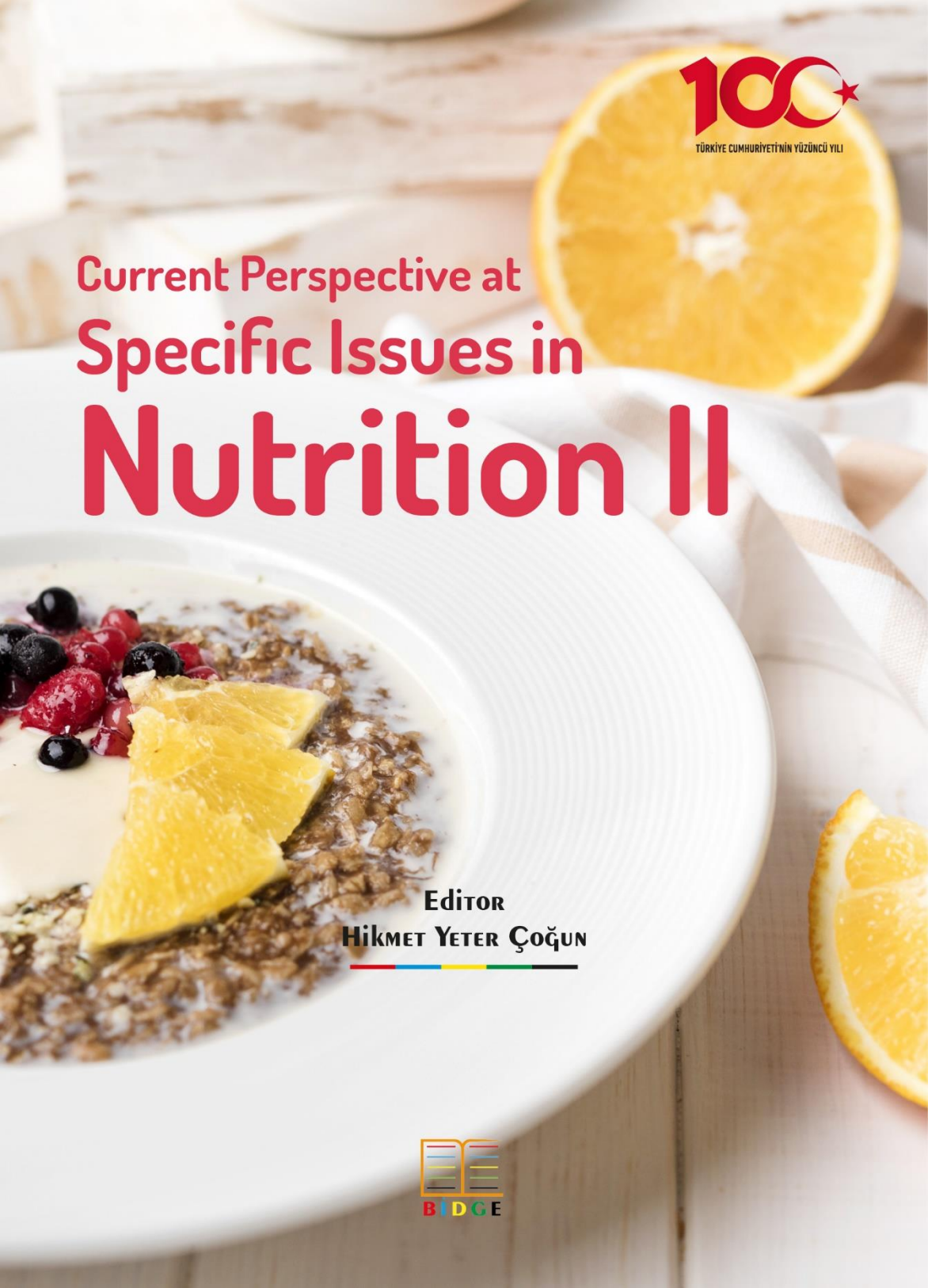

Current Perspective at Specific Issues in Nutrition II

Editor
Hikmet Yeter Çoğun

BRIDGE

BIDGE Publications

Current Perspective at Specific Issues in Nutrition II

Editor: Prof. Dr. Hikmet Yeter Çoğun

ISBN: 978-625-6488-88-5

Page Layout: Gözde YÜCEL

1st Edition:

Publication Date: 25.12.2023

BIDGE Publications,

Certificate No: 71374

www.bidgeyayinlari.com.tr - bidgeyayinlari@gmail.com

Krc Bilişim Ticaret ve Organizasyon Ltd. Şti.
Güzeltepe Mahallesi Abidin Daver Sokak Sefer Apartmanı No: 7/9 Çankaya / Ankara

Contents

CHAPTER I

Evaluation of The Relationship Between Eating Attitudes And Sustainable Nutrition

Hülya DEMİR
Sinem ALTUNAY

Introduction

The state of obtaining the energy necessary for the survival of living things from outside is called nutrition. Differences in food consumption; wrong attitude and behavior consists of lack of knowledge. Inadequate and balanced nutrition negatively affects the health of living things and causes diseases. Excessive or malnutrition brings along many diseases such as obesity, diabetes, cardiovascular diseases, hypertension, and hypercholesterolemia (Karacabey, 2009; Saygın *& et al*.,2011) . Adequate and balanced nutrition principles should be applied (Azizi& *et al*.,2011).

Eating attitude ; It defines the relationship between food, which creates the emotions, thoughts and behaviors transferred to the person. Biological, genetic factors, psychological state and family factors and social environment affect eating attitude

behaviors (Dos Santos Alvarenga, Baeza Scagliusi &Tucunduva Philippi,2012).).

The World Commission on Environment and Development first defined the concept of sustainability in 1987. It is defined as the ability of the present generation to meet their needs without compromising the ability of future generations to meet their needs. sustainable food; It is not only related to the production and consumption of foods, but also to all concepts involved in production and consumption (Alsaffar,2016).

Consumers have a great role in sustainable food and healthy food consumption. They need to be more insistent on providing sustainable products and services (Bas & Dönmez,2009)). Eating disorders (ED); defines the negativities seen in the eating behavior of individuals. Deterioration in eating attitude; american Psychiatric According to the Association (APA), bulimia nervosa (BN), anorexia nervosa (AN), eating disorders, pica, binge eating disorder, ruminant disorder constitute eating disorders classified elsewhere. Eating disorders have increased in the last 25 years in our country (Wilson, 2010). It has been defined as an abnormal and malnutrition eating disorder. The main reason for the formation of eating disorders is the feeling of being overweight, uncontrollable emotional turmoil and excessive food consumption, excessive desire due to anxiety about weight gain, and body perception disorder related to it. Environmental pressures towards thinness and dissatisfaction with their body lead individuals to make a wrong diet. Faulty diet attempts increase the risk of eating disorders. It can result in overeating as a result of short-term and low-energy diets. Eating disorders are more common in women than men (Rodin & *et al*., 2009).

The purpose of this research. To determine the eating behavior score with the EAT-26 test found by Garner and Garfinkel and to determine its effect on the Mediterranean diet, which is a sustainable diet.

Material and Method

This section; the place and time of the research, its universe and sample, data collection tools, and information about the analysis of the obtained data are included. The research was applied to 506 female volunteers between the ages of 18-65 who came to Sinem Altunay Nutrition and Counseling Center in Istanbul Bahçelievler between September 2022 and April 2023. It was conducted to evaluate the relationship between eating attitudes and sustainable nutrition. The approval of the Bezmialem University Non-Interventional Research Ethics Committee dated 06.09.2022 and numbered 19 was received for the research. After giving detailed preliminary information, a voluntary consent form, a personal information form to collect demographic information, a test to measure the sustainable nutrition knowledge level of individuals, the Mediterranean Diet Adaptation Scale (MEDAS) consisting of 14 questions to measure Mediterranean diet compliance, and the Eating Attitude Scale to determine the eating behaviors of individuals. Test-26 was applied.

Mediterranean Diet Adherence Scale (MEDAS)

In the PREDIMED study conducted by Martínez-González et al., to prevent cardiovascular diseases, the Mediterranean Diet Adherence Screener (MEDAS) was used, and then this 14 question questionnaire was validated by Schröder H et al. (Martínez-González & *et al*, 2012; Schröder & *et al*, 2011). Each positive answer is a score on the 14-question Mediterranean Diet Adherence Scale (MEDAS). Participants with a score of seven and above are classified as agreeable, and participants below seven points are classified as nonconforming.

Eating Attitude Scale

Were evaluated with EAT-26. EAT-26 is a self-report scale developed to measure the disorders in eating attitudes and behaviors that individuals can fill in themselves (Ergüney-Okumuş & Sertel-

Berk, 2020). The Eating Attitude Test-40, developed by Garner and Garfinken in 1979, was later transformed into its short form, the Eating Attitude Test-26, by Garner, Olmstad, Bohr and Garfinkel in 1982. The items of the 6-point Likert- type test are marked with one of the options "always", "very often", "often", "sometimes", "rarely", and "never". The higher the score on the EAT, the more it is interpreted as an approach to an abnormal eating attitude. EAT-26 test; 26 items are evaluated with the sum of the scores of 26 items. A score between 0 and 53 can be obtained from the test, however, 20 points are used as the cut-off point for EAT-26. According to the score results, individuals who score 20 and above are called as individuals with "impaired eating behavior", while individuals who score below 20 points are considered as individuals with "normal eating behavior". The Turkish validity and reliability study of the test was performed by Ergüney et al. Necessary permissions were obtained from the authors regarding the use of the scale. The test-retest reliability was found to be r = .65, and the Cronbach Alpha internal consistency coefficient was found to be (Ergüney-Okumuş & Sertel-Berk, 2020).

Statistical Analysis

Data analysis was performed using the SPSS 27 program. After the scales were calculated, it was checked whether all measurement tools provided the assumption of normal distribution before starting the analysis. Pearson Correlation analysis was used to analyze the relationship between the scales, Independent Samples t-test and ANOVA to analyze the comparison of scale scores to categorical demographic variables, and Kruskal Wallis-H test was applied when the assumptions of the ANOVA test were not met. In addition, the 95% confidence interval for this study was referenced as a p-value of .05 (Table 1).

Table 1. Skewness and Kurtosis Values of Childhood Trauma Scale, Somatization Scale, Multidimensional Scale of Perceived Social Support and Coping with Stress Scale

	Kurtosis	**Distortion**
Eating Attitude Scale	-.19	.56
Dieting	-.64	.18
Bulimia and Eating Preoccupation	.13	.89
Control Eating	-.03	.78
Mediterranean Diet Compliance Scale	1.13	.24

Results and Conclusions

Table 2. Demographic Characteristics of Participants

		n	**%**
Marital status	Married	330	65.2
	Single	176	34.8
Education status	Primary education	30	5.9
	High school	110	21.7
	University	366	72.3
Income status	My income is less than my expenses	110	21.7
	My income is equal to my expenses	254	50.2
	My income is more than my expenses	142	28.1
	Yes	424	83.8

Have you heard of the term 'Sustainability' before?	No	82	16.2
Have you heard of the term 'Sustainable Nutrition' before?	Yes	349	69.0
	No	157	31.0
4. Have you received sustainable nutrition education?	Yes	42	8.3
	No	464	91.7
Do you pay attention to consuming foods produced in the region you live in?	Never	62	12.3
	Rarely	182	36.0
	Now and again	144	28.5
	Always	118	23.3
Do you consume imported foods?	Never	180	35.6
	Rarely	65	12.8
	Now and again	247	48.8
	Always	14	2.8
Do you consume out-of-season foods?	Never	200	39.5
	Rarely	39	7.7
	Now and again	259	51.2
	Always	8	1.6
	Total	506	100.0

Frequency Table Findings According to the Source You Have Heard About Sustainable Nutrition

79.2% of the participants heard the concept of sustainable nutrition from the internet/social media, 20.8% did not, 6.1% learned it from the article, 93.9% did not learn from the article, 9.1% learned it from the book, 90.9% did not learn from the book, 5.1% learned from the magazine, 94.9% did not learn from the magazine, 2.8% heard from a dietitian, 97.2% did not hear from a dietitian. 7.9% of them do not know about the concept of sustainable nutrition, 92.1% of them have.

