

Healthy food choice education for undergraduate university students: a quasi-experimental design

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Abstract. – OBJECTIVE: A healthy diet is necessary in every period of life to protect health and prevent diseases. The main purpose of nutrition education is to convey the importance of adequate-balanced nutrition and healthy food choice in maintaining health.

SUBJECTS AND METHODS: This study was conducted to determine the food choice behaviors of the students who took (n=95) and did not take (n=145) the “Healthy Food Choice” course at Cukurova University. The “Healthy Food Choice” course was given as an elective in the fall semester of the 2021-2022 academic year. The data were collected between April and June 2022 through a demographic questionnaire, the healthy food choice test, and the perceived stress scale (PSS).

RESULTS: Sensory appeal and health were found to be the most important determinants, while familiarity and ethical concern were the least important factors in the food choice of the students who took the course. In the control group, sensory appeal and price were the most important determinants, while ethical concern and weight control were the least important factors. Health, natural content, and weight control were more effective in food choices of the students who took the healthy food choice course compared to the controls ($p<0.05$). Also, PSS score was associated with the importance of the food price positively in the case group and negatively associated with natural content in the controls. Furthermore, the present study showed that BMI was positively associated with weight control and familiarity in the HFC group and negatively associated with natural content in the control group.

CONCLUSIONS: Giving the HFC course to university students showed positive results in terms of food choice behaviors.

Key Words:

Food choice, University student, Health education, Healthy nutrition, Nutrition education, Perceived stress.

Introduction

Although the primary answer to the question of why we eat is to meet our biological needs, eating also includes economic, sociocultural, and

psychological factors¹. Food choices are affected by many complex factors such as physiological (metabolic rate, hormones, metabolic diseases), psychological (mood, stress), cognitive (attitude, beliefs, and knowledge) and economic factors, and social status². Stress is a condition associated with an unhealthy diet that increases the consumption of high-sugar, processed, and fast foods. An unhealthy dietary pattern promotes pro-inflammatory processes that lead to adverse health outcomes including chronic diseases and reduced cognitive ability³. It has been shown that people have a tendency to alter their eating habits when they are stressed, and about 80% of them change by increasing or decreasing their total energy intake⁴.

Entering university can itself causes a major lifestyle change for students. In many studies⁵⁻⁸, it has been shown that undergraduate university students make unhealthy food choices, their consumption of fresh vegetables and fruits is low, and their consumption of processed and packaged foods, which have high sugar and fat content, is high. Our previous study⁹ showed that academic stress caused unhealthy food choices in Turkish undergraduate university students. The consumption of processed foods and beverages with added sugar, and daily fructose increased significantly during the final exam period⁹. Universities have many responsibilities, such as planning and implementing education and training programs to promote healthy eating, the introduction of compulsory courses about health and nutrition knowledge, and the availability of healthy food and healthy eating environments for students⁸. Although there are many descriptive studies in literature evaluating the dietary habits of university students in Turkey, there is a lack of research evaluating the practices that lead students to healthy food choices. Therefore, this study aimed to investigate the effects of increasing the level of knowledge about healthy nutrition by giving the “Healthy Food Choice” (HFC) elective course on the food choices of the students at Cukurova

University, Turkey. It was hypothesized that students who took the HFC course would be more motivated toward healthier food choices compared to those who did not.

Subjects and Methods

Subjects

The study was carried out with 95 university students who took the HFC course and 145 students who did not take the course. The students participated in the study after reading and accepting the informed consent form. Students aged 18-25 studying at Cukurova University were included in the study between April and July 2022. The HFC course was given as an elective course in the fall semester of the 2021-2022 academic year, and the curriculum briefly covered the following topics: “the importance of food choice in adequate and balanced nutrition”, “healthy dietary patterns”, “diet and lifestyle changes”, “biological, physiological, economic, social, psychological, and cognitive factors affecting food choice”, “healthy-food choice and purchasing behavior”, and “nutritional labels”. Exclusion criteria were having any syndrome and/or systemic disease, using medication that would affect appetite (antidepressant, metformin, etc.), having a psychiatric disease, and/or receiving eating behavior therapy. Exclusion criteria for female students included pregnancy and lactation. Ethics approval was obtained from the Non-Interventional Clinical Research Ethics Board at Cukurova University (121/40 - 08/04/2022).

