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Relationship Between Food Neophobia and Dietary Habits in Turkish Adults: A Cross-Sectional Study

Yetişkinlerin Yeni Besin Korkusu ile Beslenme Alışkanlıkları Arasındaki İlişki: Kesitsel Bir Çalışma

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ABSTRACT

Introduction: Food neophobia (FN) is an issue that can affect the food choices and nutritional status of individuals.
Objective: This study aimed to determine FN levels of adults and to evaluate the nutritional habits and food consumption frequencies according to these levels.
Materials and Methods: The study is cross-sectional and was conducted with 1681 volunteers aged between 20 and 64 years old. The data were obtained by face-to-face interview method using the general characteristics, a food consumption frequency form including 45 types of foods, questions related to eating habits (frequencies of the daily main meal, snack, skipping meal), and the Turkish Form Food Neophobia Scale (T-FNS). Individuals were divided into three groups neophilic, neutral, and neophobic according to their T-FNS scores.
Results: Of the participants, 22.8% (n=384) were neophilic, 53.0% (n=890) were neutral, and 24.2% (n=407) were neophobic. The mean T-FNS scores were found to be statistically significantly different in groups gender (t=3.369, p=0.001), age (t=-3.408, p=0.001), educational status (F=8.699, p<0.001), marital status (t=-5.207, p<0.001), employment status (F=5.991, p<0.001), and presence of disease (t=3.467, p=0.001). Mean consumption of meat, egg, and legumes group in neophilics (176.14±96.58 g/day) compared to neutrals (160.30±96.48 g/day), fresh fruit consumption in neophobics (137.38±124.94 g/day) /day) compared to neutrals (107.51±101.57 g/day) were higher (F=4.018 p=0.018, and F=10.668 p=<0.001, respectively). Consumption of cream cheese, margarine, chocolate, fruit juice, and alcoholic beverages also differed between groups (p<0.05).
Conclusion: It was concluded that FN may affect nutritional status. However, there is a necessity for large-scale studies investigating the relationship between FN and nutritional status.

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ÖZET

Giriş: Yeni besin korkusu (YBK), bireylerin besin seçimlerini ve beslenme durumlarını etkileyebilen bir durumdur.
Amaç: Bu çalışmada, yetişkin bireylerin yeni besin korkusu düzeylerinin belirlenmesi ve bu düzeylere göre beslenme alışkanlıkları ve besin tüketim sıklıklarının değerlendirilmesi amaçlanmıştır.
Gereç ve Yöntem: Çalışma kesitsel nitelikte olup 20 ile 64 yaş aralığındaki 1681 gönüllü birey ile yürütülmüştür. Veriler, katılımcıların genel özellikleri, beslenme alışkanlıkları, 45 besin çeşidini içeren besin tüketim sıklığı formu, beslenme alışkanlıkları ile ilgili sorular (günlük ana öğün yapma, ara öğün yapma ve öğün atlama sıklıkları) ve Yeni Besin Korkusu Ölçeği'nin Türkçe Formu'nu içeren anket formu kullanılarak yüz yüze görüşme yöntemi ile elde edilmiştir. Bireyler, YBK puanlarına göre neofilik, nötr ve neofobik olmak üzere üç gruba ayrılmıştır.
Bulgular: Katılımcıların %22,8'i (n=384) neofilik, %53.0'ü (n=890) nötr ve %24,2'si (n=407) neofobik olarak belirlenmiştir. Cinsiyet (t=3,369; p=0,001), yaş (t=-3,408; p=0,001), eğitim durumu (F=8,699
p<0,001), medeni durum (t=5,207; p<0,001), meslek (F=5,991; p<0,001) ve hastalığa sahip olma (t=3,467; p=0,001) durumuna göre belirlenen gruplar arasında ortalama YBK ölçeği puanları istatistiksel açıdan anlamlı olarak farklı bulunmuştur. Ortalama et, yumurta, kurubaklagil grubu besin tüketim miktarı neofiliklerde (176,14±96,58 g/gün) nötrlere (160,30±96,48 g/gün), taze meyve tüketimi neofobiklerde (137,38±124,94 g/gün) nötrlere (107,51±101,57 g/gün) kıyasla daha yüksektir (sırası ile F=4,018 p=0,018, F=10,668 p=<0,001). Krem peynir, margarin, çikolata, meyve suyu ve alkollü içecek tüketimleri de gruplar arasında farklılık göstermiştir (p<0,05).
Sonuç: Yeni besin korkusunun beslenme durumunu etkileyebileceği sonucuna varılmıştır. Ancak yeni besin korkusu ile beslenme durumu arasındaki ilişkiyi araştıran geniş çaplı çalışmalara ihtiyaç vardır.