Frequency Table Findings According to the Source You Have Heard About Sustainable Nutrition

9.2% of the participants heard the concept of sustainable nutrition from the internet/social media, 20.8% did not, 6.1% learned it from the article, 93.9% did not learn from the article, 9.1% learned it from the book, 90.9% did not learn from the book, 5.1% learned from the magazine, 94.9% did not learn from the magazine, 2.8% heard from a dietitian, 97.2% did not hear from a dietitian. 7.9% of them do not know about the concept of sustainable nutrition, 92.1% of them have.

Features You Consider While Buying Food Frequency Table Findings by Respect

While purchasing food, 60.9% of the participants pay attention to the price, 39.1% do not pay attention to the price, 80.4% pay attention to the expiration date, 19.6% do not pay attention to the expiration date, 34% .3% pay attention to the ingredients, 65.6% do not pay attention to the ingredients, 8.5% pay attention to the diet product, 91.5% do not pay attention to the diet product, 52.2% pay attention to the seasonality 47.8% do not pay attention to seasonality, 21.7% pay attention to the place of production, 78.3% do not pay attention to the place of production, 23.9% pay attention to the packaging or not, 76%, 1 is not paying attention.

Frequency Table Findings According to Sustainable Nutrition Characteristics

In terms of sustainable nutrition, 82.4% of the participants should promote healthy life, 17.6% should not, 19.4% should have low environmental impact, 80.6% should not, 56.3% should be economical. should be 43.7% not include 34% local foods, 66% should not contain local foods, 32.6% should contain seasonal fruits, 67.4% should not contain seasonal fruits, 9.9% 90.1% should not be suitable for cultural and ethnic preferences, 50.6% should meet their nutritional and nutritional needs, 49.4% should not meet their food and nutrient needs, 33% should ensure food safety, 67% should not provide food safety, 57.7% should include accessible foods, 42.3% should not include accessible foods, 1% other, 99% other.

Table 3. Descriptive Values of the Mediterranean Diet Scale, Eating Attitude Scale

	n	min	Max	$\bar{X}$	ss.
Mediterranean Diet Compliance Scale	506	0	14	7.12	2.62
Eating Attitude Scale	506	0	75	24.86	15.40
Dieting	506	0	36	14.18	7.86
Bulimia and Eating Preoccupation	506	0	18	4.21	4.18
Control Eating	506	0	21	6.47	4.79

Mean Mediterranean Diet Adherence Scale ($\bar{X}$=7.12 SD=2.62) , Eating Attitude Scale mean ($\bar{X}$=24.86 SD=15.40) , Dieting mean ($\bar{X}$=14.18 SD=7.86) , Bulimia and Eating Preoccupation mean ($\bar{X}$=4.21 SD=4.18) , Eating Control mean ($\bar{X}$=6.47 SD=4.79) (Table 3).

Correlation Analysis

In this part, Pearson Correlation analysis was applied to analyze the relationship between measurement tools. The results are given in Tables 4 and 5.

Table 4.The Relationship between the Mediterranean Diet Scale and the Eating Attitude Scale

	one	2	3	4	5
1-Mediterranean Diet Compliance Scale	one				
2-Eating Attitude Scale	-.15 **	one			
3-Diet	-.13 **	.95 **	one		
4-Bulimia and Eating Preoccupation	-.19 **	.87 **	.75 **	one	
5-Control Eating	-.11 *	.89 **	.78 **	.69 **	one

***p<0.01, *p<0.05 Name of the test applied: Pearson Correlation Test*

Mediterranean Diet Adherence Scale and Eating Attitude Scale (r=-0.15, p<0.01) , Mediterranean Diet Adherence Scale and Dieting (r=-0.13, p<0.01) , Mediterranean Diet Adherence Scale and Bulimia and Eating Preoccupation (r=-- 0.19, p<0.01) , low-level negative correlations were found between the Mediterranean Diet Scale and Control Eating (r=-0.11, p<0.05) variables.

Table5. Between Mediterranean Diet Scale, Eating Attitude Scale, Age, Height, Weight, and BMI

	Age	**Size**	**Kilo**	**BMI**
Mediterranean Diet Compliance Scale	.41 **	-.06	-.08	-.06
Eating Attitude Scale	-.11 *	.10 *	.06	.02
Dieting	-.13 **	.09 *	.07	.04
Bulimia and Eating Preoccupation	-.06	.10 *	.14 **	.11 *
Control Eating	-.08	.09 *	-.05	-.10 *

***p<0.01, *p<0.05 Name of the test applied: Pearson Correlation Test*

Moderate positive correlation between age and Mediterranean Diet Adaptation Scale (r=0.41, p<0.01) variables , Age and Eating Attitude Scale (r=-0.11, p<0.05) , Age and Dieting (r=-0.13, p< 0.01) low-level negative correlations were detected between the variables.

Height and Eating Attitude Scale (r=0.10, p<0.05) , Dieting (r=0.09, p<0.05) , Bulimia and Eating Preoccupation (r=0.10, p<0.05) , Eating Control (r=0.09, p<0.05) 0.05) low-level positive correlations were found between the variables. Weight and the

variables of Bulimia and Eating Preoccupation (r=0.14, p<0.01) were found between BMI and Bulimia and Eating Preoccupation (r=0.11, p<0.01) variables , and low-level negative correlations between BMI and Eating Control (r=-0.10, p<0.05) variables.

Comparison Analysis

In this section, Independent Groups t-test and ANOVA, Kruskal Wallis-H test were applied to compare the scores of the Mediterranean Diet Scale and Eating Attitude Scale in terms of socio-demographic variables. The results are presented in Tables 6-**17.**

Table 6. Comparison of Mediterranean Diet Compliance Scale and Eating Attitude Scale by Marital Status

		n	**X̄**	**ss.**	**t**	**sd.**	**p**
Mediterranean Diet Compliance Scale	Married	330	7.35	2.60	2.80	504	0.005*
	Single	176	6.68	2.60			
Eating Attitude Scale	Married	330	24.76	16.10	-0.21	401,590	0.835
	Single	176	25.05	14.04			
Dieting	Married	330	14.01	8.11	-0.67	504	0.501
	Single	176	14.51	7.37			
Bulimia and Eating Preoccupation	Married	330	4.29	4.25	0.61	504	0.539
	Single	176	4.05	4.06			
Control Eating	Married	330	6.45	5.03	-0.08	404,587	0.937
	Single	176	6.49	4.34			

**p<0.05 Test Used: Independent Samples T-Test*

The scores they got from the Eating Attitude Scale, Dieting, Bulimia and Preoccupation with Eating, and Controlling Eating were evaluated according to the marital status groups, no significant difference was found between the groups (p>.05) (Table 6).

From the Mediterranean Diet Scale *(t(504)=2.80, p<0.05)* When the scores they got were evaluated according to the marital status groups, a significant difference was found between the groups. When the averages were compared , those who were married scored higher than those who were single (Table 6).

Table 6. Comparison of Mediterranean Diet Adherence Scale and Eating Attitude Scale, According to Whether or Not Heard of the Concept of 'Sustainability' Before

		n	$\bar{X}$	ss.	t	sd.	p
Mediterranean Diet Compliance Scale	Yes	424	7.07	2.54	-0.83	104,565	0.406
	No	82	7.37	3.00			
Eating Attitude Scale	Yes	424	24.19	15.19	-2.23	504	0.026*
	No	82	28.32	16.15			
Dieting	Yes	424	13.83	7.80	-2.30	504	0.022*
	No	82	16.00	7.96			
Bulimia and Eating Preoccupation	Yes	424	4.08	4.12	-1.62	504	0.106
	No	82	4.89	4.43			
Control Eating	Yes	424	6.28	4.75	-1.99	504	0.047*
	No	82	7.43	4.92			

**p<0.05 Test Used: Independent Samples T-Test*

When the scores they got from the Mediterranean Diet Scale, Bulimia and Eating Preoccupation sub-dimension were evaluated

according to the groups of whether or not they had heard of the concept of 'Sustainability' before, no significant difference was found between the groups (p>.05).

Eating Attitude Scale *(t(504)=-2.23, p<0.05)* , Dieting subscale *(t(504)=-2.30, p<0.05)* , Control Eating subscale *(t(504)=-1.99, p<0.05) 0.05)* When the scores they got were evaluated according to the groups of whether or not they had heard of the concept of 'Sustainability' before , a significant difference was found between the groups. When the averages are compared, those who have not heard the concept of 'Sustainability' before got higher scores than those who have heard the concept of 'Sustainability' before (Table 6).

Table 7. Comparison of the Mediterranean Diet Adaptation Scale and the Eating Attitude Scale according to whether or not to have heard of the concept of 'sustainable nutrition' before

		n	$\bar{X}$	ss.	t	sd.	p
Mediterranean Diet Compliance Scale	Yes	349	7.11	2.59	-0.12	504	0.901
	No	157	7.14	2.68			
Eating Attitude Scale	Yes	349	24.46	15.28	-0.87	504	0.385
	No	157	25.75	15.70			
Dieting	Yes	349	14.00	7.78	-0.77	504	0.440
	No	157	14.59	8.02			
Bulimia and Eating Preoccupation	Yes	349	4.08	4.19	-1.00	504	0.319
	No	157	4.48	4.17			
Control Eating	Yes	349	6.37	4.84	-0.66	504	0.512
	No	157	6.68	4.69			

**p<0.05 Test Used: Independent Samples T-Test*

When the scores obtained from the Mediterranean Diet Scale, Eating Attitude Scale, Dieting, Bulimia and Preoccupation with Eating, and Controlling Eating sub-dimension were evaluated according to the groups of whether or not they had heard of the concept of 'Sustainable Nutrition' before , no significant difference was found between the groups (p>.05) (Table7).

Table 8. Comparison of Mediterranean Diet Adaptation Scale and Eating Attitude Scale according to Sustainable Nutrition Education or Not

		n	$\bar{X}$	ss.	t	sd.	p
Mediterranean Diet Compliance Scale	Yes	42	6.95	2.96	-0.43	504	0.668
	No	464	7.13	2.59			
Eating Attitude Scale	Yes	42	29.76	15.62	2.16	504	0.031*
	No	464	24.41	15.33			
Dieting	Yes	42	16.86	7.58	2.31	504	0.021*
	No	464	13.94	7.84			
Bulimia and Eating Preoccupation	Yes	42	5.07	4.66	1.40	504	0.162
	No	464	4.13	4.13			
Control Eating	Yes	42	7.83	5.22	1.93	504	0.054
	No	464	6.34	4.74			

**p<0.05 Test Used: Independent Samples T-Test*

The scores they got from the Mediterranean Diet Scale, Bulimia and Eating Preoccupation, Control Eating sub-dimension When the status of receiving sustainable nutrition education was evaluated according to the groups, no significant difference was found between the groups (p>.05). Eating Attitude Scale *(t(504)=2.16, p<0.05)* , Dieting subscale *(t(504)=2.31, p<0.05)* When the scores they received were evaluated according to the groups of whether they received sustainable nutrition education or not, a significant difference was found between the groups. When the averages were compared , those who received sustainable nutrition education scored higher than those who did not receive sustainable nutrition education (Table 8).

Table 9. Comparison of Mediterranean Diet Compliance Scale and Eating Attitude Scale by Educational Status

		n	X̄	ss.	There is. k.	KT	sd.	KO	F	p
Mediterranean Diet Compliance Scale	Primary education	30	6.00	3.04	Between G.	45.52	2	22.76	3.36	0.036*
	High school	110	6.99	2.48	G.Inside	3411.37	503	6.78		
	University	366	7.25	2.60	Total	3456.89	505			
Eating Attitude Scale	Primary education	30	27.47	18.81	Between G.	331.22	2	165.61	0.70	0.499
	High school	110	23.80	15.09	G.Inside	119508.53	503	237.59		
	University	366	24.96	15.21	Total	119839.75	505			
Dieting	Primary education	30	14.83	9.70	Between G.	35.03	2	17.51	0.28	0.754
	High school	110	13.75	7.87	G.Inside	31124.88	503	61.88		
	University	366	14.26	7.70	Total	31159.91	505			
Bulimia and Eating Preoccupation	Primary education	30	5.23	4.72	Between G.	66.41	2	33.21	1.91	0.149
	High school	110	3.66	3.73	G.Inside	8754.80	503	17.41		
	University	366	4.29	4.25	Total	8821.21	505			
Control Eating	Primary education	30	7.40	5.34	Between G.	27.89	2	13.95	0.61	0.546
	High school	110	6.38	4.78	G.Inside	11578.04	503	23.02		
	University	366	6.42	4.76	Total	11605.93	505			

**p<0.05 Test Used: One Way Analysis of Variance (ANOVA)*

The Eating Attitude Scale, Dieting, Bulimia and Preoccupation with Eating, and Controlling Eating sub-dimensions were evaluated according to the educational status groups, no significant difference was found between the groups (p>.05). The scores obtained from the Mediterranean Diet Adaptation Scale ($F(2.503)=3.36$, $p<0.05$) *according to* education level, a significant difference was found between the averages. According to the findings obtained as a result of the Tukey test applied, it has been determined that the scores of those who are university graduates have a significantly higher score when compared to those who are primary school graduates (Table 9).