Questionnaire Design

The questionnaire consisted of four sections: i) sociodemographic characteristics, ii) nutritional habits, iii) food choice questionnaire (FCQ), and iv) perceived stress scale (PSS). Measurements of weight and height were recorded and used to derive body mass index (BMI). The BMI was calculated based on the following formula: $BMI = \text{weight (kg)} / \text{height (m)}^2$ and classified in accordance with the World Health Organization (WHO) (underweight: $<18.5 \text{ kg/m}^2$; normal: $18.5\text{--}24.9 \text{ kg/m}^2$; pre-obesity: $25.0\text{--}29.9 \text{ kg/m}^2$; obesity class I: $30.0\text{--}34.9 \text{ kg/m}^2$; obesity class II: $35.0\text{--}39.9 \text{ kg/m}^2$; obesity class III: $> 40 \text{ kg/m}^2$)¹⁰.

The food choice test was developed by Step-toe et al¹¹, and a 4-point Likert-type scale consisting of 36 items was developed to determine the reasons for the food choice of the society. The FCQ consists of health, mood, convenience, sen-

sory appeal, natural content, price, weight control, familiarity, and ethical concerns. Turkish validation was performed by Dikmen et al¹² in 2016. The Cronbach’s alpha value of the entire scale was 0.96. It was found that the scale was valid in Turkish. The PSS was developed in 1983 by Cohen et al¹³. The Turkish adaptation and validity-reliability study of the PSS were performed by Eskin et al¹⁴. Composed of 14 elements in total, PSS is designed to measure how stressful an individual’s life is perceived. Participants rated each component on a five-point Likert scale ranging from “never (0)” to “very often (4)”. 7 of the items with positive expressions are scored in reverse. The scores of PSS-14 range from 0 to 56. The score is cumulative by adding the sum of the answers to questions 1, 2, 3, 8, 11, 12, and 14, and reversing the scores for answers 4, 5, 6, 7, 9, 10, and 13. A high score indicates an excess of one’s perception of stress. The author has permission to use the mentioned scales from the copyright holders.

Statistical Analysis

All statistical analyses were performed with Statistical Package for the Social Sciences (SPSS) software (Version 25.0, IBM Corp., Armonk, NY, USA). The variables were tested for their normal distribution using the Kolmogorov-Smirnov/Shapiro-Wilk test. The socio-demographic characteristics of the participants, their nutritional habits, and factors affecting food choices were summarized descriptively. Data were compared using Students’ *t*-test or Mann-Whitney U tests, as appropriate. Linear regression analysis was implemented to investigate the effect of perceived stress and BMI on the food choice determinants. A *p*-value below 0.05 was deemed to show a statistically significant result.

Results

The study sample consisted of 95 students who took the HFC course and 145 students who did not take the course. Table I shows the demographic and anthropometric characteristics of the participants. There were no significant differences in average years, smoking, and drinking status. The majority of both the HFC and control groups were female (70.5% vs. 71.7%), from the Department of Medicine and Health Sciences (57.9% vs. 49.7%), and in their first year of university (43.2% vs. 49.7%, respectively). Similarly, in both groups, the majority of students lived with their families

Table I. General characteristics of the participants.