1. Introduction

Providing nutrition and food variety for the protection of health is important (1). Achieving food variety is possible by eliminating concerns about new and unknown foods (2). Food neophobia (FN) is defined as a personal reluctance related to accepting and liking new/unknown foods or a tendency to be disgusted and anxious when exposed to these foods (3,4). The reluctance of some consumers to accept the addition of new ingredients or the implementation of new food production processes limits the food variety. In this context, it is necessary to evaluate the tendencies of both consumers as individuals and different societies to accept new foods (3).

Food neophobia is a very complex attitude that changes throughout life. Various factors such as age, cultural and economic status, gender, and genetic can affect FN (5,6). It is reported that FN is a barrier to healthy food selection and diet quality in the results of most studies (2,7,8). However, various, adequate and balanced consumption of food groups is required for a healthy life (9).

Most studies of FN in the literature have been conducted with children. These studies are substantial because permanent eating habits are formed in the first years of life (10,11). At the same time, there is a possibility that children's reluctance to try various foods will continue into the later years of life (12). Besides, there are various factors affecting FN in adulthood. As a matter of fact, it was stated that food rejection and disgust were more common in women than men, and participants generally avoided high-protein foods (13). In other studies, FN has been associated with less consumption of fruit, vegetables, protein foods, and fish (10,14). According to the data obtained from these studies, it is seen that FN affects the nutritional status of individuals, but the results in the literature are not clear. This study aimed to determine the FN status of adults and investigate the relationship between FN and nutritional status.

2. Materials and Methods

2.1. Sampling and design of the study

The study was conducted between November 2019 and March 2020 at Kırıkkale University, the Hospital of Medicine School, with 1681 adults who could communicate clearly, aged between 20 and 64 years old, and who voluntarily agreed to participate in the study. The sample size was detected according to the data collection period and the participants who met the inclusion criteria were contacted during this time.

Characteristics of the participants (gender, age, the status of education, employment, marital status, disease, and using supplements), a scale of the level of food neophobia, and questions about dietary habits (frequencies of the daily main meal, snack, skipping meal by presenting options), and food frequency questionnaire were collected by the researchers with a survey form using the face-to-face interview method after all the participants were informed about the study and their written consent was obtained.

2.2. Ethical approval

The study was performed in accordance with the Helsinki Declaration. The study protocol was approved by the Non-Interventional Research Ethics Committee of Kırıkkale University (protocol number: 2019.10.02 dated 23.10.2019).

2.3. The food frequency questionnaire

The food frequency questionnaire used in this study consisted of six main food groups [dairy products (i), meat, egg, legumes (ii), cereals and bread (iii), fruit and vegetables (iv), fats and oily products (v), and other foods (vi)]. Amounts consumed at one time (as g/mL), and consumption frequencies of 45 types of food that were under these groups were asked by considering the last month's consumption. Options of consumption frequencies were every meal, every day, 1-2 time(s) a week, 3-4 times a week, 5-6 times a week, once fifteen days, once a month, and no consumption, respectively. Daily consumption amounts were calculated by multiplying coefficients and total declared amounts.

2.4. Detecting of food neophobia level of participants

The original food neophobia scale (FNS) for determining food neophobia was developed by Pliner and Hobden (15). The 7-point Likert-type scale consisting of ten items was arranged to increase by 1 point for each option from strongly disagree (1 point) to strongly agree (7 points). It is in the range of 10-70 points (questions 1, 4, 6, 9 and 10 are reverse scored). As the score obtained from the scale increases, the level of food neophobia increases. The adaptation of the FNS scale to Turkish for use in our country was studied by Uçar in 2018 for his master's thesis and published in 2021 (16). The scale adapted to Turkish by Uçar was used with the permission of the researcher. In this study, by detecting quartiles of FNS that were obtained by participants, scores of FNS were divided into three groups as neophilic (10-33 low), neutral (34-47 moderate), and neophobic (48-70 high).

