-square analysis, and a binary logit model were used. The Chi-square test is a nonparametric statistical analysis method often used in experimental studies where the data consists of frequencies or "counts" as distinct from quantitative data obtained from measurement of continuous variables such as income, age, and education. The test assumes that an individual is faced with two alternatives: the first year of a pandemic or the second year of a pandemic. He/she was diagnosed with COVID-19, and the data consists of having sufficient knowledge about COVID-19.

Binary logit model that can be used in cases when the dependent variable can be binary (0,1) are limited. In this context, commonly used analysis methods are Logit, Probit and Linear Probability Models, which are called limited dependent variable models (27). The logit model is designed to model a phenomenon of interest that is discrete: i.e., it occurs (Y = 1) or it does not occur (Y = 0) (28). The population logit model of the binary dependent variable Y with multiple regressors is logit regression is similar to probit regression, except that the cumulative distribution function is different (29). Pr (Y= 1| X_1, X_2,…,X_k) =

$$F \text{ ß}_o + \text{ß}_1 X_1 + \ldots \text{ß}_k X_k = \frac{1}{1 + e^{-(\text{ß}_o + \text{ß}_1 X_1 + \ldots \text{ß}_k X_k)}}$$

Logit regression is similar to probit regression, except that the cumulative distribution function is different (29).

Result and discussion

The socio-demographic characteristics of the consumers participating in the survey are given in Table 1. More than half of the consumers are women and married. According to age groups, consumers aged 29 and

Table 1. Socio-demographic features.

		%
Gender	Male	44.5
	Female	55.5
Marital Status	Single	30.8
	Married	69.2
Age	≤29	25.2
	30-49	51.0
	≥50	23.8
Number of individuals in the family	≤3	48.2
	≥4	51.8
Number of employees in the family	≤1	53.5
	≥2	46.5
Ilness	Yes	33.7
	No	66.3
Education (year)	≤8	12.7
	9-12	30.8
	≥13	56.5
Income (Turkish Liras/month)	≤4000	29.0
	4001-9999	39.7
	≤10000	31.3
Job	Housewife	13.0
	Civil servant	31.5
	Student	9.5
	Employee in the private sector	20.5
	Self employment/ tradesman	7.0
	Other	18.5
	Total	100.0

under constitute 25.2% of the total, 51.0% between the ages of 30-49, and 23.8% aged 50 and over. 51.8% of consumers have more than 3 household members. Less than 2 people work in the households of 53.5% of consumers, and 66.3% of them do not have any diagnosed diseases. 56.5% of the consumers participating in the survey have a higher education level. In addition, 39.7% of consumers have an income of between 4001 and 9999 TL, while 31.3% of them have an income of 10.000 TL or more. As for the profession, it has been determined that approximately one third (31.5%) of the consumers work in the public sector and 20.5% work in the private sector.

Some questions were asked to determine the knowledge of the individuals participating in the survey about the COVID-19 pandemic and their exposure to this pandemic (Table 2). 88.0% of individuals stated that they had sufficient information about COVID-19. These findings are consistent with other studies (30-34). While 16% of individuals state that they have been diagnosed with COVID-19, the rate of individuals who state that they know a person who has this disease is 43.7%.

It has been determined that individuals who have information about COVID are mostly informed in the second year of COVID-19 (p<0.05). Almost all of those who have had COVID-19 have had it in the second year (p<0.05). In the second year, the number of people who have COVID was higher (p<0.05).

Logistic regression analysis was used to determine factors affecting having knowledge of fermented food. In the model, those who have information about fermented food are coded as '1', and those who do not have information about fermented food are coded as '0'. Explanations, averages and standard deviations of all variables included in the model are given in the Table 3. The results show that the majority of consumers (%73.6) are aware of benefits of the fermented foods in first year of pandemic. A research conducted in India, %76 of the respondents did not know the meaning of fermented food term even though they consume fermented food in their daily life (35).