Variables	HFC course takers (n=95)	Control (n=145)	p-value
Age, years (mean ± SD)	20.9 ± 2.09	20.9 ± 2.92	0.962
Sex			
Male, % (n)	29.5 (28)	28.3 (41)	0.841
Female, % (n)	70.5 (67)	71.7 (104)	
Weight, kg (mean ± SD)	63.6 ± 13.10	63.3 ± 14.29	0.870
Height, m (mean ± SD)	168.9 ± 7.94	168.7 ± 8.61	0.870
BMI, kg/m² (mean ± SD)	22.2 ± 3.49	22.1 ± 3.67	0.802
Underweight, % (n)	11.6 (11)	18.6 (27)	0.950
Normal, % (n)	71.5 (68)	57.3 (83)	
Overweight, % (n)	13.7 (13)	20.7 (30)	
Obesity, % (n)	3.2 (3)	3.4 (5)	
Department			
Medicine, Health Sciences, % (n)	57.9 (55)	49.7 (72)	0.955
Engineering, Architecture, % (n)	21.0 (20)	43.4 (63)	
Education Sciences, % (n)	11.6 (11)	4.8 (7)	
Arts and Sciences, % (n)	6.3 (6)	0.7 (1)	
Economics and Administrative Sciences, % (n)	3.2 (3)	1.4 (2)	
Which academic year undergraduate			
1 st , % (n)	43.2 (41)	49.7 (72)	0.158
2 nd , % (n)	18.9 (18)	21.4 (31)	
3 rd , % (n)	20.0 (19)	17.9 (26)	
4 th , % (n)	17.9 (17)	11.0 (16)	
Life styles factors			
Smokers, % (n)	8.4 (8)	18.6 (27)	0.183
Drinkers, % (n)	13.7 (13)	10.3 (15)	0.06
Place of residence			
With family, % (n)	50.5 (48)	54.5 (79)	0.690
Living with a housemate, % (n)	5.3 (5)	4.1 (6)	
Dormitory, % (n)	44.2 (42)	41.4 (60)	
Total scores of Perceived Stress Scale (mean ± SD)	28.8 ± 5.97	29.2 ± 6.68	0.651

HFC, healthy food choice; SD, standard deviation; BMI, body mass index.

(50.5% vs. 54.5%) or in dormitories (44.2% vs. 41.4%) ($p=0.690$). According to the WHO classification for BMI, 11.6% of the HFC group were underweight, 71.5% were normal, 13.7% were overweight, and 3.2% were obese. The percentages of the control group in the underweight, normal, overweight, and obese were 18.6%, 57.3%, 20.7%, and 3.4%, respectively. There was not a significant difference in BMI between the HFC and control groups. Perceived stress scores of the groups were similar (28.8 ± 5.97 vs. 29.2 ± 6.68 , $p=0.651$) (Table I).

The dietary habits of the participants are summarized in Table II. In the HFC group, about 52.6% of subjects skipped lunch, while 26.3% and 2.1% skipped breakfast and dinner, respectively. Similarly, lunch (46.9%) and breakfast (37.9%) were the meals most often skipped in the control group. Lack of time, habits, and lack of appetite were the top reasons for skipping meals in both groups. The majority of the participants in both groups had breakfast and dinner at home or in the dormitory dining hall. In both the HFC and

control groups, the participants preferred eating their lunch mostly in the university dining hall (48.4% and 43.4%, respectively).

Table III shows the determinants of food choice for the two groups. Sensory appeal (3.44 ± 0.52), price (3.24 ± 0.64), health (3.16 ± 0.57), and natural content (3.15 ± 0.70) were found to be the most important factors, while familiarity (2.80 ± 0.69) and ethical concern (2.60 ± 0.80) were the least important factors in the HFC course takers. On the other hand, in the control group, sensory appeal (3.37 ± 0.59), price (3.35 ± 0.63), mood (3.10 ± 0.67), and convenience (3.00 ± 0.64) were found to be the most important factors, while ethical concern (2.51 ± 0.80) and weight control (2.56 ± 0.79) were the least important factors. When both groups were compared, health, natural content, and weight control were more determinant in food choice for those who took the HFC course, and the difference was statistically significant ($p=0.013$, $p=0.003$, and $p=0.005$, respectively).

Analysis of the association between food choi-

Table II. Nutritional habits of the participants.