Table 10. Comparison of Mediterranean Diet Compliance Scale and Eating Attitude Scale by Income Status

		n	$\bar{X}$	ss.	There is. k.	KT	sd.	KO	F	p
Mediterranean Diet Compliance Scale	My income is less than my expenses	110	7.45	2.83	Between G.	28.87	2	14.43	2.12	0.121
	My income is equal to my expenses	254	6.89	2.63	G.Inside	3428.02	503	6.82		
	My income is more than my expenses	142	7.27	2.38	Total	3456.89	505			
Eating Attitude Scale	My income is less than my expenses	110	25.34	13.14	Between G.	81.36	2	40.68	0.17	0.843
	My income is equal to my expenses	254	24.99	16.44	G.Inside	119758.39	503	238.09		
	My income is more than my expenses	142	24.25	15.20	Total	119839.75	505			
Dieting	My income is less than my expenses	110	14.77	6.77	Between G.	49.01	2	24.51	0.40	0.673
	My income is equal to my expenses	254	14.04	8.28	G.Inside	31110.90	503	61.85		
	My income is more than my expenses	142	13.99	7.88	Total	31159.91	505			
Bulimia and Eating Preoccupation	My income is less than my expenses	110	4.05	3.74	Between G.	40.86	2	20.43	1.17	0.311
	My income is equal to my expenses	254	4.48	4.44	G.Inside	8780.35	503	17.46		
	My income is more than my expenses	142	3.84	4.01	Total	8821.21	505			
Control Eating	My income is less than my expenses	110	6.51	4.26	Between G.	0.39	2	0.20	0.01	0.991
	My income is equal to my expenses	254	6.47	5.04	G.Inside	11605.53	503	23.07		
	My income is more than my expenses	142	6.43	4.76	Total	11605.93	505			

**p<0.05 Test Used: One Way Analysis of Variance (ANOVA)*

When the Mediterranean Diet Scale, Eating Attitude Scale, Dieting, Bulimia and Preoccupation with Eating, and Controlling Eating sub-dimension were evaluated according to income status groups, no significant difference was found between the groups (p>.05)(Table 10).

Table 11. Comparison of Mediterranean Diet Scale and Eating Attitude Scale according to Consumption of Food Produced in the Region

		n	$\bar{X}$	ss.	There is. k.	KT	sd.	KO	F	p
Mediterranean Diet Compliance Scale	Never	62	6.52	2.36	Between G.	113.20	3	37.73	5.66	0.001*
	Rarely	182	7.49	2.73	G.Inside	3343.69	502	6.66		
	Now and again	144	6.56	2.31	Total	3456.89	505			
	Always	118	7.54	2.77						
Eating Attitude Scale	Never	62	24.94	14.19	Between G.	1172.93	3	390.98	1.65	0.176
	Rarely	182	23.34	15.15	G.Inside	118666.83	502	236.39		
	Now and again	144	24.69	14.99	Total	119839.75	505			
	Always	118	27.37	16.73						
Dieting	Never	62	14.35	7.28	Between G.	80.61	3	26.87	0.43	0.729
	Rarely	182	13.76	7.89	G.Inside	31079.30	502	61.91		
	Now and again	144	14.14	7.78	Total	31159.91	505			
	Always	118	14.81	8.23						
Bulimia and Eating Preoccupation	Never	62	4.40	3.74	Between G.	98.72	3	32.91	1.89	0.130
	Rarely	182	3.64	4.04	G.Inside	8722.49	502	17.38		
	Now and again	144	4.43	4.29	Total	8821.21	505			
	Always	118	4.71	4.42						
Control Eating	Never	62	6.18	4.47	Between G.	301.00	3	100.33	4.46	0.004*
	Rarely	182	5.94	4.67	G.Inside	11304.93	502	22.52		
	Now and again	144	6.12	4.35	Total	11605.93	505			
	Always	118	7.86	5.42						

**p<0.05 Test Used: One Way Analysis of Variance (ANOVA)*

The Eating Attitude Scale, Dieting, Bulimia, and Eating Occupation sub-dimension were evaluated according to the status of consuming foods produced in the region where they lived, no significant difference was found between the groups (p>.05).

The scores obtained from the Mediterranean Diet Scale (*F(3.502)=5.66, p<0.05) according to* the consumption status of the foods produced in the region where they lived, a significant difference was found between the averages. According to the findings obtained as a result of the Tukey test applied, it has been determined that the scores of those who rarely and always consume the foods produced in the region they live have a significantly higher score when compared to those who consume it occasionally.

The scores obtained from the Eating Control subscale (*F(3.502)=4.46, p<0.05) according to* the consumption status of the foods produced in the region where they lived, a significant difference was found between the averages. According to the findings obtained as a result of the Tukey test, it was determined that the scores of those who always consume the foods produced in the region they live in have significantly higher scores when compared to those who rarely and occasionally consume them (Table 11).

Table 12. Comparison of the Mediterranean Diet Compliance Scale and the Eating Attitude Scale according to Imported Food Consumption Status

					There is.					
		n	**$\bar{X}$**	**ss.**	**k.**	**KT**	**sd.**	**KO**	**F**	**p**
Mediterranean Diet	Never	180	7.12	2.70	Between G.	33.05	3	11.02	1.62	0.185
Compliance Scale	Rarely	65	6.68	2.48	G.Inside	3423.83	502	6.82		
	Now and again	247	7.29	2.58	Total	3456.89	505			
	Always	14	6.14	2.54						
Eating Attitude Scale	Never	180	26.11	16.41	Between G.	873.60	3	291.20	1.23	0.299
	Rarely	65	25.66	14.41	G.Inside	118966.16	502	236.98		
	Now and again	247	23.56	14.74	Total	119839.75	505			
	Always	14	27.93	17.59						
Dieting	Never	180	14.66	8.21	Between G.	175.50	3	58.50	0.95	0.417
	Rarely	65	14.83	7.84	G.Inside	30984.41	502	61.72		
	Now and again	247	13.60	7.54	Total	31159.91	505			
	Always	14	15.43	8.78						
Bulimia and Eating	Never	180	4.42	4.37	Between G.	42.99	3	14.33	0.82	0.484
Preoccupation	Rarely	65	4.37	4.03	G.Inside	8778.22	502	17.49		
	Now and again	247	3.95	4.02	Total	8821.21	505			
	Always	14	5.29	5.06						
Control Eating	Never	180	7.03	5.15	Between G.	114.62	3	38.21	1.67	0.173
	Rarely	65	6.46	4.24	G.Inside	11491.31	502	22.89		
	Now and again	247	6.02	4.62	Total	11605.93	505			
	Always	14	7.21	5.15						

When the Mediterranean Diet Scale, Eating Attitude Scale, Dieting, Bulimia and Eating Preoccupation, Eating Control sub-dimension were evaluated according to the imported food consumption status groups, no significant difference was found between the groups (p>.05) (Table 12).

Table 13. Comparison of Mediterranean Diet Adaptation Scale and Eating Attitude Scale according to Out of Season Food Consumption Status

		n	SO	x^2	sd.	p
Mediterranean Diet Compliance Scale	Rarely	39	134.00	2.62	2	0.270
	Now and again	259	156.94			
	Always	8	137.19			
Eating Attitude Scale	Rarely	39	154.47	5.47	2	0.065
	Now and again	259	151.13			
	Always	8	225.38			
Dieting	Rarely	39	157.33	5.53	2	0.063
	Now and again	259	150.72			
	Always	8	224.75			
Bulimia and Eating Preoccupation	Rarely	39	155.26	5.07	2	0.079
	Now and again	259	151.13			
	Always	8	221.56			
Control Eating	Rarely	39	149.49	2.19	2	0.334
	Now and again	259	152.71			
	Always	8	198.56			

**p<0.05 Test used: Kruskal Wallis-H*

The Mediterranean Diet Scale, Eating Attitude Scale, Dieting, Bulimia and Eating Preoccupation, Eating Control sub-dimension were evaluated according to the non-seasonal food consumption status groups, no significant difference was found between the groups ($p>.05$)(Table 13).

Discussion

There are limited number of studies on sustainable nutrition in our country. Data between the ages of 18-65 are very valuable in order to increase awareness about sustainable nutrition, to develop policies on this issue and to contribute to the literature. For this reason, this study was planned to evaluate the behaviors and knowledge levels of female clients coming to Sinem Altunay Nutrition and Counseling Center about sustainable nutrition and to examine their relationship on food preferences. In this part of the study, the demographic characteristics of the participants and the relationship between these characteristics and the scales will be discussed in line with the findings. Disordered eating behaviors and attitudes have become a global problem, especially among female individuals. Obesity; unhealthy eating attitudes are closely associated with an increased risk of disordered eating, including weight concerns, very low-calorie diets, anorexia, bulimia, and binge eating disorder. All eating disorders, including obesity, are a major public health problem today. There are many factors that affect eating attitudes and behaviors, these are social, cultural and psychological factors. In developing countries, nutrition and cultural transition, social changes, family order, exposure to mass media and globalization affect eating attitudes and behaviors (Alpaslan&et al., 2015).

According to Turkey Nutrition and Health Survey (TBSA, 2019) 2019 data, 24.8% of women aged 15 and over are obese (BMI $\geq$ 30.00) and 30.4% are slightly obese (25.00$\leq$BMI<30) .00). In this study, 1.8% of female individuals are underweight, 27.9% are normal, 38.1% are overweight, 14.6% are first degree obese, 4.3% are second degree, obese, and 3.2% of them are 3rd degree obese. It

is seen that the obesity rates of the individuals participating in the study are lower than the Turkish population. The Eating Attitude Test-26 (EAT-26) was used to screen for the risk of eating disorders. In this study, low-level positive correlations were found between individuals' eating attitudes and BMI and bulimia and eating preoccupation variables, and low-level negative correlations between BMI and control variables. There are similar findings in the literature (Sánchez-Carracedo & et al.2012; Aghasi & et al,2020). Since the Mediterranean diet is a diet model rich in plant-based foods and high in fish consumption, it has a positive effect on weight control.

When the findings of the participants in the study are examined; Female individuals between the ages of 18 and 65 participated in this study and the majority of the participants were between the ages of 26-30. Considering the educational status of individuals, 72.3% are university graduates.

83.8% of the individuals participating in the study have heard of the concept of sustainability before. It is a possible result that individuals who have heard the definition of sustainability have a higher behavioral score. According to these findings, it is thought that more awareness of the concept of sustainability may affect sustainable behaviors. 69% of the participating individuals have heard of the concept of sustainable nutrition, but have not received sustainable nutrition education. The rate of people who received training on the concept of sustainable nutrition is 8.3%. In another study conducted on individuals aged 20 and over, it was observed that women heard the concept of sustainable nutrition more than men (Gülsöz, 2017). 79.2% of the participants heard the concept of sustainable nutrition through the internet/social media. In another study conducted in a different way, participants stated that they heard the concept of sustainable nutrition mostly from health professionals (doctor / dietitian) (Garipoğlu&Çakır, 2020). 80.4% of the attention is paid to the expiry date when purchasing foods, while 60.9% of the price is also looked at. 52.2% of the participants consider seasonality. In a study conducted in America and China, it

was found that they paid more attention to sensory appeal and weight control (Pearcey&Zhan, 2018). In another study, it is seen that the expiry date is mostly looked at when purchasing foods (Gezmen-Karadağ &Türközü,2017). In Çelik's study, it is seen that the expiry date and production date are mostly looked at from the information on the label. Afterwards, it is seen that the price and energy value are looked at (Çelik,2010). When it is determined what affects food preferences, it can make important contributions to the dissemination of sustainable nutrition.