The logistic regression model run with the data given in Table 4 was found to be statistically significant (X^2: 64,883, p<0.01). The rate of confirming the dependent variable (76.3%) of the independent variables

Table 2. Information about the COVID-19 pandemic.

| | | General | Period | | | Chi-square |
		%	First year	Second year	%	(p)
Having sufficient knowledge about COVID-19	Yes	88.0	48.3	51.7	100.0	5.114
	No	12.0	62.5	37.5	100.0	(0.024)
He/She was diagnosed with COVID-19	Yes	16.0	2.1	97.9	100.0	104.96
	No	84.0	59.1	40.9	100.0	0.000
Knowing a person around who suffers from COVID-19	Yes	43.7	16.0	84.0	100.0	214.671
	No	56.3	76.3	23.7	100.0	0.000

Table 3. Variables used in logistic regression model (First year of COVID-19).

	Explanation	Variable Type	Mean	Std. Dev.
Dependent Variable				
Fr_Food	have knowledge fermented foods yes=1, no=0	Categoric	0.74	0.441
Independent Variables				
Gender	male=1, female=0	Categoric	0.47	0.500
Marital_Status	married=1, single=0	Categoric	0.75	0.434
Age	age (years)	Continuous	44.68	12.970
Education	≤ 12 year s=0 ≥13 years=1	Categoric	0.48	0.500
Household_Num	Number of individuals in the family	Continuous	3.48	1.357
Dıncome_1	≤3500 TL=1, others=0	Dummy	0.26	0.438
Dıncome_2	3501-9000 TL=1, others=0	Dummy	0.47	0.500
Dıncome_3	≥9001 TL=1, others=0	Dummy	0.27	0.448
Illness	yes=1, no=0	Categoric	0.38	0.485
Knowledge _COVID	Having sufficient knowledge about COVID-19 yes=1, no=0	Categoric	0.85	0.358
Diagnosed_COVID	Know a person around who suffers from COVID-19 yes=1, no=0	Categoric	0.14	0.348

TL:Turkish Liras

used in the model is quite high for cross-section data. 2 out of 10 variables used in the model (gender, education) were found to be statistically significant in first year of the pandemic. The logistic regression did not show any significant differences between having knowledge about fermented food and marital status, age, income, illness and status of being diagnosed with COVID-19 (p>0.05).

A statistically significant relationship was found between having knowledge about fermented food and gender (p<0.01). Men are less likely to know about fermented food than women. This is related to the fact that women are more interested in food preparation than men.

Educational status affects having knowledge about fermented food (p<0.01). As the education level increases, the number of people who have information about fermented food increases. Increased education by one year improves the likelihood of knowing about fermented foods by 2.81 times. There is no statistically significant relationship between the marital status,

Table 4. Logistic regression analysis result (first year of COVID-19).

	B	S.E.	Wald	Sig.	Exp(B)
Gender	-1.518	0.323	22.060	0.000	0.219
Marital_Status	0.268	0.393	0.465	0.495	1.307
Age	-0.010	0.014	0.512	0.474	0.990
Education	1.033	0.359	8.292	0.004	2.808
Household_Num	-0.210	0.114	3.406	0.065	0.810
DIncome2	-0.222	0.356	0.389	0.533	0.801
DIncome3	0.634	0.524	1.463	0.226	1.885
Illness	0.065	0.326	0.040	0.841	1.068
Knowledge_COVID	0.597	0.381	2.455	0.117	1.817
Diagnosed_COVID	-0.405	0.418	0.939	0.333	0.667
Constant	2.042	0.920	4.928	0.026	7.705

Chi-square:67.914 p:0.000
Overall Percentage: 77.3

household number, age of the individuals and the income status of the family and having knowledge about fermented food (p>0.10).

It is observed that those who have sufficient knowledge about COVID-19 have information about fermented food there was no statistically significant relationship between the status of being diagnosed with COVID-19 and having knowledge about fermented food (p>0.05).

In the second year of COVID-19, logistic regression analysis was used to determine the factors affecting consumers' knowledge of fermented foods. In the model, those who have knowledge of fermented foods are coded as "1" and those who do not know about fermented foods are coded as "0". The explanations, averages, and standard deviations of all variables in the model are given in Table 5. The results show that in the second year of the pandemic, the majority of consumers (77.0%) have knowledge about fermented foods.