Variables	HFC course takers (n=95)	Control (n=145)	p-value
Skipping meal			
I don't skip meals	19.0 (18)	12.4 (18)	0.372
Breakfast	26.3 (25)	37.9 (55)	
Lunch	52.6 (50)	46.9 (68)	
Dinner	2.1 (2)	2.8 (4)	
Reasons for skipping meal*			
No time	35.0 (27)	30.7 (39)	0.836
Hard to prepare	7.8 (6)	13.4 (17)	
No appetite	19.5 (15)	18.9 (24)	
Habitual	22.1 (17)	19.7 (25)	
Weight control	5.2 (4)	2.4 (3)	
Cost saving	10.4 (8)	14.9 (19)	
Place of breakfast meal			
Home	51.6 (49)	48.3 (70)	0.653
Dormitory dining hall	43.1 (41)	39.3 (57)	
Cafeteria, bakery etc.	1.1 (1)	7.6 (11)	
Others	4.2 (4)	4.8 (7)	
Place of lunch meal			
Home	15.8 (15)	20.7 (30)	0.375
Dormitory dining hall	3.2 (3)	4.1 (6)	
University dining hall	48.4 (46)	43.4 (63)	
Cafeteria, bakery etc.	20.0 (19)	20.7 (30)	
Others	12.6 (12)	11.1 (16)	
Place of dinner meal			
Home	48.4 (46)	53.1 (77)	0.772
Dormitory dining hall	44.2 (42)	38.6 (56)	
Cafeteria, bakery etc.	4.2 (4)	8.3 (12)	
Others	3.2 (3)	0 (0)	
Frequency of online ordering food			
Everyday	2.1 (2)	2.1 (3)	0.422
5-6 times a week	2.1 (2)	6.9 (10)	
3-4 times a week	7.4 (7)	3.4 (5)	
1-2 times a week	18.9 (18)	11.7 (17)	
Twice per month	22.1 (21)	22.8 (33)	
Once a month	9.5 (9)	9.0 (13)	
Rarely	22.1 (21)	27.6 (40)	
Never	15.8 (15)	16.6 (24)	
Satisfaction with body weight			
Yes	45.3 (43)	43.4 (63)	0.826
No	35.8 (34)	42.1 (61)	
Indecisive	18.9 (18)	14.5 (21)	
Following special diet			
Yes	10.5 (10)	7.6 (11)	0.431
No	89.5 (85)	92.4 (134)	
Who recommended your diet?***			
Doctor	10 (1)	0 (0)	0.272
Dietitian	40 (4)	27.3 (3)	
Social media	0 (0)	9.1 (1)	
Internet	0 (0)	0 (0)	
Friends	10 (1)	18.2 (2)	
Family	20 (2)	0 (0)	
Others	20 (2)	45.4 (5)	

HFC, healthy food choice. *Percentages were calculated based on the number of participants who skipped meals. **Percentages were calculated based on the number of participants who followed a special diet.

ce determinants assessed by FCQ and perceived stress assessed by the PSS is presented in Table IV. Perceived stress score was only positively as-

sociated with price in the HFC group ($\beta=0.387$, $p=0.003$) and negatively associated with natural content in the control group ($\beta= -0.264$, $p=0.038$).

Table III. Factors affecting food choices of the participants according to the Food Choice Questionnaire (FCQ).

It is important to me that the food I eat on a typical day has the following characteristics:	HFC course takers (n=95)	Control (n=145)	p-value
Factor 1 - Health	3.16±0.57	2.96±0.68	0.013
Is high in fibre and roughage	2.43±0.87	2.30±0.84	0.255
Is nutritious	3.07±0.80	3.12±0.94	0.710
Contains a lot of vitamins and minerals	3.23±0.74	3.12±0.91	0.337
Is high in protein	3.12±0.76	3.04±0.90	0.505
Keeps me healthy	3.42±0.61	3.41±0.81	0.937
Is good for my skin/teeth/hair/nails etc.	3.17±0.91	3.13±0.97	0.765
Factor 2 - Mood	3.10±0.73	3.10±0.67	0.971
Cheers me up	3.52±0.77	3.47±0.76	0.644
Helps me cope with stress	2.93±1.05	2.81±1.05	0.390
Keeps me awake/alert	2.78±0.94	3.06±0.90	0.023
Helps me relax	3.09±0.95	3.10±0.90	0.943
Makes me feel good	3.37±0.74	3.41±0.81	0.663
Helps me to cope with life	2.85±1.02	2.85±1.04	0.974
Factor 3 - Convenience	2.99±0.64	3.00±0.64	0.947
Is easy to prepare	2.98±0.82	2.91±0.85	0.537
Is easily available in shops and supermarkets	2.95±0.90	2.87±0.94	0.523
Can be cooked very simply	2.98±0.87	2.97±0.89	0.909
Takes no time to prepare	2.96±0.93	3.05±0.92	0.461
Can be bought in shops close to where I live or work	3.17±0.78	3.18±0.72	0.912
Factor 4 - Sensory Appeal	3.44±0.52	3.37±0.59	0.361
Tastes good	3.80±0.52	3.67±0.66	0.087
Smells nice	3.61±0.66	3.44±0.72	0.040
Has a pleasant texture	3.15±0.90	3.03±0.89	0.340
Looks nice	3.42±0.82	3.19±0.90	0.041
Factor 5 - Natural Content	3.15±0.70	2.85±0.82	0.003
Contains no additives	2.99±0.88	2.77±1.06	0.077
Contains natural ingredients	3.14±0.69	2.98±0.91	0.124
Contains no artificial ingredients	3.05±0.89	2.96±0.99	0.458
Factor 6 - Price	3.24±0.64	3.35±0.63	0.172
Is not expensive	3.11±0.82	3.24±0.87	0.226
Is good value for money	3.62±0.66	3.60±0.72	0.819
Is cheap	3.04±0.84	3.19±0.82	0.187
Factor 7 - Weight control	2.84±0.74	2.56±0.79	0.005
Is low in calories	2.43±1.04	2.30±0.97	0.307
Is low in fat	2.88±0.94	2.74±0.98	0.275
Helps me control my weight	2.87±1.00	2.86±1.02	0.931
Factor 8 - Familiarity	2.80±0.69	2.80±0.65	0.969
Is familiar	3.26±0.76	3.12±0.83	0.192
Is like the food I ate when I was a child	2.18±0.99	2.36±0.98	0.167
Is what I usually eat	2.93±0.82	2.93±0.86	0.966
Factor 9 - Ethical Concern	2.60±0.80	2.51±0.80	0.389
Is packaged in an environmentally friendly way	2.94±0.98	3.03±0.93	0.469
Comes from countries I approve of politically	2.15±1.07	2.23±1.03	0.561
Has the country of origin clearly marked	2.53±1.08	2.41±0.99	0.409