Considering the sustainable nutritional characteristics of the people participating in the study, 82.4% should promote healthy life, 19.4% should have low environmental impact, 56.3% should be economical, 34% should include local foods, 32.6% of them should contain seasonal fruits, 9.9% should be suitable for cultural and ethnic preferences, 50.6% should meet nutritional and nutritional needs, 33% should ensure food safety, 57.7% should contain accessible foods says.

In this study, it was determined that the income of the majority (50.2%) of the participants whose income status was examined was equal to the expenditure (Table 2). In another study conducted on women, it was determined that 55.7% of the participants had equal income and expenditure (Fıçıcıoğlu,2018). The results of the study show similarity. The Mediterranean diet has protective effects on health. It is a diet that includes multigrain foods, dried legumes, oil seeds, and fruit-vegetables, fish is frequently consumed as a quality protein source, red wine is consumed in moderation, and olive oil is included (Barbaros & Kabaran,2014). In the study, the Mediterranean diet adherence scale (MEDAS) was used to determine the suitability for the Mediterranean diet. One reason why this scale was used in this study is that it is a valid criterion that can be useful in clinical practice for short-term evaluation of adherence to the Mediterranean diet (Papadaki 2018& Radd-Vagenas,2018). The second reason is that this 14-item scale of individuals is to record both faster and more accurate data instead of taking food consumption records, since it is collected by online survey method.

Among the findings of this study, the relationship between the age of the participants and the Mediterranean diet adaptation scale variables and their eating attitudes were examined, and it was found that there was a significant relationship between the eating attitudes and age of the individuals. Low-level negative correlations were found between age and eating attitude scale ($r=-0.11$, $p<0.05$), and age and dieting ($r=-0.13$, $p<0.01$) variables. However, in the study published in the Journal of The Academy of Nutrition and Dietetic, 1553 people in three different age groups (20-49 years, 49-62 years, 62-80 years) were compared in terms of their adherence to the Mediterranean diet, the age group with the lowest compliance was 20-49. young adults in the age group, and the highest adaptive age group was reported as individuals in the 62-80 age group.

The data were collected by the online survey method and the anthropometric values are based on the statements of the person. Since it is not a direct measurement, the limitation of the study is that the individuals' body weight and height values are under- or over-specified. In this study, a negative correlation was observed between Mediterranean diet adherence scale scores and BMI, but it was not found statistically significant. In a different study, when dietary habits and socio-demographic variables were examined, BMI was positively correlated with meat consumption and negatively correlated with plant foods and fish consumption ((Pfeiler&Egloff,2020).). In the Mediterranean diet, rich vegetable consumption and fish consumption have positive effects on weight control.

Level positive correlations were found between BMI and bulimia and eating preoccupation ($r=0.11$, $p<0.01$) variables, and low level negative correlations between BMI and eating control ($r=-0.10$, $p<0.05$) variables.

From the Mediterranean Diet Scale *($t(504)=2.80$, $p<0.05$)* When the scores they got were evaluated according to the marital status groups, a significant difference was found between the groups. When the averages were compared, those who were married scored

higher than those who were single. In a different study, individuals whose marital status was married showed more compliance with the Mediterranean diet compared to other marital statuses (Alonso&et al., 2014).

Eating attitude test-26 (EAT-26) was used to determine the risk of eating disorders. When the scores obtained from the eating attitude scale, dieting, bulimia and preoccupation with eating, and control over eating were evaluated according to marital status groups, no significant difference was found between the groups ($p>.05$).

When the scores they got from the Mediterranean diet adaptation scale, bulimia and preoccupation with eating sub-dimension were evaluated according to whether or not they had heard of the concept of 'sustainability' before, no significant difference was found between the groups ($p>.05$). Scores of Mediterranean diet adaptation scale, bulimia and preoccupation with eating, and control over eating sub-dimension When the status of receiving sustainable nutrition education was evaluated according to the groups, no significant difference was found between the groups ($p>.05$). However, in another study, it was determined that with the increase in the level of sustainability knowledge, the sustainable consumption behavior increased (Ateş, 2018).

When the educational status is evaluated according to the groups; no significant difference was found between the eating attitude scale, dieting, bulimia and preoccupation with eating, and control over eating ($p>.05$). However, in the study conducted by Güraksu (2021), when we compared the educational status of the eating attitude scale, dieting, bulimia and preoccupation with eating, controlling eating, and life satisfaction subscale according to the variable of educational status, no significant difference was found between the averages (81). When we compared the scores obtained from the Mediterranean Diet Scale ($F(2.503)=3.36, p<0.05$) *according to* education level , a significant difference was found between the averages. According to the findings obtained as a result

of the Tukey test applied, it has been determined that the scores of those who are university graduates have a significantly higher score when compared to those who are primary school graduates (Güraksu, 2021).

When the Mediterranean diet adaptation scale, eating attitude scale, dieting, bulimia and preoccupation with eating, and controlling eating sub-dimension were evaluated according to income status groups, no significant difference was found between the groups ($p>.05$). The scores obtained from the Mediterranian Diet Scale according to the consumption of foods produced in the region where they lived, a significant difference was found between the averages. According to the findings obtained as a result of the Tukey test applied, it has been determined that the scores of those who rarely and always consume the foods produced in the region they live have a significantly higher score when compared to those who consume it occasionally. Factors affecting food preferences include consumers' ecological food preferences and sustainable eating behaviors. In the researches, local nutrition, seasonal nutrition, consuming organic foods and not consuming packaged foods have come to the fore.

The scores obtained from the Eating Control subscale according to the consumption of foods produced in the region where they lived, a significant difference was found between the averages. According to the findings obtained as a result of the Tukey test, it was determined that the scores of those who always consume the foods produced in the region they live in have significantly higher scores when compared to those who rarely and occasionally consume them.

When the scale of adaptation to the Mediterranean diet, the eating attitude scale, dieting, bulimia and preoccupation with eating, and the sub-dimension of controlling eating were evaluated according to the imported food consumption status groups, no significant difference was found between the groups ($p>.05$). Reducing the distance between production and consumption points

provides more greenhouse gas to the nature. Since the majority of the greenhouse gas is formed during the production phase, there are opinions stating that what comes from the food mile is unimportant, and how the food is transported is more important than the distance it is transported (Lee, Miller & Loveridge 2017). The lack of significant difference in this regard may be due to the fact that the individuals participating in the survey do not have enough ideas.

When the Mediterranean diet scale, eating attitude scale, dieting, bulimia and preoccupation with eating, and control over eating sub-dimension were evaluated according to the out-of-season food consumption groups, no significant difference was found between the groups ($p>.05$). Preferring seasonal food is recommended for a more sustainable diet. While artificial conditions such as heated greenhouses are required to grow food that is not in its natural growing season, the absence of such a requirement for in-season food causes less greenhouse gas emissions (Aldaya &et al., 2021).

As a result, this study is a pioneering study examining the eating attitude behaviors of individuals and the evaluation of adherence to the Mediterranean diet, which is a sustainable nutrition model. Low-level negative correlations were found between adherence to the Mediterranean Diet and eating attitude behaviors.

Recommendations

Today, sustainable nutrition is gaining importance, but there are limited studies on sustainable nutrition in our country. The data to be obtained as a result of the evaluation of the behaviors and knowledge levels of female individuals related to sustainable nutrition and their relationship to the Mediterranean diet and eating behaviors are pioneers for future studies on this subject. Understanding what influences preferences can guide the promotion of sustainable dieting. It is necessary to raise awareness about sustainable nutrition, which is gaining importance in the world, and to develop policies on this issue in order to meet the needs of the current and future population. For this, large-scale studies reflecting

the whole society and higher levels of evidence, large and diverse populations (studies on sustainable nutrition are needed. In this study, it has been shown that there is a relationship between the education of individuals and healthy and balanced nutrition. In the scope of nutrition education, sustainable nutrition, health and environment issues should be emphasized.

References

Aghasi M, Matinfar A, Golzarand M, Salari-Moghaddam A, Ebrahimpour-Koujan, S.(2020). Internet use in relation to overweight and obesity: A systematic review and meta-analysis of cross-sectional studies. *Advances in Nutrition*.11(2): 349-56.

Aldaya, M. M., Ibañez, F. C., Domínguez-Lacueva, P., Murillo-Arbizu, M. T., Rubio-Varas, M., Soret, B., ve Beriain, M. J. (2021). Indicators and recommendations for assessing sustainable healthy diets. *Foods. 10*(5), 999.

Alonso, M.C.P., Rodriguez, J.I.R., Belio, J.F.M., Garrido, R.C., Bartolome, J.L., Arranz, A.G.(2014). Factors associated with adherence to the Mediterranean Diet in the adult population. *Journal of The Academy of Nutrition and Dietetic*. *114*(4):583-589.

Alpaslan, A.H., Koçak, U., Avci, K., Uzel Taş H. (2015).The association between internet addiction and disordered eating attitudes among Turkish high school students. *Eat Weight Disord.20*(4):441-8. doi: 10.1007/s40519-015-0197-9.

Alsaffar, AA. (2016).Sustainable diets: The interaction between food industry, nutrition, health and the environment. *Food Science and Technology International*.*22*(2):102- 11.

Ateş, H. (2018). Fen Bilgisi ve Sosyal Bilgiler öğretmen adaylarının sürdürülebilir tüketim davranışlarının ve bilgi düzeylerinin araştırılması. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi. 31*(2), 507-531.

Azizi, M., Aghaee, N., Ebrahimi, M., Ranjbar, K. (2011). Nutrition knowledge, the attitude and practices of college students. *Facta Universitatis: Series Physical Education and Sport 9*(3):349-57.

Barbaros B, Kabaran S.(2014). Akdeniz diyeti ve sağlığı koruyucu etkileri. *Beslenme ve Diyet Dergisi*. *42*(2): 140-147.

Bas, M., Donmez, S. (2009). Self-efficacy and restrained eating in relation to weight loss among overweight men and women in Turkey. *Appetite*. *52*, 209-216.

Çelik, M.(2010). Tokat ilinde gıda alış verişi esnasında halkın etiket okuma alışkanlığının saptanması. Yüksek lisans tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Aile Ekonomisi ve Beslenme Eğitimi Anabilim Dalı, Ankara, 2010.

Dos Santos Alvarenga, M., Baeza Scagliusi, F., Tucunduva Philippi, S. (2012). Comparison of eating attitudes among university students from the five Brazilian regions. *Cienc. Saude coletiva.*, *17*(2): 435-444.

Ergüney-Okumuş, F. E., Sertel-Berk, H. Ö. (2020). Yeme tutum testi kısa formunun (YTT-26 üniversite örnekleminde Türkçeye uyarlanması ve psikometrik özelliklerinin değerlendirilmesi. *Psikoloji Çalışmaları*, 57–78. Doi:10.26650/Sp2019-0039

Fıçıcıoğlu HO. (2018) Sosyal medya kullanan kadınların duygu ve durumlarının iştah üzerine etkisinin değerlendirilmesi. İstanbul Okan Üniversitesi, Sağlık Bilimleri Enstitüsü, Yüksek Lisans Tezi, İstanbul.

Garipoğlu, G., Çakır, B. (2020). Investigation of knowledge and behaviour of adult individuals in terms of sustainable Nutrition. *Journal of Health Sciences*. *2*:1-4.

Gezmen-Karadağ, M., Türközü, D.(2017).Consumers' opinions and use of food labels, nutrition, and health claims: Results from Turkey. *Journal of Food Marketing*. doi: 10.1080/10454446.2017.1266558.

Gülsöz, S. (2017). Yirmi yaş ve üzeri bireylerin sürdürülebilir beslenme konusundaki bilgi düzeylerinin ve uygulamalarının değerlendirilmesi. Yüksek Lisans Tezi. Başkent Üniversitesi, Sağlık Bilimleri Enstitüsü, Ankara.

Güraksu, E. (2021). Diyabet hastalarında yaşam doyumu ve yeme tutumu arasındaki ilişkinin incelenmesi. Yüksek lisans tezi, İstanbul Gelişim Üniversitesi, İstanbul.

Karacabey, K. (2009). Üniversite öğrencilerinin beslenme bilgi ve alışkanlıklarının incelenmesi. *Sport Sciences. 4*(2):124-33.

Lee, G. E., Miller, S. R., Loveridge, S. (2017). Modelling local food policy and greenhouse gas emission due to transportation. *Journal of Regional Analysis and Policy*, *47*; 75-87.