2.5. Data analysis

The analysis of the data obtained from this study was done in SPSS (IBM SPSS Statistics 23.0. Armonk, NY, USA Corp; 2013). It was hypothesized that FNS scores differ according to dietary habits, and consumption of foods. Number and frequency (%) were used to determine the descriptive characteristics of the participants. The mean, standard deviation (SD) and minimum-maximum values were calculated for quantitative data. To compare the means

between the two groups, the Independent T-test, for more than the two groups, the One-Way ANOVA test (with the Bonferroni multiple comparison test) was performed. A value of p <0.05 was used as the reliability coefficient.

3. Results

In this study, 1681 adults aged between 20 and 64 years old attended as 831 (49.4%) male and 850 (50.6%) female. The majority of them had university undergraduate educational level (52.0%), were officers (22.8%), married (56.7%), had no disease (65.5%), and did not use any supplementation (86.4%).

In examining of mean FNS score of participants according to some characteristics, there were significant differences between gender, age groups, education status, employment status, marital status, and presence of disease. The mean FNS score of females (41.80±10.05) was higher than males (40.13±10.25) (t=3.369, p=0.001). The mean FNS score of participants aged 51-64 (43.14±11.09) was higher than those aged between 20 and 50 years old (40.64±10.00) (t=-3.408, p=0.001). Mean FNS score of married individuals (42.09±10.27) was higher than single (39.51±9.88) (t=5.207, p<0.001). There was a significant difference between participants who had no disease and those who had any disease (t=3.467, p=0.001). Among individuals having any disease, there was a difference for only type 2 diabetes between having and not, those who had type 2 diabetes (43.54±10.30) statistically differed from those who had no type 2 diabetes (40.74±10.14) (t=-3.152, p=0.002).

The mean FNS score of participants who had primary school or less educational status (44.88±9.52) was higher than other educational levels (F=8.699, p<0.001). The mean FNS score of housewives (43.47±9.42) was higher than officers and students (40.08±9.99 and 39.24±9.83, respectively) (F=5.991, p<0.001). The mean FNS score of participants who had primary school or less educational status (44.88±9.52) was higher than other educational levels (F=8.699, p<0.001). The mean FNS score of housewives (43.47±9.42) was higher than officers and students (40.08±9.99 and 39.24±9.83, respectively) (F=5.991, p<0.001) (Table 1).

Table 1. Mean Food Neophobia Scale scores according to characteristics of participants (n=1681)

Characteristics	Number	Frequency (%)	Mean SD	Min-Max	t/F	p
Gender						
Male	831	49.4	40.13±10.25^{a}	10-70	3.369	0.001
Female	850	50.6	41.80±10.05^{b}	13-70		
Age (year)						
20-50	1459	86,8	40.64±10.00^{a}	10-70	-3.408	0.001
51-64	222	13,2	43.14±11.09^{b}	12-70		
Education status*						
Primary school or less	187	11.1	44.88±9.52^{a}	18-70	8.699	<0.001
Secondary school	167	9.9	40.82±10.26^{b}	11-67		
High school	400	23.8	40.93±9.91^{b}	16-66		
University Undergraduate	874	52.0	40.22±10.21^{b}	10-70		
University Postgraduate	53	3,2	40.13±10.66^{b}	12-59		
Employment status						
Officer	384	22.8	40.08±9.99^{a}	12-69	5.991	<0.001
Worker	219	13.0	41.53±11.09^{ac}	12-70		
Student	346	20.6	39.24±9.83^{a}	10-64		
Self-employment	215	12.8	40.83±9.74^{ac}	11-69		
Housewife	318	18.9	43.47±9.42^{bc}	13-66		
Unemployed	106	6.3	40.25±10.54^{ac}	13-64		
Retired	93	5.6	42.46±11.39^{ac}	16-70		
Marital status						
Married	953	56.7	42.09±10.27^{a}	11-70	5.207	<0.001
Single	728	43.3	39.51±9.88^{b}	10-66		
Presence of disease**						
No	1101	65.5	40.35±9.74	10-69	3.467	0.001
Yes	580	34.5	42.16±10.87	11-70		
Type 2 diabetes	142	8.4	43.54±10.30	18-70	-3.152	0.002
Hypertension	173	10.3	42.40±9.98	11-70	-1.947	0.052
Other cardiovascular disease	110	6.5	42.11±11.44	17-70	-1.211	0.226
Gastrointestinal disease	106	6.3	41.65±12.51	13-70	-0.708	0.561
Thyroid diseases	88	5.2	41.75±10.26	24-65	-0.735	0.462
Musculoskeletal diseases	50	3.0	42.78±8.71	26-59	-1.274	0.203
Psychiatric diseases	38	2.3	42.39±9.37	26-63	-0.871	0.384
Other***	99	5.9	40.70±10.02	18-65	0.223	0.824