HFC, healthy food choice.

In the HFC group, BMI was positively associated with weight control ($\beta=3.155$, $p=0.002$) and familiarity ($\beta=0.295$, $p=0.023$). On the other hand, BMI was positively associated with weight control ($\beta=0.480$, $p<0.001$) and negatively associated with natural content in the control group ($\beta=-0.239$, $p=0.046$) (Table V).

Discussion

Studies^{15,16} on European adults show that low education level is associated with the fact that health factor is less determinant in the food choices of individuals. When the factors affecting the food choices of the participants were examined,

Table IV. Analysis of the effects of students' perceived stress scores on food choices by regression analysis.

Food choice determinants	HFC course takers (n=95)					Control (n=145)				
	Unstandardized coefficients		Standardized coefficients			Unstandardized coefficients		Standardized coefficients		
	B	SE	β	t-value	p-value	B	SE	β	t-value	p-value
Constant/stress score	16.623	5.181		3.209	0.002	22.368	4.002		5.589	<0.001
Health	-0.394	1.504	-0.038	-0.262	0.794	-0.964	1.482	-0.099	-0.650	0.517
Mood	-0.459	1.207	-0.056	-0.381	0.704	0.042	1.181	0.004	0.036	0.971
Convenience	0.545	1.275	0.059	0.427	0.670	0.279	0.999	0.027	0.279	0.781
Sensory appeal	1.707	1.434	0.147	1.190	0.237	1.817	1.262	0.162	1.440	0.152
Natural content	-0.978	1.224	-0.114	-0.799	0.426	-2.146	1.022	-0.264	-2.100	0.038
Price	3.601	1.192	0.387	3.021	0.003	1.614	1.020	0.152	1.583	0.116
Weight control	0.245	0.994	0.030	0.247	0.806	0.112	0.906	0.013	0.124	0.902
Familiarity	-1.367	1.084	-0.158	-1.260	0.211	-0.397	1.024	-0.039	-0.388	0.699
Ethical concern	0.724	1.129	0.097	0.641	0.523	1.627	0.927	0.194	1.755	0.082

Dependent Variable: Food choice determinants; Predictors (Constant): Perceived stress score. HFC, healthy food choice; B, unstandardized beta coefficients; SE, standard error; β , standardized beta coefficients; t, t-test statistic.

Table V. Analysis of the effect of BMI on food choice by regression analysis.