Macdiarmid, JI.(2013). Is a healthy diet an environmentally sustainable diet? *Proceedings of the Nutrition Society*.*72*,13-20.

Martínez-González, M.A., García-Arellano, A., Toledo, E., Salas-Salvadó, J., Buil- Cosiales, P., Corella D. (2012). A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. *Plos One*;*7*(8):e43134. Doi: 10.1371/journal.pone.0043134.

Papadaki, A., Johnson, L., Toumpakari, Z. (2018). Validation of the English version of the 14-item Mediterranean Diet Adherence Screener of the PREDIMED Study, in people at high cardiovascular risk in the UK. *Nutrients. 10*(2), 138.

Pearcey, S. M., ve Zhan, G. Q. (2018). A comparative study of American and Chinese college students' motives for food choice. *Appetite*. 123, 325-333.

Pfeiler, T.M., Egloff, B. (2020). Personality and eating habits revisited: Associations between the big five, food choices, and Body Mass Index in a representative Australian sample. *Appetite.149*, 104607.

Radd-Vagenas, S, Fiatarone Singh, M. A., Daniel, K., Noble, Y., Jain,N., O'Leary, F.0., Flood, V.M. (2018). Validity of the Mediterranean diet and culinary index (MediCul) for online assessment of adherence to the 'traditional'diet and aspects of cuisine in older adults. *Nutrients*. *10*(12), 1913.

Rodin, G., Olmsted, MP., Rydall, A.C., Maharaj, S.I., Colton, P.A., Jones, J.M.(2002). Eating disorders in young women with type 1 diabetes mellitus. *J Psychosom Res*. *53*, 943-949.

Sánchez-Carracedo, D., Neumark-Sztainer, D., López-Guimerà.(2012). Integrated prevention of obesity and eating disorders: barriers, developments and opportunities. *Public health nutrition. 15*(12): 2295-309.

Saygın, M., Öngel, K., Çalışkan, S., Yağlı, M., Has, M., Gonca, T.(2011). Süleyman Demirel Üniversitesi öğrencilerinin beslenme alışkanlıkları. *SDÜ Tıp Fak Derg*. *18*(2):43-7.

Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas- Salvadó J, et al.(2011). A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *J Nutr.,141*(6):1140-5.

Wilson, GT.(2010). Eating disorders, obesity and addiction. *Eur Eat Dısord Rev*.*18*, 341-351.

CHAPTER II

The Expanding Landscape of Functional Foods: Insights Into Health Effects

Gökhan DEGE[1]

Introduction

Changing living conditions have led to changes in consumers' expectations towards nutrients. In recent years, the importance of functional foods has increased as people have paid more attention to health and have turned to natural products and functional foods rather than products with medical effects such as drugs. The global functional food market is estimated at US$ 33 billion (Menrad et al. 2003). It is estimated that functional foods, as a critical technology issue, will drive the food trade all over the world and will be one of the fastest developing sectors of the food industry in the new millennium. Today, more than 400 products are sold, and vegetables constitute the largest group in the functional food market, followed by bread and cereals (Aryee & Boye, 2014). It is known that there

[1] Dr. Öğr. Üyesi, Ağrı İbrahim Çeçen Üniversitesi, gdege@agri.edu.tr, 0000-0001-9237-770X

has been a noticeable increase in the amount and variety of such products in Turkey as of 2005. It is also estimated that functional foods have the potential to alleviate and prevent diseases and promote health and well-being, leading to a significant reduction in overall national healthcare costs (Sikand et al., 2015). Today, the number of recognized functional foods is increasing and is estimated to be more than 1000. In this review, the health effects of some functional nutrients are explained, supported by the literature (Duggan et.al.,2002). To date, there is no single accepted definition for functional foods. Countries include the term functional food in different nomenclatures in legal status (Luo et.al., 2015). The North American International Life Sciences Institute (ILSI) defined functional foods as "foods that provide health benefits beyond basic nutrition thanks to physiologically active food components" (Benvenga Luo et.al., 2019).

Functional products, which have started to be seen on market shelves in Turkey since the 2000s, are defined in the "Law No. 5179 on the Amendment and Adoption of the Decree Law on the Production, Consumption and Supervision of Foods" as "foods that have health-protective, corrective, or disease risk-reducing effects depending on one or more effective components in addition to their nutritional effects, and these effects have been scientifically and clinically proven" (Oliveira et.al., 2018). Functional foods are used to reduce the risk of certain diseases such as cardiovascular diseases, cancer, hypertension, high cholesterol, diabetes, ulcers, and diarrhea. In order for people to obtain accurate information about these nutrients that are important for health, it is of great importance to translate scientific terms into a language that consumers can understand and to create a common area (Martirosyan et.al., 2021).

The Relationship Between Functional Foods and Diseases

Soybeans

Due to the functional properties of bioactive components like protease inhibitors, phytosterols, saponins, phenolic acid, and phytic

acid derived from soy and their positive impact on health, there is a growing trend to incorporate soy into traditional foods either in whole or in part or to use it as a substitute for other ingredients in product development (Pedrosa et.al., 2020). Phytosterols in soy contribute to reducing serum cholesterol levels by inhibiting cholesterol absorption in the intestines (Lin et.al., 2009). A study examining the effect of soy protein on cardiovascular risk found that low-density lipoprotein (LDL) decreased by 5.25% (Liu et al., 2012). Additionally, a research suggests that phytosterols aid in decreasing the conversion of carbohydrates into fat and increasing fat breakdown, thereby promoting weight management and reducing the risk of prostate cancer (Moreau et al., 2018).

Oligosaccharides and polysaccharides, the primary carbohydrates found in soy, serve as dietary fiber. The attributes of soluble fiber in regulating blood glucose levels and reducing cholesterol levels are also exhibited by soy fiber (Choct et al., 2010).

Epidemiological studies have revealed a reduced risk of breast, prostate, and colon cancer, cardiovascular diseases, menopausal symptoms, and osteoporosis associated with soybean consumption, especially in Asian countries. Isoflavones present in soybeans exhibit antioxidant and anti-osteoporosis activities (Dixit et al., 2011; Kim, 2021; Messina, 2016). Based on these research findings, it is believed that soybeans offer potential health benefits to humans.

Tea

In recent years, there has been a surge in studies focusing on the polyphenolic compounds found in green tea. Research findings examining its potential health benefits suggest that tea could offer protective effects against cancer. Notably, the consumption of five cups or more of green tea daily has been linked to a reduced risk of breast cancer recurrence, particularly in stages I and II, among Japanese women (Braakhuis et al., 2016).

While epidemiological studies on the prevention of coronary heart disease through increased tea consumption have not provided

definitive conclusions, several studies have reported a significant reduction in risk for green tea and black tea consumers (Tang et al., 2009; Henning et al., 2004).

Flaxseed

Flaxseed is an annual crop plant that reaches heights of 30-100 cm and boasts distinctive blue flowers. Plant lignans, phenolic compounds formed through the amalgamation of two cinnamic acid derivatives, are a significant component of flaxseed (Oomah, 2019). Flaxseed stands out by containing 800 times more lignans compared to other plant-based foods. Lignans found in flaxseed have displayed promising potential in reducing the growth of cancerous tumors, particularly hormone-sensitive cancers such as breast, endometrial, and prostate cancer (Truan et al., 2003).

Flaxseed has a rich history of traditional and medicinal applications in addressing various health issues. For instance, flaxseed tea is employed to alleviate respiratory ailments like dyspnea, asthma, dysphonia, severe coughs, and bronchitis, while flaxseed flour is used to tackle conditions such as pulmonary tuberculosis, intestinal issues, and abdominal discomfort (Moghaddasi, 2011).

Furthermore, it can influence cholesterol homeostasis by modulating enzymes involved in bile acid formation, thereby impacting cholesterol metabolism (Parihk, Netticadan, & Pierce, 2018). A study investigating the effects of flaxseed powder consumption on the lipid profiles of individuals with hyperlipidemia concluded that flaxseed can be regarded as a valuable therapeutic dietary component in managing hyperlipidemia (Torkan, Entezari, & Siavash, 2015).

Walnut

Walnuts qualify as functional foods, owing to the presence of vitamin E and other antioxidants such as phytosterols and polyphenols. These compounds are recognized for their protective

role against cardiovascular diseases, specific cancer types, and the detrimental effects of aging (Chauhan et al., 2020). Vitamin E, in particular, is noted for safeguarding against LDL cholesterol oxidation and reducing the risk of heart diseases (Asgary et al., 2018).

L-arginine, an essential amino acid found in substantial amounts in walnuts, holds special significance in the treatment of hypertension. In the human body, L-arginine is converted to nitric oxide, which serves to soften the inner linings of blood vessels, inducing vessel relaxation (Xu et al., 2022). A meta-analysis suggests that the consumption of walnuts could potentially have a clinically significant impact on peripheral endothelial function (Mohammadi-Sartang and Bellissimo and Totosy, 2018).

The protective influence of walnuts on heart health is attributed to its fatty acid composition, encompassing omega-3 and omega-9, as well as its wealth of polyphenols (Crupi et al.i, 2013; Esmaeili et al., 2015). Notably, a study examining the effects of walnuts on blood lipid profiles demonstrated positive outcomes in individuals with hyperlipidemia. Additionally, it revealed that walnut consumption offers a means of supplying essential fatty acids that greatly contribute to brain development (Chauhan & Chauhan, 2020).Furthermore, a study investigating the impact of walnut supplementation on cognitive performance among young adults observed an 11.2% increase in verbal reasoning ability, emphasizing the need to raise awareness about the significance of walnut consumption (Cahoon et al., 2021).

Tomato

Tomatoes and many tomato products contain potassium, phosphorus, vitamins A, C, E, and phytochemicals such as carotenoids, polyphenols, and flavonoids. It is known that vitamins and carotenoids have antioxidant properties and support cardiovascular health (Ali et al., 2020). The results of a study using tomato extracts to prevent platelet activation showed that tomato

extract may contribute to a reduction in thrombotic events and may act as a primary preventive of cardiovascular disease (Müller et al., 2016). In a prospective cohort study of more than 47,000 men, it was reported that those who consumed tomatoes and their products at least 10 times a week reduced the risk of developing prostate cancer (Dalbeni et al., 2018)

Garlic-Onion

Garlic and onion, which belong to the Allium species, are spices commonly used in cooking. In addition to culinary use, they are also used in alternative medicine for preventive and curative purposes (Papu et al., 2014). Onions are rich in two chemical groups that are beneficial for human health. These are flavonoids and alkenyl cysteine sulfoxides. Flavonoids provide onion-specific colors with compounds such as anthocyanin and quercetin, which are subgroups of flavonoids, while alkenyl cysteine sulfoxides produce the characteristic smell and taste of onions when they are broken down by the enzyme allinase (Yamaguchi & Kumagai, 2020). In a study, it was shown that daily garlic consumption decreased systolic blood pressure by 3.75 mmHg and diastolic blood pressure by 3.39 mmHg in patients with hypertension (Wang et al., 2015). There are also studies investigating the effects of garlic on lipid metabolism. In one study, patients with hypercholesterolemia were given garlic preparation, and as a result, an 11.5% increase in high-density lipoprotein (HDL) levels and a 7.5% decrease in cholesterol levels were observed (Villaño et al., 2023). A meta-analysis of articles published between 1988 and 2016, investigating the effect of garlic on lipid profile and blood glucose in diabetic patients, was conducted. This meta-analysis showed that garlic has a therapeutic effect on glucose and lipid profile (Shabani, Savemiri, and Mohammadpur, 2019).

Olive Oil

Olive oil is derived from the fruits of the Olea europaea L. tree, renowned for its distinctive flavor and aroma. The components of

olive oil offer a range of benefits, featuring antioxidant, anti-inflammatory, and anticarcinogenic properties. They serve to lower LDL cholesterol levels, safeguard cellular membranes and intracellular molecules against oxidative stress, and exhibit substantial protective effects against various ailments (Summerhill et al., 2018). Notably, oleic acid, a prominent constituent of olive oil, is instrumental in diminishing LDL cholesterol and triglycerides, fortifying cell membranes and lipoproteins against oxidative strain. It may also contribute to reducing plasma glucose and insulin levels, thereby reducing the risk of colon, breast, and prostate cancer (Violi et al., 2015). Furthermore, squalene and phenolic compounds have the potential to shield against UV radiation and radioactivity (Luna et al., 200+).