Table 1 (continued)

Characteristics	Number	Frequency (%)	Mean SD	Min-Max	t/F	p
Using of supplement						
No	1452	86.4	40.84±10.03	10-70	1.391	0.196
Yes	228	13.6	41.84±11.06	16-69		
Vitamin	182	10.8	42.08±11.18	16-69	0.082	0.921
Mineral	42	2.5	41.33±11.41	20-67		
Fish oil	4	0.2	41.25±10.72	33-57		

* Highest level of completed education. ** More than one answer could be. Compared with those who do not have specific disease separately. ***Other: urinary system diseases, other endocrine diseases, pulmonary diseases, brain diseases. [abc] Statistically significant difference between scores. t values were given for independent t test. F values were given for One-Way ANOVA test.

According to FNS score 22.8%, 53.0%, and 24.2% of participants had neophilic, neutral, and neophobic, respectively. The mean FNS score of them was 40.97±10.18 and the mean score of individuals who had different FNS levels changed between 27.63 and 54.33 (Table 2).

Table 2. Food Neophobia Scale (FNS) scores of participants (n=1681)

Quartiles	FNS Score	Number	Frequency (%)	Mean SD
Neophilic (Low)	10-33	384	22.8	27.63±4.91
Neutral (Moderate)	34-47	890	53.0	40.62±3.76
Neophobic (High)	48-70	407	24.2	54.33±5.25
Total	10-70	1681	100.0	40.97±10.18

In this study, 57.8%, 41.2%, and 1.0% of participants had three or above, two, and one main meal per day, and had 40.73±10.36, 41.28±9.88, and 43.56±11.72 mean FNS scores, respectively (F=1.115, p=0.328). There were no significant differences in the mean FNS scores of participants according to both habit of snacks (F=0.872, p=0.418), and the number of snacks daily (F=1.897, p=0.128). Similarly, the mean FNS score of those who generally or sometimes skipped meals (80.0%) did not statistically differ from the mean FNS score of those who did not skip meals (20.0%) (t=-1.797, p=0.073) (Table 3).

Table 3. Mean Food Neophobia Scale (FNS) scores of participants according to dietary habits

			FNS Scores			
	Number	Frequency (%)	Mean SD	Min-Max	t/F	P
Number of main meals*						
1	16	1.0	43.56±11.72	20-62	1.115	0.328
2	692	41.2	41.28±9.88	16-70		
≥3	972	57.8	40.73±10.36	10-70		
Habit of snack**						
Yes	719	42.8	40.85±10.60	11-70	0.872	0.418
Sometimes	593	35.4	40.74±9.78	10-69		
No	365	21.8	41.59±10.02	10-69		
Number of snacks						
No	323	19.1	41.72±10.42	10-69	1.897	0.128
1	643	38.3	41.31±10.39	10-70		
2	544	32.4	40.49±9.73	16-70		
≥3	171	10.2	39,86±10.26	11-67		
Skipping meals						
Yes/sometimes	1344	80.0	40.75±10.25	10-70	-1.797	0.073
No	337	20.0	41.86±9.87	11-70		

*1 missing answer. **4 missing answers. t values were given for independent t test. F values were given for One-Way ANOVA test.