The logistic regression model was shown to be statistically significant when used with the data in Table 5. (X^2: 40.019, p<0.01). The validation rate for the dependent variable (77.0%) of the independent variables used in the model is quite high for cross-sectional data. Two variables (gender and age) were statistically significant out of the nine employed in the model.

Logistic regression did not show a significant difference between having knowledge about fermented food and marital status, education level, number of household members, income, illness, knowing the concept of COVID-19 and being diagnosed with COVID-19 (p > 0.10).

A statistically significant relationship was found between gender and having knowledge about fermented food (p<0.05). Men are less likely to know about fermented food than women. This result is similar to the model result made with consumers in the first year of COVID-19.

There is a statistically significant relationship between the age of individuals and their knowledge of fermented foods (p<0.01). An increase in the average age of individuals by 1 year will increase the probability of knowing about fermented food by 1.06 times (Table 6).

Fermented foods are more likely to be healthy than industrial foods due to the high microbial diversity they contain (11) and are clinically effective in reducing the incidence, severity, and duration of upper respiratory infections (36). Furthermore, fermented foods are used as supplementary products in the treatment of diseases.

Previous studies found that fermented foods can be used as a supportive product in COVID-19. Mortality risk resulted from COVID-19 was found to decrease by 35.4% when there is an increase in the consumption of fermented vegetable g/day (25).

Table 5. Variables used in logistic regression model (second year of COVID-19).

	Explanation	Variable Type	Mean	Std. Dev.
Dependent Variable				
Fr_Food	have knowledge fermented foods yes=1, no=0	Categoric	0.77	0.422
Independent Variables				
Gender	male=1, female=0	Categoric	0.42	0.494
Marital_Status	married=1, single=0	Categoric	0.63	0.483
Age	age (years)	Continuous	36.95	12.932
Education	≤ 12 years=0 ≥13 years=1	Categoric	2.58	0.626
Household_Num	Number of individuals in the family	Continuous	3.65	1.384
Dıncome_1	≤4000 TL=1, others=0	Dummy	0.25	0.432
Dıncome_2	4001-10000 TL=1, others=0	Dummy	0.53	0.499
Dıncome_3	≥10001 TL=1, others=0	Dummy	0.22	0.417
Illness	yes=1, no=0	Categoric	0.30	0.458
Knowledge _COVID-19	Having sufficient knowledge about COVID-19 yes=1, no=0	Categoric	0.91	0.287
Diagnosed_COVID-19	Know a person around who suffers from COVID-19 yes=1, no=0	Categoric	0.73	0.443

TL:Turkish Liras

Table 6. Logistic regression analysis result (second year of COVID-19).

	B	S.E.	Wald	Sig.	Exp(B)
Gender	-0.693	0.302	5.270	0.022	0.500
Marital_Status	-0.262	0.374	0.489	0.484	0.770
Age	0.057	0.019	9.334	0.002	1.058
Education	0.249	0.313	0.634	0.426	1.283
Household_Num	-0.165	0.111	2.204	0.138	0.848
DIncome2	0.217	0.354	0.376	0.540	1.243
DIncome3	0.343	0.465	0.546	0.460	1.410
Illness	0.299	0.372	0.646	0.422	1.349
Knowledge _COVID	0.779	0.471	2.734	0.098	2.180
Diagnosed_COVID	-0.519	0.388	1.788	0.181	0.595
Constant	-0.339	0.969	0.122	0.727	0.713

Chi-square: 39.816 p:0.000
Overall Percentage: 77,0

Moreover, numerous studies have explored that there is an inverse relationship between fermented food consumption and mortality. In other words, as the consumption of fermented food products increases, the mortality rate decreases. The death rate brought about by COVID-19 is very low in most of the European countries, East Asian countries and sub-Saharan African countries where fermented foods are commonly consumed (25). Over half of those surveyed reported that have information about fermented food, while 26,3% of them do not have information about fermented food. While 73.7% of the respondents in the

first year of COVID-19 stated that they knew about fermented foods, 77.0% of those surveyed in the second year of COVID-19 were knowledgeable about fermented foods. Before analyzing fermented food consumption information, individuals who did not have information about fermented food were given information about fermented food. After that, their consumption of fermented food was examined. According to the results of the survey, 95.0% of individuals in the first year of COVID-19 and 97.3% of individuals in the second year of COVID-19 consume fermented products. Consumption amounts in some product groups were examined in order to determine consumers whether there is any change in fermented food consumption during the COVID-19 pandemics. Results show that a significant portion of the consumers stated that they increased their consumption of fermented food, but the other important part of consumers stated that they did not change their consumption of fermented food (Table 7). The majority of