Food choice determinants	HFC course takers (n=95)					Control (n=145)				
	Unstandardized coefficients		Standardized coefficients			Unstandardized coefficients		Standardized coefficients		
	B	SE	β	t-value	p-value	B	SE	β	t-value	p-value
Constant/BMI	20.223	3.068		6.591	<0.001	25.753	2.082		12.370	<0.001
Health	0.044	0.891	0.007	0.049	0.961	0.047	0.771	0.009	0.061	0.952
Mood	-0.071	0.715	-0.015	-0.099	0.921	-0.593	0.614	-0.108	-0.965	0.336
Convenience	-0.238	0.755	-0.044	-0.316	0.075	-0.719	0.520	-0.125	-1.383	0.169
Sensory appeal	-0.126	0.849	-0.019	-0.148	0.883	-0.489	0.656	-0.079	-0.744	0.458
Natural content	-0.838	0.725	-0.167	-1.156	0.251	-1.068	0.531	-0.239	-2.010	0.046
Price	-0.187	0.706	-0.034	-0.265	0.791	0.689	0.531	0.118	1.299	0.196
Weight control	1.858	0.589	0.393	3.155	0.002	2.223	0.471	0.480	4.715	<0.001
Familiarity	1.490	0.642	0.295	2.320	0.023	-0.472	0.533	-0.084	-0.887	0.377
Ethical concern	-1.160	0.669	-0.265	-1.736	0.086	-0.726	0.482	-0.158	-1.506	0.134

Dependent Variable: Food choice determinants; Predictors (Constant): BMI. HFC, healthy food choice; BMI, body mass index; B, unstandardized beta coefficients; SE, standard error; β , standardized beta coefficients; t, t-test statistic.

health, natural content, and weight control were more determinant in the HFC group compared to the control group. Other determinants such as mood, convenience, sensory appeal, price, familiarity, and ethical concern were of similar importance for both groups. According to the results, the HFC course may be interpreted as a positive approach in terms of increasing nutritional literacy, gaining nutritional knowledge, and healthy food choice behaviors among university students. In a study¹⁷ conducted with university students in the United States of America (USA), the dietary habits of the students who took health-related fitness courses were evaluated before and after the semester. According to post-semester data, it was reported¹⁷ that the consumption of fruits and vegetables and breakfast frequency increased, and the consumption of sugar-added beverages decreased. Interventions targeting young adults are needed to teach healthy lifestyle behaviors, develop skills, and promote nutrition education to prevent obesity and malnutrition caused by poor nutrition, as well as to prevent chronic diseases and maintain health¹⁸⁻²⁰.

Malnutrition refers to poor nutrition and includes both undernutrition and overnutrition²¹. This study revealed that all forms of malnutrition (underweight, overweight, and obesity) coexisted among both groups (Table I). Previous studies²²⁻²⁴ conducted with university students in developing countries have shown similar results to the present study. Universities have an important role in preventing the double burden of malnutrition for university students, such as increasing health and nutrition literacy, education on healthy food choices, and increasing accessibility to healthy food^{18,25}.

The present study reported that the majority of students in both groups skipped breakfast and lunch meals similarly (Table II). Since the breakfast meal was not available in the university cafeteria, the students preferred to consume their breakfast meals at home or in the dormitory cafeteria. Providing students with cheap and healthy breakfast options in the university dining hall to students may be an action that will increase the breakfast consumption habits of the students, since breakfast is the most important meal of the day and has been reported by studies²⁶⁻²⁹ to have a significant impact on academic success. Considering that the majority of the students in both groups prefer consuming their lunch in the university, increasing the accessibility of healthy options for this meal in university cafeterias will be an important practice for students.

This study showed a positive relationship between perceived stress and price in the HFC group (Table IV). The price factor contains items such as “it is not expensive”, “it is good value for money”, and “it is cheap”. Some studies³⁰⁻³³ suggest that people living in low-income households and with higher stress levels are more likely to exhibit unhealthy eating behaviors and have a higher body weight. Therefore, individuals who experience higher perceived stress may be more likely to purchase affordable and cheaper but less nutritious food options due to financial constraints. A qualitative study³⁴ among consumers living in poverty in the USA revealed that the main factor of food choice was cost, and nutrition was much less important, even if there were health issues.