It was observed that the food frequency questionnaire of individuals in FNS levels deviated from other(s) in some food or food groups. The consumption of daily "total meat, egg, legumes" in neophilics (176.14±96.58) was more than participants who were neutral (160.30±96.48 g) (F=4.018, p=0.018). The daily amount of meat (30.86±34.25), poultry (38.75±40.16), dried fruit/vegetables (7.42±25.20), other food types (158.08±199.83), and alcoholic beverage (14.58±56.61) that was eaten by participants who were neophilic was higher than neophobics (25.12±36.92, 30.06±36.96, 3.93±10.13, 116.10±163.63, and 4.10±24.22, respectively) (F=3.032, p=0.048; F=5.506, p=0.004; F=4.666, p=0.010; F=5.203, p=0.006; and F=5.776, p=0.003, respectively).

There were significant differences between neutrals and neophobics in terms of the consumption of fresh fruits (107.51±101.57 vs 137.38±124.94, F=10.668, p=<0.001) and margarine (1.08±3.62 vs 1.88±8.43, F=3.104, p=0.045). The consumption of cream cheese (1.26±3.74) and juice (18.55±44.28) in neophobics was lower than other neophobia levels (F=7.654, p=<0.001; and F=3.726, p=0.024, respectively). The consumption of chocolate (18.51±25.57) in neophilics was higher than other neophobia levels (F=4.310, p=0.014). In terms of the consumed mean other food and food groups, there was no statistically significant difference among neophobia levels (Table 4).

Table 4. Differences by Food Neophobia Scale groups for Food Frequency Questionnaire (Mean±SD)