Table 7. Change in fermented food consumption after COVID-19.

| | | General | Period | | |
		%	First year	Second year	Sum
Yogurt	Increased	43.5	55.2	44.8	100.0
	Decreased	0.8	60.0	40.0	100.0
	It has not changed	54.8	46.5	53.5	100.0
	It never consumed	0.8	0.0	100.0	100.0
Cheese	Increased	30.0	55.6	44.4	100.0
	Decreased	1.8	54.5	45.5	100.0
	It has not changed	67.5	47.9	52.1	100.0
	It never consumed	0.7	0.0	100.0	100.0
Butter	Increased	29.2	53.1	46.9	100.0
	Decreased	2.3	50.0	50.0	100.0
	It has not changed	67.0	48.8	51.2	100.0
	It never consumed	1.5	44.4	55.6	100.0
Kefir	Increased	21.0	49.2	50.8	100.0
	Decreased	3.5	28.6	71.4	100.0
	It has not changed	48.7	52.1	47.9	100.0
	It never consumed	26.8	49.7	50.3	100.0
Boza	Increased	5.5	51.5	48.5	100.0
	Decreased	5.3	43.8	56.3	100.0
	It has not changed	50.7	54.3	45.7	100.0
	It never consumed	38.5	45.0	55.0	100.0
Shalgam	Increased	18.0	38.0	62.0	100.0
	Decreased	4.7	46.4	53.6	100.0
	It has not changed	59.7	53.6	46.4	100.0
	It never consumed	17.7	50.9	49.1	100.0
Tarhana	Increased	31.7	46.8	53.2	100.0
	Decreased	2.5	66.7	33.3	100.0
	It has not changed	61.2	51.8	48.2	100.0
	It never consumed	4.7	39.3	60.7	100.0

		General	Period		Sum
		%	First year	Second year	
Pickles	Increased	40.5	45.7	54.3	100.0
	Decreased	2.2	76.9	23.1	100.0
	It has not changed	54.2	52.6	47.4	100.0
	It never consumed	3.2	42.1	57.9	100.0
Sausage	Increased	16.7	53.0	47.0	100.0
	Decreased	9.3	60.7	39.3	100.0
	It has not changed	66.7	47.8	52.3	100.0
	It never consumed	7.3	50.0	50.0	100.0

consumers have increased their consumption of yogurt (43.5%), pickles (40.5%) cheese (30%), butter (29.2%), tarhana (31.2%), and kefir (21%). In the studies conducted in Nigeria and Alaska, 63.5% of consumers in Nigeria (37) and 81% of consumers in Alaska (38) consumed domestic fermented food. In a study conducted in Sikkim, consumers allocate 12.6% of total food expenditure to fermented food expenditure (39). In the first year of COVID-19, consumers who increased their consumption of fermented foods consumed more yogurt, cheese, butter, boza, and sausage than in the second year. In the second year of COVID-19, they increased their consumption of kefir, shalgam, tarhana, and pickles compared to the first year.

Conclusion

This study aims to determine the knowledge of consumers living in Türkiye about fermented foods and the situation of consumption. In addition, it was conducted to determine the change in the consumption of fermented food during the COVID-19 pandemic.

In the first year of COVID-19, it was determined that the state of having knowledge about fermented foods was affected by gender and education, and in the second year, it was affected by gender and age. Consumers who increased their consumption of fermented foods increased their consumption of yogurt, cheese, butter, boza, and sausage in the first year of COVID-19 compared to the second year. In the second year of COVID-19, they increased their consumption

of kefir, shalgam, tarhana, and pickles compared to the first year. The results will contribute to the prevention of disease by raising awareness about fermented food consumption in the COVID-19 pandemic. Encouraging fermented food consumption will play a supportive role in the treatment of many diseases such as immune, digestive, respiratory system. It is thought that promotions and information to be made on this subject will be beneficial to raise the awareness of the relevant consumers.