Olive oil plays a pivotal role in the protection against cancer and cardiovascular diseases (Nocella et al., 2018). The PREDIMED study underlines the significance of olive oil intake in reducing cardiovascular risk by 10% and overall mortality by 7% (Guasch-Ferré et al., 2014). The value of olive oil is further underscored by its bioactive components, which confer positive health effects.

Buckwheat

Buckwheat grains consist of approximately 73.5% starch, with 33.5% of this starch being classified as resistant starch. Foods rich in resistant starch typically have low glycemic indexes. Given that low glycemic index diets contribute to blood glucose regulation and reduce the risk of obesity, buckwheat emerges as a valuable component in the prevention of certain chronic diseases (Yang et al., 2019).

Notably, buckwheat qualifies as a prebiotic food due to its capacity to enhance lactic acid bacteria populations in the intestinal tracts of mice, primarily owing to its high content of resistant starch. Buckwheat protein sets itself apart by offering a superior nutritional profile in comparison to other cereal proteins, boasting an amino acid composition that positions it as one of the best sources of high-

biological-value proteins. These proteins bear a striking resemblance to those of animal origin and feature flavonoids, fagopyrin, and thiamine-binding proteins, all of which carry prophylactic significance. They have demonstrated cholesterol-lowering and antihypertensive effects (Zhang et al., 2017).

Chia Seeds

Chia seeds derive their antioxidant capacity primarily from flavonoids and tocopherols. These seeds are rich in phenolic compounds like gallic acid, caffeic acid, chlorogenic acid, rosmarinic acid, myristin, quercetin, and kaempferol. These phenolic compounds, with their antioxidant properties, play a protective role against chronic illnesses such as cardiovascular diseases, dyslipidemia, diabetes, and cancer by ensuring cellular oxidative balance (Enes et al., 2020).

Moreover, chia seeds serve as a source of peptides derived from albumin, globulin, prolamin, and glutelin proteins, which contribute to blood pressure regulation (Rabail et al., 2021). In a study evaluating the impact of chia supplementation (Salvia hispanica L.) on blood pressure and related cardiometabolic factors in individuals with hypertension, significant blood pressure reductions were observed in the intervention group (de Souza Ferreira., 2015).

Chia seeds are a versatile food choice that can be incorporated into weight loss programs. They are packed with dietary fiber, minerals, proteins, and fats, particularly alpha-linolenic acid (ALA). These nutritious components not only support weight loss but also provide a protective effect against obesity (Oyalo & Mburu, 2021). In a study investigating the influence of chia seeds on body weight in overweight and obese adults with type 2 diabetes, the group consuming chia seeds experienced greater weight loss and a reduction in waist circumference (Alwosais et al., 2021).

Conclusion

It is widely believed that the consumption of functional foods, with their capacity to enhance overall well-being, will contribute to a reduction in healthcare expenses and productivity losses while simultaneously improving the quality of human life. Hence, the production and consumption of functional foods should be actively promoted. In order to substantiate health claims associated with functional foods, it is imperative to foster the growth of functional food science, provide support for research in this domain, achieve international consensus on objective scientific standards, and undertake initiatives to ensure accurate public awareness through media channels. Furthermore, seminars and educational programs should be conducted for dietitians, nutrition educators, healthcare professionals, and educators working in health and education sectors, emphasizing the pivotal role of functional foods in maintaining healthy nutrition. By doing so, societies can be more effectively informed and educated about the significance of functional foods.

References

Ali, M. Y., Sina, A. A. I., Khandker, S. S., Neesa, L., Tanvir, E. M., Kabir, A., ... & Gan, S. H. (2020). Nutritional composition and bioactive compounds in tomatoes and their impact on human health and disease: A review. Foods, 10(1), 45.

Alwosais, E. Z. M., Al-Ozairi, E., Zafar, T. A., & Alkandari, S. (2021). Chia seed (Salvia hispanica L.) supplementation to the diet of adults with type 2 diabetes improved systolic blood pressure: A randomized controlled trial. Nutrition and health, 27(2), 181-189.

Aryee, A. N., & Boye, J. I. (2014). Current and emerging trends in the formulation and manufacture of nutraceuticals and functional food products. Nutraceutical and functional food processing technology, 1-63.

Asgary, S., Rastqar, A., & Keshvari, M. (2018). Functional food and cardiovascular disease prevention and treatment: a review. Journal of the American College of Nutrition, 37(5), 429-455.

Benvenga, S., Feldt-Rasmussen, U., Bonofiglio, D., & Asamoah, E. (2019). Nutraceutical supplements in the thyroid setting: health benefits beyond basic nutrition. Nutrients, 11(9), 2214.

Braakhuis, A. J., Campion, P., & Bishop, K. S. (2016). Reducing breast cancer recurrence: the role of dietary polyphenolics. Nutrients, 8(9), 547.

Cahoon, D., Shertukde, S. P., Avendano, E. E., Tanprasertsuk, J., Scott, T. M., Johnson, E. J., ... & Nirmala, N. (2021). Walnut intake, cognitive outcomes and risk factors: a systematic review and meta-analysis. Annals of Medicine, 53(1), 972-998.

Chauhan, A., & Chauhan, V. (2020). Beneficial effects of walnuts on cognition and brain health. Nutrients, 12(2), 550.

Chauhan, A., & Chauhan, V. (2020). Beneficial effects of walnuts on cognition and brain health. Nutrients, 12(2), 550.

Crupi, R., Marino, A., & Cuzzocrea, S. (2013). n-3 fatty acids: role in neurogenesis and neuroplasticity. Current medicinal chemistry, 20(24), 2953-2963.

Dalbeni, A., Treggiari, D., Tagetti, A., Bevilaqua, M., Bonafini, S., Montagnana, M., ... & Fava, C. (2018). Positive effects of tomato paste on vascular function after a fat meal in male healthy subjects. Nutrients, 10(9), 1310.

de Souza Ferreira, C., de Sousa Fomes, L. D. F., Santo da Silva, G. E., & Rosa, G. (2015). Effect of chia seed (Salvia hispanica L.) consumption on cardiovascular risk factors in humans: a systematic review. Nutricion hospitalaria, 32(5), 1909-1918.

Dixit, A. K., Antony, J., Sharma, N. K., & Tiwari, R. K. (2011). 12. Soybean constituents and their functional benefits. Research signpost, 37(661), 2.

Duggan, C., Gannon, J., & Walker, W. A. (2002). Protective nutrients and functional foods for the gastrointestinal tract. The American journal of clinical nutrition, 75(5), 789-808

Enes, B. N., Moreira, L. P., Silva, B. P., Grancieri, M., Lúcio, H. G., Venâncio, V. P., ... & Martino, H. S. (2020). Chia seed (Salvia hispanica L.) effects and their molecular mechanisms on unbalanced diet experimental studies: A systematic review. Journal of food science, 85(2), 226-239.

Esmaeili, V., Shahverdi, A. H., Moghadasian, M. H., & Alizadeh, A. R. (2015). Dietary fatty acids affect semen quality: a review. Andrology, 3(3), 450-461.

Guasch-Ferré, M., Hu, F. B., Martínez-González, M. A., Fitó, M., Bulló, M., Estruch, R., ... & Salas-Salvadó, J. (2014). Olive oil intake and risk of cardiovascular disease and mortality in the PREDIMED Study. BMC medicine, 12, 1-11.

Kim, I. S. (2021). Current perspectives on the beneficial effects of soybean isoflavones and their metabolites for humans. Antioxidants, 10(7), 1064.

Lin, X., Ma, L., Racette, S. B., Anderson Spearie, C. L., & Ostlund Jr, R. E. (2009). Phytosterol glycosides reduce cholesterol absorption in humans. American Journal of Physiology-Gastrointestinal and Liver Physiology, 296(4), G931-G935.

Liu, Z. M., Ho, S. C., Chen, Y. M., & Ho, Y. P. (2012). The effects of isoflavones combined with soy protein on lipid profiles, C-reactive protein and cardiovascular risk among postmenopausal Chinese women. Nutrition, Metabolism and Cardiovascular Diseases, 22(9), 712-719.

Luna, G., Morales, M. T., & Aparicio, R. (2006). Changes induced by UV radiation during virgin olive oil storage. Journal of agricultural and food chemistry, 54(13), 4790-4794.

Luo, X., Su, P., & Zhang, W. (2015). Advances in microalgae-derived phytosterols for functional food and pharmaceutical applications. Marine drugs, 13(7), 4231-4254.

Martirosyan, D., Kanya, H., & Nadalet, C. (2021). Can functional foods reduce the risk of disease? Advancement of functional food definition and steps to create functional food products. Functional Foods in Health and Disease, 11(5), 213-221.

Menrad, K. (2003). Market and marketing of functional food in Europe. Journal of food engineering, 56(2-3), 181-188.

Messina, M. (2016). Soy and health update: evaluation of the clinical and epidemiologic literature. Nutrients, 8(12), 754.

Moghaddasi, M. S. (2011). Linseed and usages in Humanlife. Advances in Environmental Biology, 1380-1393.

Mohammadi-Sartang, M., Bellissimo, N., de Zepetnek, J. T., Brett, N. R., Mazloomi, S. M., Fararouie, M., ... & Mazloom, Z. (2018). The effect of daily fortified yogurt consumption on weight loss in adults with metabolic syndrome: A 10-week randomized controlled trial. Nutrition, Metabolism and Cardiovascular Diseases, 28(6), 565-574.

Moreau, R. A., Nyström, L., Whitaker, B. D., Winkler-Moser, J. K., Baer, D. J., Gebauer, S. K., & Hicks, K. B. (2018). Phytosterols and their derivatives: Structural diversity, distribution, metabolism, analysis, and health-promoting uses. Progress in Lipid Research, 70, 35-61.

Müller, L., Caris-Veyrat, C., Lowe, G., & Böhm, V. (2016). Lycopene and its antioxidant role in the prevention of cardiovascular diseases—a critical review. Critical Reviews in Food Science and Nutrition, 56(11), 1868-1879.

Nocella, C., Cammisotto, V., Fianchini, L., D'Amico, A., Novo, M., Castellani, V., ... & Carnevale, R. (2018). Extra virgin olive oil and cardiovascular diseases: Benefits for human health. Endocrine, Metabolic & Immune Disorders-Drug Targets (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders), 18(1), 4-13.

Oliveira, A., Amaro, A. L., & Pintado, M. (2018). Impact of food matrix components on nutritional and functional properties of fruit-based products. Current Opinion in Food Science, 22, 153-159.

Oomah, B. D., Kenaschuk, E. O., & Mazza, G. (1995). Phenolic acids in flaxseed. Journal of agricultural and food chemistry, 43(8), 2016-2019.

Oyalo, J., & Mburu, M. (2021). Health Potential of Chia (Salvia hispanica L.) Seeds-Derived α-linoleic Acid and α-linolenic Acids: A Review. European Journal of Agriculture and Food Sciences, 3(4), 5-10.

Papu, S., Jaivir, S., Sweta, S., & Singh, B. R. (2014). Medicinal values of garlic (Allium sativum L.) in human life: an overview. Greener Journal of Agricultural Sciences, 4(6), 265-280.

Parikh, M., Netticadan, T., & Pierce, G. N. (2018). Flaxseed: Its bioactive components and their cardiovascular benefits. American Journal of Physiology-Heart and Circulatory Physiology.

Pedrosa, M. M., Varela, A., Domínguez-Timón, F., Tovar, C. A., Moreno, H. M., Borderías, A. J., & Díaz, M. T. (2020). Comparison of bioactive compounds content and techno-functional properties of pea and bean flours and their protein isolates. Plant Foods for Human Nutrition, 75, 642-650.

Rabail, R., Khan, M. R., Mehwish, H. M., Rajoka, M. S. R., Lorenzo, J. M., Kieliszek, M., ... & Aadil, R. M. (2021). An overview of chia seed (Salvia hispanica L.) bioactive peptides' derivation and utilization as an emerging nutraceutical food. Frontiers in Bioscience-Landmark, 26(9), 643-654.

Shabani, E., Sayemiri, K., & Mohammadpour, M. (2019). The effect of garlic on lipid profile and glucose parameters in diabetic patients: A systematic review and meta-analysis. Primary care diabetes, 13(1), 28-42.