In the control group, perceived stress was negatively associated with natural content (Table IV). As the stress level increases in the control group, the natural content being less determinant in food choices supports our previous data. In our previous study⁹ with undergraduate university students, we observed that fructose and processed food consumption increased significantly with the increase in the perceived stress levels of the students during the exam period. Similarly, other studies^{5-7,35-37} have shown that increased perceived stress level is associated with increased consumption of fast foods and snack foods with high fat and sugar content and decreased consumption of healthy food groups such as vegetables and fruits with high nutritional value. In particular, academic stress negatively affects students' food choices and diet quality index, increasing their consumption of fast food and snacks with high energy and fat levels and low nutritional value³⁸. In a study³⁷ conducted among university freshmen in the USA, a positive correlation was found between perceived stress levels and consumption of salty packaged snacks, frozen foods, and fast food. The authors explained this result with the tendency to obtain energy sources quickly and easily under stress³⁷. Processed foods are easier and faster to prepare than unprocessed foods. In particular, ultra-processed foods are designed to be consumed without the need for preparation and cooking. These foods are usually offered to the market in the form of snacks, beverages, or ready-to-eat meals. Food environments characterized by low availability of high nutritional quality products and aggressive marketing of low nutritional quality food/beverages may be another factor contributing to the unhealthy food choice among university students³⁹.

According to the present study, weight control and familiarity were positively associated with BMI in the HFC group (Table V). The fact that weight control is more determinant in the food choices of the students with high BMI in the HFC group is a positive result in terms of knowing the energy and fat contents of foods, their roles in weight control, and increasing their importance. Similarly, BMI and the factor-weight control were positively correlated in the control group. However, in the control group, the negative correlation between BMI and natural content indicated that as BMI increases, natural content is less determinant in food choices, and they prefer more processed foods in terms of food choices, and therefore they cannot make healthy choices (Table V). One of the psychological factors that may explain the relationship between BMI and food choices is executive function. Executive functions are a set of processes involving high-level cognitive abilities such as working memory, inhibitory control, cognitive flexibility, planning, reasoning, and problem-solving⁴⁰. In terms of obesity, working memory and inhibitory control play an important role in keeping information about healthy food choices in mind and controlling desires and impulses against unhealthy food consumption⁴¹. The HFC course given to the students is an intervention that contributes to executive function. There is evidence⁴²⁻⁴⁴ that low executive function is associated with less healthy eating behaviors and higher BMI. In this context, it may partially explain the fact that the natural content was less determinative as the BMI increased in students who did not take the HFC course.

Strengths and Limitations

This is the first study in Turkey to investigate how stress and nutrition education affect the food choices of university students. This study presented a piece of original primary research with clearly defined research question that fills the gap in current understanding of university student dietary behaviors in Turkey. It consisted of two student groups who took the HFC course and who did not take the course and whose socio-demographic characteristics, departments, BMI, and stress levels were similar. Dietary habits, determinants of food choice, and association with food choices and BMI and stress levels of both groups were evaluated. The strength of this study was that a one-semester HFC course was open to all departments within the university. Also, the control group was homogeneously selected

from all departments within the university. The limitation of this study was that the food choices of the HFC group were not evaluated before taking the course. Therefore, we cannot exclude the possibility that reported differences between the course-takers and the control group did not exist prior to the course. Also, if more students could be reached, stronger evidence could be provided.

Conclusions

Universities are not only the places where young people are educated, but they also represent their life spaces. It is an important task of universities to prepare the curriculum in this direction to provide information that will orientate to healthy eating behaviors and to provide suitable physical environments to ensure the accessibility of healthy food. It is important to note that food choice is a complex behavior, and knowledge is just one of many factors that can influence it. Other factors, such as stress, access to healthy foods, food marketing, cultural and social norms, and individual preferences and beliefs, also play a role in shaping food choices. University education can be a unique opportunity for targeted educational interventions against perceived barriers and drivers of healthy choices. A holistic approach, including nutrition education, stress management, and accessibility to healthy food, is necessary to fight against unhealthy food choices of university students.

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Conflict of Interest

None.

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None.

Ethics Approval

The study was approved by the Non-Interventional Clinical Research Ethics Board at Cukurova University (121/40 - 08/04/2022).

Informed Consent

All participants signed informed consent for inclusion.

Availability of Data and Materials

The data of the study are available from the first and corresponding author.

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