References

1. World Health Organization & Food and Agriculture Organization of the United Nations (2020). Viruses in food: scientific advice to support risk management activities : meeting report [online]. Website https://apps.who.int/iris/handle/10665/44030 [accessed 24.03.2021].
2. World Health Organization (2020a). Coronavirus disease 2019 (COVID-19) Situation Report-51 [online]. Website https://www.who.int/docs/default-source/coronaviruse/situationreports/20200311-sitrep-51-covid-19.pdf?sfvrsn=1ba62e57_10 [accessed 24.03.2021].
3. World Health Organization (2020b). Coronavirus disease 2019 (COVID-19) Situation Report-32 [online]. Website https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200221-sitrep-32-covid-19.pdf?sfvrsn=4802d089_2 [accessed 24.03.2021].

4. World Health Organization (2020). Coronavirus disease (COVID-19): Virus Evolution [online]. Website https://www.who.int/news-room/q-a-detail/sars-cov-2-evolution [accessed 24.03.2021].

5. Hemida MG, Ba Abduallah MM. The SARS-CoV-2 outbreak from a one health perspective. One Health 2020; 10: 1-6.

6. Zhang R, Wang X, Ni L, et al. COVID-19: Melatonin as a potential adjuvant treatment. Life Sciences 2020; 250: 117583.

7. Sarfraz I, Rasul A, Hussain G, Adem S, Ali M. Natural Immune boosters as first-line armours to combat viral infection-COVID19: Myth or Science?. Preprints 2020; 2020030427.

8. Bozkurt HS. Coronavirus Treatment with Bifidobacteria Species Through Autophagy: A Hypothetical Approach. Turkiye Klinikleri J Intern Med 2020; 75706.

9. Jayawardena R, Sooriyaarachchi P, Chourdakis M, Jeewandara C, Ranasinghe P. Enhancing immunity in viral infections, with special emphasis on COVID-19: A review. Diabetes Metab Syndr 2020; 14(4): 367-382.

10. Dimidi E, Cox SR, Rossi M, Whelan K. Fermented Foods: Definitions and characteristics, impact on the gut microbiata and effects on gastrointestinal health and disease. Nutrients 2019; 11(8): 1-26.

11. Gibson GR, Hutkins R, Sanders ME et al. Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. Nature reviews Gastroenterology & Hepatology 2017; 14(8); 491-502.

12. Ögel ZB, Öztürk Hİ. Antiviral mechanisms related to lactic acid bacteria and fermented food products. Biotech Studies 2020; 29(1): 18-28.

13. Tamang JP, Shin DH, Jung SJ, Chae SW. Functional properties of microorganisms in fermented foods. Front Microbiol 2016; 7(578): 1-13.

14. Frias J, Martinez-Villaluenga C, Peñas E. Fermented foods in health and disease prevention. 1st ed. Amsterdam: Academic Press 2017.

15. Wilburn JR, Ryan EP. Fermented foods in health promotion and disease prevention: An overview. In: Frias J, Martinez-Villaluenga C, Peñas E (editors). Fermented Foods in Health and Disease Prevention. 1st ed. Amsterdam: Academic Press 2017; 3-20.

16. Degeest B, Vaningelgem F, De Vuyst L. Microbial physiology, fermentation kinetics, and process engineering of heteropolysaccharide production by lactic acid bacteria. Int Dairy J 2001; 11(9): 747-757.

17. Duboc P, Mollet B. Applications of exopolysaccharides in the dairy industry. Int Dairy J 2001; 11(9): 759-768.

18. Jolly L, Stingele F. Molecular organization and functionality of exopolysaccharide gene clusters in lactic acid bacteria. Int Dairy J 2001; 11(9): 733-745.