Sikand, G., Kris-Etherton, P., & Boulos, N. M. (2015). Impact of functional foods on prevention of cardiovascular disease and diabetes. Current cardiology reports, 17, 1-16.

Summerhill, V., Karagodin, V., Grechko, A., Myasoedova, V., & Orekhov, A. (2018). Vasculoprotective role of olive oil compounds via modulation of oxidative stress in atherosclerosis. Frontiers in cardiovascular medicine, 5, 188.

Tang, N., Wu, Y., Zhou, B., Wang, B., & Yu, R. (2009). Green tea, black tea consumption and risk of lung cancer: a meta-analysis. Lung cancer, 65(3), 274-283.

Torkan, M., Hassan Entezari, M., & Siavash, M. (2015). Effect of flaxseed on blood lipid level in hyperlipidemic patients. Reviews on recent clinical trials, 10(1), 61-67.

Truan, J. S., Chen, J. M., & Thompson, L. U. (2010). Flaxseed oil reduces the growth of human breast tumors (MCF-7) at high levels of circulating estrogen. Molecular Nutrition & Food Research, 54(10), 1414-1421.

Villaño, D., Marhuenda, J., Arcusa, R., Moreno-Rojas, J. M., Cerdá, B., Pereira-Caro, G., & Zafrilla, P. (2023). Effect of Black Garlic Consumption on Endothelial Function and Lipid Profile: A Before-and-After Study in Hypercholesterolemic and Non-Hypercholesterolemic Subjects. Nutrients, 15(14), 3138.

Violi, F., Loffredo, L., Pignatelli, P., Angelico, F., Bartimoccia, S., Nocella, C., ... & Carnevale, R. (2015). Extra virgin olive oil use is associated with improved post-prandial blood glucose and LDL cholesterol in healthy subjects. Nutrition & diabetes, 5(7), e172-e172.

Wang, H. P., Yang, J., Qin, L. Q., & Yang, X. J. (2015). Effect of garlic on blood pressure: A meta-analysis. The Journal of Clinical Hypertension, 17(3), 223-231.

Xu, X., Song, Y., Jiang, M., Liu, M., Zhang, X., Wang, D., ... & Liu, X. (2022). An assessment of the potential of defatted walnut powder extract against hyperlipidemia-intensified L-arginine-induced acute pancreatitis. Food Science and Technology, 42, e19722.

Yamaguchi, Y., & Kumagai, H. (2020). Characteristics, biosynthesis, decomposition, metabolism and functions of the garlic odour precursor, S-allyl-l-cysteine sulfoxide. Experimental and therapeutic medicine, 19(2), 1528-1535.

Yang, J., Gu, Z., Zhu, L., Cheng, L., Li, Z., Li, C., & Hong, Y. (2019). Buckwheat digestibility affected by the chemical and structural features of its main components. Food Hydrocolloids, 96, 596-603.

Zhang, C., Zhang, R., Li, Y. M., Liang, N., Zhao, Y., Zhu, H., ... & Chen, Z. Y. (2017). Cholesterol-lowering activity of Tartary buckwheat protein. Journal of Agricultural and Food Chemistry, 65(9), 1900-1906.

CHAPTER III

Food of the Future: Laboratory-Produced Meat and Plant-Based Alternatives

Hakan TOĞUÇ[1]

1.Introduction: Projecting Nutritional Trends in the Future

Contemporary food systems confront significant challenges, including the burgeoning global population, environmental constraints, and sustainability imperatives. The United Nations' 2019 projection anticipates the world population reaching 9.7 billion by 2050, suggesting potential inadequacies in existing food production paradigms (Godfray & et al., 2010). Consequently, innovative and non-traditional methodologies are essential for the future of food production.

Traditional livestock farming has faced substantial critique regarding its extensive water and land consumption, greenhouse gas emissions, and animal welfare concerns (Steinfeld & et al., 2006).

[1] Assistant Professor, İnönü University Faculty of Health Sciences Department of Nutrition and Dietetics

These environmental detriments have heightened interest in alternative protein sources, spotlighting innovative solutions such as laboratory-produced meat and plant-based meat substitutes. Laboratory-produced meat, created through biotechnological cultivation of animal cells, aims to mitigate environmental impact and enhance animal welfare relative to conventional livestock farming (Post, 2012; Bhat & et al., 2017). Conversely, plant-based meat alternatives replicate the texture and flavor of animal meat using plant proteins and other components, offering a sustainable option increasingly favored by consumers attentive to animal welfare (McClements & Grossmann, 2022; Janssen & et al., 2016).

2.The Ascendancy and Potential of Laboratory-Produced Meat

Regarded as a groundbreaking innovation in sustainable food production and ethical nutrition, laboratory-produced meat actualizes Winston Churchill's 1931 vision of lab-grown meat, as described in his article "Fifty Years Hence" (Churchill, 1931). The unveiling of the world's first laboratory-produced hamburger by Dr. Mark Post and his team in 2013 marked a significant advancement in this arena (Post, 2012). This meat is cultivated using cell culture techniques and tissue engineering to develop muscle tissue, integrating stem cell biology with bioreactor systems to produce meat sustainably (Bhat & et al., 2017; Datar & Betti, 2010). Nutritionally akin to conventional meat, laboratory-produced meat may also offer health benefits by potentially mitigating issues associated with traditional meat consumption (Tilman & Clark, 2014).

Laboratory-produced meat exhibits a reduced environmental footprint compared to traditional animal agriculture, presenting a more efficient alternative in terms of water and land utilization, greenhouse gas emissions, and energy consumption (Tuomisto & Teixeira de Mattos, 2011). The evolution of this meat type is driven by advancing technologies and growing consumer interest, with research focusing on food safety, nutritional content, and sensory characteristics (Post, 2012). Commercialization and broader market

introduction represent imminent challenges in this field (Stephens & et al., 2018).

3.Plant-Based Meat Alternatives: Diversification and Technological Advancements

Plant-based meat alternatives are anticipated to significantly influence consumer preferences, aligning with the current demands for environmental sustainability and ethical nutrition practices. The genesis of these alternatives traces back to the mid-20th century, coinciding with the burgeoning popularity of vegetarian and vegan diets. Recent advancements, particularly in technology and research and development (R&D), have remarkably enhanced the quality and variety of these products (Gregory, 2017). These developments have enabled plant-based products to closely resemble traditional meat in texture, flavor, and nutritional value, presenting compelling alternatives.

The primary constituents of plant-based meat substitutes include vegetable proteins like soy, pea, and wheat. These proteins undergo various processing techniques to imitate the texture and flavor characteristics of animal meat. Techniques such as extrusion, which employs high pressure and heat, transform vegetable proteins into fibrous, meat-like textures. Additional methods like protein texturing and fermentation further refine the texture and flavor profiles to resemble meat more closely (Kumar & et al., 2017). These alternatives typically offer a high protein content with generally lower levels of saturated fat compared to animal meat. Their enrichment with fiber, vitamins, and minerals enhances their nutritional profile, positioning them as healthful options. Furthermore, the availability of allergen-free or low-gluten variants caters to diverse dietary requirements (Sabaté & Soret, 2014).

Amidst growing consumer consciousness regarding environmental, health, and animal welfare issues, plant-based meat alternatives have carved a substantial niche in the global food market, with prospects for continued expansion (Bryant & Barnett,

2018). This escalating demand is propelling food manufacturers to innovate and diversify in the realm of plant-based meat substitutes. The trajectory of these products is being shaped by evolving technologies and heightened consumer awareness, presenting a more sustainable option relative to traditional animal agriculture. This translates to a reduced environmental footprint in terms of water and land usage, greenhouse gas emissions, and overall energy consumption. The safety and health benefits associated with these crops suggest their significant role in future food systems (Eshel & et al., 2019).

Catering not only to vegetarian and vegan diets but also appealing to a broader demographic seeking to reduce meat consumption, plant-based meat alternatives are integral to the sustainability of contemporary food systems. They aim to offer innovative solutions to meet a spectrum of nutritional needs, thereby contributing to the diversification and resilience of modern food paradigms (Bryant & Barnett, 2018).

4.Nutritional and Health Implications of Novel Food Sources

The exploration of the health impacts of laboratory-produced meat and plant-based meat alternatives is a burgeoning area in contemporary nutritional science. Laboratory-produced meat offers the potential to replicate the nutritional profile of conventional meat while optimizing key aspects such as the fatty acid composition, and the levels of vitamins and minerals. This bioengineering approach can potentially reduce saturated fat levels while augmenting beneficial fats like omega-3 fatty acids, thereby potentially diminishing the risk of cardiovascular diseases and certain chronic conditions (Bhat & et al., 2017). Moreover, the absence of antibiotic residues, hormones, and pathogens, commonly associated with conventional meat, positions laboratory-produced meat as a safer alternative in terms of food safety (Stephens & et al., 2018).

Plant-based meat alternatives are lauded for their high fiber content and reduced saturated fat levels. These characteristics are

linked to a decreased risk of chronic diseases, including cardiovascular disease, type 2 diabetes, and certain cancers (McClements & Grossmann, 2022). However, it is crucial to recognize that these alternatives may fall short in delivering optimal bioavailability of certain key nutrients, such as vitamin B12, iron, and zinc (Sabaté & Soret, 2014).

Both laboratory-produced meat and plant-based meat alternatives are posited to contribute significantly to public health. These novel food sources may provide solutions to health issues attributed to traditional meat consumption, such as antibiotic resistance and zoonotic diseases. Furthermore, they could play a pivotal role in chronic disease prevention when integrated into a balanced and healthy diet (Tilman & Clark, 2014). The increasing adoption of these alternatives could instigate shifts in nutrition policies and public health strategies. Advocating for and supporting these products might foster the adoption of sustainable and healthy eating practices. Nevertheless, it is imperative to advocate for further research to comprehensively understand the health impacts of these innovative food sources (WHO, 2019). Particular emphasis should be placed on conducting extensive research into their long-term health effects, the diversity of nutrient intake, and their overall influence on nutritional balance.

5.Sustainability and Environmental Implications of Emerging Food Technologies

The emergence of laboratory-produced meat and plant-based meat alternatives marks a pivotal shift in sustainability and environmental stewardship. Laboratory meat production emerges as a sustainable alternative to traditional animal agriculture, offering the potential to drastically reduce greenhouse gas emissions, water usage, and land requirements (Tuomisto & Teixeira de Mattos, 2011). This technology negates the need for expansive land and intensive water resources typically associated with conventional animal rearing, positioning it as a significant contributor to climate change mitigation efforts (Post, 2012).

Similarly, plant-based meat alternatives exhibit a reduced environmental footprint in comparison to traditional animal meat production. The utilization of plant proteins as a base is associated with decreased soil erosion, water pollution, and greenhouse gas emissions. Additionally, the production processes of these alternatives are generally more energy-efficient and are considered conducive to the adoption of renewable energy sources (Sabaté & Soret, 201; Eshel & et al., 2019).

Both laboratory-produced meat and plant-based meat alternatives are posited to substantially enhance the sustainability of global food systems. These novel food sources could offer viable solutions to pressing issues such as food security and malnutrition, potentially leading to more equitable and accessible food systems. Their production is also thought to promote more efficient utilization of food resources and conservation of natural resources (Godfray & et al., 2010).

However, a thorough assessment of the environmental impacts of these innovative food sources remains necessary. The scaling up of production processes poses economic and technological challenges, and shifting consumer behavior is essential for their widespread acceptance and integration into diets (Stephens & et al., 2018). Future strategies should focus on developing innovative approaches and policies to minimize environmental impacts and maximize the sustainability potential of these food sources. Laboratory-produced meat and plant-based meat alternatives not only transform food production and consumption patterns but also have profound ethical and social implications. These developments are expected to play a critical role in steering towards a sustainable and equitable global food system (Post, 2012).

6.Ethical and Social Considerations in Novel Food Technologies

The burgeoning utilization of laboratory-produced meat and plant-based meat alternatives introduces significant ethical and social considerations. Laboratory meat production is heralded for its

potential to substantially improve animal welfare, mitigating ethical concerns inherent in traditional animal agriculture. This technology is anticipated to circumvent ethical dilemmas associated with animal rearing and slaughtering practices (Hopkins & Dacey, 2008). Similarly, plant-based meat alternatives are regarded as ethically favorable, offering a means of production devoid of animal harm. These alternatives might appeal particularly to consumers with strong convictions about animal welfare, potentially elevating ethical standards in food production.