19. Leroy F, De Vuyst L. Lactic acid bacteria as fuctional starter cultures for the food fermentation industry. Trends Food Sci Technol 2004; 15(2): 67-78.

20. Usinger L, Ibsen H, Jensen LT. Does fermented milk possess antihypertensive effect in humans? J Hypertens 2009; 27(6): 1115–1120.

21. Ehlers PI, Kivimäki AS, Turpeinen AM, Korpela R, Vapaatalo H. High blood pressure-lowering and vasoprotective effects of milk products in experimental hypertension. Br J Nutr 2011; 106: 1353-1363.

22. Agerholm-Larsen L, Raben A, Haulrik N, Manders M, Astrup A. Effects of 8 weeks intake of probiotic milk products on risk factors for cardiovascular diseases. Eur J Clin Nutr 2000; 54(4): 288–297.

23. Saikali J, Picard C, Freitas M, Holt P. Fermented milks, probiotic cultures, and colon cancer. Nutr Cancer 2004; 49(1): 14–24. D,

24. De Moreno de LeBlanc A, Castillo AN, Perdigon G. Anti-infective mechanisms induced by a probiotic Lactobacillus strain against Salmonella enterica serovar Typhimurium infection. Int J Food Microbiol 2010; 138(3): 223-231.

25. Bousquet J, Anto JM, Czarlewski W, et al. Cabbage and fermented vegetables: from death rate heterogeneity in countries to candidates for mitigation strategies of severe COVID-19. Allergy 2020; 76(3): 735-750.

26. Ozdamar K. Modern Bilimsel Araştırma Yöntemleri. Eskisehir: Kaan Kitabevi, 2003.

27. Gujarati DN. Basic Econometrics, New York, NY: McGrawHill, 1995.

28. Berry WD, Demeritt JHR, Esarey J. Testing for Interaction in Binary Logit and Probit Models: Is a Product Term Essential? American Journal of Political Science 2009; 54(1): 248-266. doi: 10.1111/j.1540-5907.2009.00429.x.

29. Stock JH, Watson MW. Introduction to Econometric. Boston: Pearson education, 2007.

30. Leung GM, Lam TH, Ho LM, et al. The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. J Epidemiol Community Health 2003; 57(11): 857-63.

31. Moran KR, Del Valle SYA. A meta-analysis of the association between gender and protective behaviors in response to respiratory epidemics and pandemics. PLoS ONE 2016; 11(10): 1-25.

32. Aldowyan N, Abdallah AS, El-Gharabawy R. Knowledge, Attitude and Practice(KAP) Study about Middle East Respiratory Syndrome Coronavirus (MERSCoV) among Population in Saudi Arabia. Int Arch Med 2017; 10(254): 1-12.

33. Zhong BL, Luo W, Li HM, Zhang QQ, Liu X-G. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online crosssectional survey. Int J Biol Sci 2020; 16: 1745–52.

34. Al-Hanawi MK, Angawi K, Alshareef N, et al. Knowledge, attitude and practice toward COVID-19 among the p.ublic in the Kingdom of Saudi Arabia: A cross-sectional study. Front Public Health 2020; 8: 217.

35. Sahoo S, Lenka C, Biswal G. Knowledge and awareness about health benefits of indigenous fermented foods: A comprehensive study. Int J Food Sci Nutr 2017; (1): 109-113.

36. Tapiovaara L, Pitkaranta A, Korpela R. Probiotics and the upper respiratory tract - a review. Pediatr Infect Dis 2016; 1(19): 1-8.

37. Aderiye BI, Laleye SA. Relevance of fermented food products in southwest Nigeria. Plant Foods Hum Nutr 2003; 58: 1-16.

38. Chiou LA, Hennessy TW, Horn A, Carter G, Butler JC. Botulism among Alaska natives in the Bristol Bay area of southwest Alaska: a survey of knowledge, attitudes, and practices related to fermented foods known to cause botulism. Int J Circumpolar Health 2002; 61(1): 50-60.

39. Tamang JP, Thapa N, Rai B, et al. Food Consumption in Sikkim with special reference to Traditional Fermented Foods and Beverages: A Micro-level Survey. J Hill Res 2007; 20(1): 1-37.

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