The widespread acceptance of these new food sources is intricately linked to consumer perceptions and cultural attitudes. There exists a degree of skepticism, particularly concerning the perceived naturalness and safety of laboratory-produced meat, which could influence public acceptance (Bryant & Barnett, 2018). Effective consumer education and transparent communication are pivotal in fostering public acceptance of these innovations.

The integration of laboratory-produced meat and plant-based meat alternatives into mainstream diets could significantly alter traditional food cultures and eating habits. This shift reflects an increasing demand for sustainable and ethical food choices and evolving social norms around conventional meat consumption (Janssen & et al., 2016). The implications of these products on food safety, as well as their impact on local economies, constitute critical considerations at the socio-economic level.

The ethical and social aspects of laboratory-produced meat and plant-based meat alternatives are crucial factors likely to influence future food policies and regulations. A holistic policy approach is necessary to align these novel food sources with broader objectives of social welfare, environmental sustainability, and economic development. Additionally, interdisciplinary research is imperative to thoroughly assess the ethical and social impacts of these emerging technologies (Bryant & Barnett, 2018).

7.Gelişen Gıda Teknolojilerinin Ekonomik Etkileri ve Pazar Dinamikleri

Laboratuvar ortamında üretilen et ve bitki bazlı et alternatiflerinin piyasaya sürülmesi, ekonomik perspektifler ve pazar dinamiklerinde önemli dönüşümlere sebep olmaktadır. Çevresel, sağlık ve etik endişelerle bu yeni gıda kaynaklarına olan küresel talebin artması, yakın gelecekte pazarın büyük ölçüde genişleyeceğini göstermektedir (GFI, 2019). Özellikle bitki bazlı et alternatifleri, geniş bir tüketici kitlesine ulaşarak hızla büyüyen bir sektör haline gelmiştir (FAIRR Initiative, 2019). Bu büyüme, hem yeni kurulan start-up'lar hem de köklü gıda şirketlerinin bu alanlara yaptığı yatırımlarla desteklenmektedir. Bu yatırımlar, teknolojik ilerlemeleri hızlandırmakla kalmayıp, üretim maliyetlerini düşürmeyi de hedeflemektedir. Bunun yanı sıra, geleneksel et üreticileri de bu yeni pazar segmentine girerek ürün çeşitliliklerini artırmaktadır (Kearney, 2019).

Tüketici tercihleri ve davranışları, laboratuvar ortamında üretilen et ve bitki bazlı et alternatiflerinin pazar dinamiklerini önemli ölçüde etkilemektedir. Çevresel ve sağlık konularındaki artan farkındalık, tüketicileri bu yenilikçi gıda kaynaklarına yönlendirmektedir. Bu ürünlerin lezzeti, fiyatı ve erişilebilirliği de tüketici kabulü ve pazara nüfuz etme açısından önemli faktörler arasında yer almaktadır (Nielsen, 2019). Bu ürünlerin pazarı, sürekli değişen tüketici talepleri, teknolojik gelişmeler ve düzenleyici çerçeveler tarafından şekillendirilmektedir.

Gelecek yıllarda, bu ürünlerin daha maliyet etkin ve geniş çapta erişilebilir olması beklenmektedir. Bununla birlikte, bu yeni gıda kaynaklarının pazar payının, geleneksel et ürünleriyle nasıl rekabet edeceği, hem ekonomik hem de toplumsal faktörlere bağlı olacaktır. Bu durum, gıda endüstrisinde bir ekonomik dönüşümü temsil etmekte ve pazar dinamiklerini yeniden şekillendirmektedir. Laboratuvar ortamında üretilen et ve bitki bazlı et alternatiflerinin, sürdürülebilir ve yenilikçi bir gıda ekonomisinin önemli bileşenleri haline gelmesi beklenmektedir (McKinsey & Company, 2020).

8.Legal Frameworks and Food Safety Protocols for Novel Food Sources

The introduction of laboratory-produced meat and plant-based meat alternatives necessitates a reevaluation and enhancement of existing food safety and regulatory standards. Given their unique nature, these innovative food products transcend the scope of current regulations and standards that govern conventional food items. There is a pressing need for new regulatory frameworks that address the safety, labeling, and marketing of these products. Therefore, key regulatory bodies such as the European Food Safety Authority (EFSA) and the United States Food and Drug Administration (FDA) are poised to play instrumental roles in establishing safety and labeling standards for these novel food sources (FDA, 2019).

Each phase of the production process, including raw material procurement, production methodology, packaging, and distribution, must be meticulously regulated. Ensuring the safety of these products mandates comprehensive risk analyses and stringent quality control measures to mitigate risks of foodborne illnesses and contamination (ISO, 2020). There is notable international variability in the regulation of laboratory-produced meat and plant-based meat alternatives, with significant discrepancies in legal frameworks and standards between regions like the European Union and the United States. Such differences may pose challenges for international trade and market access (WTO, 2018).

Furthermore, the labeling of these products is critical to enable consumers to make informed choices. Labels should transparently disclose information about ingredients, nutritional content, and production processes. Additionally, adherence to regulatory guidelines is essential to prevent consumer deception and to clearly differentiate these products from traditional offerings. This scenario underscores the need for novel approaches and standards in food safety and regulatory domains. The safe, ethical, and transparent production and consumption of these emerging food sources can be

achieved through robust legal frameworks and standards (EU Commission, 2021).

9.Future Prospects: Navigating Challenges and Harnessing Opportunities in Food Technology

The advent of laboratory-produced meat and plant-based meat alternatives heralds a period of both challenges and opportunities within the food industry. The production of laboratory meat and the advancement of plant-based meat substitutes necessitate cutting-edge technologies and sustained research and development (R&D) endeavors. Breakthroughs in biotechnology, tissue engineering, and food processing technologies are crucial for enhancing the quality and economic viability of these products (Post, 2013; Bhat & et al., 2017). Future research should aim to enhance the nutritional value of these products while minimizing their environmental footprint (Specht & et al., 2018).

The sustainability aspect of these products is paramount, especially in reducing the environmental burden of food production. However, the large-scale production and consumption of these products must be evaluated in the context of natural resource utilization and energy consumption (Tuomisto & Teixeira de Mattos, 2011; Eshel & et al., 2019).

Consumer acceptance of these innovative food sources hinges on perceptions and market dynamics. Educational initiatives and awareness campaigns are vital in fostering acceptance (Bryant & Barnett, 2018; Janssen & et al., 2016). The evolution of the market for these products will be influenced by factors such as pricing, taste, and accessibility (Nielsen, 2019).

Regulating and ethically framing these new food sources present significant legal and ethical challenges. Food safety standards, labeling practices, and animal welfare considerations ought to underpin legal frameworks in this sector (FDA, 2019). Additionally, the social and cultural implications of these products

should be considered by policymakers and regulatory bodies (WTO, 2018).

Laboratory-produced meat and plant-based meat alternatives have the potential to address global challenges related to food security and malnutrition. By making food production more sustainable and accessible, these new sources could play a crucial role in meeting the burgeoning food demands of the global population (Godfray & et al., 2010). Progress in this field necessitates collaboration and investment between the private sector and government entities. Such partnerships are essential for the commercialization, scaling, and widespread accessibility of these novel food sources (Kearney, 2019).

References

Kearney AT. (2019). How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry?

https://european-biotechnology.com/up-to-date/latest-news/news/report-how-will-meat-alternatives-disrupt-the-agricultural-and-food-industry.html. Access date: 07.12.2023

Bhat, Z.F., Kumar, S., & Fayaz, H. (2017). In Vitro Cultured Meat—a Future Harvest. *Journal of Integrative Agriculture*, 16(4), 756-766.

Bryant, C., & Barnett, J. (2018). Consumer Acceptance of Cultured Meat: A Systematic Review. *Meat Science*, 143, 8-17.

Churchill, W. (1931). Fifty Years Hence. *Strand Magazine*.

https://winstonchurchill.org/wp-content/uploads/2008/06/krummenackeredithuxleywsc.pdf

Access date: 07.12.2023

Datar, I., & Betti, M. (2010). Possibilities for an In Vitro Meat Production System. *Innovative Food Science & Emerging Technologies*, 11(1), 13-22.

Eshel, G., Shepon, A., Makov, T., & Milo, R. (2019). Land, Irrigation Water, Greenhouse Gas, and Reactive Nitrogen Burdens of Meat, Eggs, and Dairy Production in the United States. *Proceedings of the National Academy of Sciences*, 111(33), 11996-12001.

EU Commission. (2021). EU Food Labeling Regulations.

https://food.ec.europa.eu/safety/labelling-and-nutrition/food-information-consumers-legislation_en. Access date: 07.12.2023

FAIRR Initiative. (2019). Plant-based Profits: Investment Risks & Opportunities in Sustainable Food Systems.

https://www.fairr.org/resources/reports/plant-based-profits-investment-risks-opportunities-sustainable-food-systems. Access date: 07.12.2023

FDA. (2019). Regulation of Cultured Meat.

https://www.fda.gov/food/food-ingredients-packaging/human-food-made-cultured-animal-cells. Access date: 07.12.2023

Food and Agriculture Organization of the United Nations and World Health Organization. (2019). Sustainable Healthy Diets.

Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., & Toulmin, C. (2010). Food Security: The Challenge of Feeding 9 Billion People. *Science*, 327(5967), 812-818.

Good Food Institute. (2019). Plant-based Meat Market Report.

https://gfi.org/marketresearch/ Access date: 07.12.2023

Gregory, A. (2017). Plant-based Meats Gaining Traction. *Food Technology*, 71(1), 38-43.

Hopkins, P.D., & Dacey, A. (2008). Vegetarian Meat: Could Technology Save Animals and Satisfy Meat Eaters? *Journal of Agricultural and Environmental Ethics*, 21(6), 579-596.

ISO 22000. Food safety management.

https://www.iso.org/iso-22000-food-safety-management.html. Access date: 07.12.2023

Janssen, M., Busch, C., Rödiger, M., & Hamm, U. (2016). Motives of Consumers Following a Vegan Diet and Their Attitudes Towards Animal Agriculture. *Appetite*, 105, 643-651.

Kumar, P., Chatli, M.K., Mehta, N., Singh, P., Malav, O.P., & Verma, A.K. (2017). Meat Analogues: Health Promising Sustainable Meat Substitutes. *Critical Reviews in Food Science and Nutrition*, 57(5), 923-932.

McClements, D.J., & Grossmann, L. (2022). The Rise of Plant-Based Foods. *In Next-Generation Plant-based Foods* (pp. 1–21).

McKinsey & Company. (2020). The Future of Meat: A McKinsey Report.

Nielsen. (2018). The Plant-based Protein Opportunity.

Post, M.J. (2012). Cultured Meat from Stem Cells: Challenges and Prospects. *Meat Science*, 92(3), 297-301.

Post, M.J. (2013). The First Lab-Grown Hamburger. *The Guardian.*

https://www.theguardian.com/science/2013/aug/05/first-hamburger-lab-grown-meat-press-conference. Access date: 07.12.2023

Sabaté, J., & Soret, S. (2014). Sustainability of Plant-based Diets: Back to the Future. *The American Journal of Clinical Nutrition*, 100(Supplement 1), 476S-482S.

Specht, E.A., Welch, D.R., Clayton, E.M.R., & Lagally, C.D. (2018). Opportunities for Applying Biomedical Production and Manufacturing Methods to the Development of the Clean Meat Industry. *Biochemical Engineering Journal*, 132, 161-168.

Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., & De Haan, C. (2006). Livestock's Long Shadow: Environmental Issues and Options. *FAO*.

Stephens, N., Di Silvio, L., Dunsford, I., Ellis, M., Sexton, A., & Chang, D. (2018). Bringing Cultured Meat to Market: Technical, Socio-Political, and Regulatory Challenges in Cellular Agriculture. *Trends in Food Science & Technology*, 78, 155-166.

Tilman, D., & Clark, M. (2014). Global Diets Link Environmental Sustainability and Human Health. *Nature*, 515, 518-522.

Tuomisto, H.L., & Teixeira de Mattos, M.J. (2011). Environmental Impacts of Cultured Meat Production. *Environmental Science & Technology*, 45(14), 6117-6123.

WTO. (2018). International Trade and Food Safety Standards.

https://www.wto.org/english/res_e/publications_e/world_trade_report18_e.pdf. Access date: 07.12.2023