	Food consumption (g or ml/day)			
Foods/Food groups	**Neophilic (n=384)**	**Neutral (n=890)**	**Neophobic (n=407)**	**F/p**
Total dairy product	250.29±174.02	229.47±168.86	233.38±175.62	2.001/0.136
Milk	61.23±77.59	58.84±77.14	55.58±80.65	0.527/0.591
Yoghurt, ayran, kefir	149.06±138.58	135.55±134.34	141.11±131.07	1.372/0.254
Cheese*	40.00±39.42	35.08±30.13	36.70±32.95	2.950/0.053
Total meat, egg, legumes	176.14±96.58^{a}	160.30±96.48^{b}	159.59±100.97^{ab}	4.018/0.018
Meat	30.86±34.25^{a}	27.35±30.66^{ab}	25.12±36.92^{b}	3.032/0.048
Poultry	38.75±40.16^{a}	33.86±35.37^{ab}	30.06±36.96^{b}	5.506/0.004
Fish	9.68±16.97	11.47±30.23	9.93±19.80	0.903/0.406
Offal	2.56±9.57	2.10±8.88	2.19±11.97	0.293/0.746
Processed meat	6.78±12.61	5.54±12.53	6.83±13.93	1.751/0.174
Egg	36.19±30.04	33.51±27.86	33.28±26.04	1.443/0.237
Legumes	37.93±39.31	34.48±37.66	37.90±38.57	1.688/0.185
Oil seeds	13.39±25.31	12.00±21.10	14.00±20.19	1.344/0.261
Total cereals and bread	297.51±174.75	286.18±174.26	291.38±192.21	0.553/0.575
White bread varieties	143.28±137.08	145.40±145.27	141.65±154.05	0.099/0.906
Whole grain	26.77±59.95	20.31±49.91	25.00±57.65	2.294/0.101
Rice, bulgur, pasta, noodles, couscous, semolina	70.68±60.80	68.13±60.31	75.64±67.90	2.027/0.132
Biscuits, crackers	23.11±40.24	19.32±30.80	18.14±27.33	2.615/0.073
Breakfast cereals	5.58±23.85	4.36±18.24	3.06±15.18	1.739/0.176
Turkish bagel	18.49±33.60	17.42±26.72	16.08±28.57	0.699/0.497
Cookies, cake, croissant	9.60±15.96	11.25±22.97	11.81±31.05	0.945/0.389
Total fruit and vegetables	256.56±194.24	245.36±180.21	272.68±199.05	2.97.2/0.051
Dark green leafy vegetables	40.59±51.21	47.62±65.51	48.00±73.02	1.823/0.162
Yellow vegetables	62.25±94.94	56.80±64.33	56.99±58.68	0.848/0.429
Fresh legumes	11.48±21.91	13.38±29.68	12.40±28.72	0.657/0.519
Fresh 100% juices	13.56±35.17	14.48±47.49	13.98±37.24	0.068/0.935
Fresh fruits	121.36±109.01^{ab}	107.51±101.57^{a}	137.38±124.94^{b}	10.668/<0.001
Dried fruit/vegetables	7.42±25.20^{a}	5.57±12.93^{ab}	3.93±10.13^{b}	4.666/0.010
Total fats and oily products	50.59±41.53	50.59±46.09	53.43±56.14	0.544/0.580
Olive oil	11.00±17.38	11.29±21.49	12.05±23.65	0.274/0.760
Hazelnut oil	0.36±2.61	0.50±4.58	0.72±6.22	0.602/0.548
Other oils**	28.30±31.98	27.49±36.40	30.59±42.74	0.977/0.377
Margarine	1.18±4.76^{ab}	1.08±3.62^{a}	1.88±8.43^{b}	3.104/0.045
Soft margarine	0.93±3.58	1.23±5.54	1.55±7.06	1.231/0.292
Mayonnaise	1.26±3.65	1.29±4.03	1.15±5.82	0.136/0.873
Butter	4.27±6.89	4.60±8.25	3.95±7.57	1.015/0.363
Tail fat	0.27±1.03	0.44±2.65	0.29±1.24	1.284/0.277
Cream cheese	3.03±8.21^{a}	2.68±7.57^{a}	1.26±3.74^{b}	7.654/<0.001
Total other foods	158.08±199.83^{a}	139.67±185.69^{ab}	116.10±163.63^{b}	5.203/0.006
Chocolate	18.51±25.57^{a}	14.49±24.31^{b}	14.01±24.37^{bc}	4.310/0.014
Fruit juices	27.39±55.31^{a}	25.93±51.96^{a}	18.55±44.28^{b}	3.726/0.024
Carbonated drinks	52.91±144.68	51.58±124.44	40.49±97.32	1.349/0.260
Alcoholic beverages	14.58±56.61^{a}	8.35±44.08^{ab}	4.10±24.22^{b}	5.776/0.003
Sugar, candy and sweets	10.86±22.60	8.93±17.30	8.77±16.36	1.720/0.179
Honey, jam, molasses	5.88±9.76	5.06±8.74	5.68±9.73	1.325/0.266
Pastries	9.29±18.69	8.07±18.21	8.52±23.56	0.516/0.597
Milk desserts, ice creams	18.67±31.59	17.26±32.99	15.80±32.19	0.771/0.463

*Except for cream cheese **Other oils; sunflower oil, corn oil, soy oil, canola oil. One-Way ANOVA test was used. ^{abc} Statistically significant difference between groups

4. Discussion

Although food neophobia, which affects food variety and diet quality, is generally considered a problem of childhood, it continues throughout life. Therefore, food neophobia may be a barrier to developing adequate and balanced dietary habits (17) and preventing nutrition-related health problems (2). This study determined that food neophobia is affected by sociodemographic characteristics, and food choices differ according to the level of food neophobia.

Food neophobia is affected in different ways by demographic factors such as gender, age, education level, and income level. Food neophobia was found to be higher in men in some studies (18, 19); and on the other hand, it was reported that there was no difference according to gender (20,21). When the effect of age is investigated, it has been reported that in the life cycle food neophobia changes according to age periods (22), increases with age (21), and especially increases after age of 50 (22,23). The effect of education level on food neophobia also differs. In addition, studies report that food neophobia is higher in individuals with low education levels (22,24), it has also been reported that it is higher in individuals with higher education levels (19). As can be seen, the effect of demographic factors can be different. Thus, Meiselman et al. stated that food neophobia is affected by exposure to foods, and individuals with high education and income levels, urban residents,

women, and the elderly may be more exposed to new foods (21). In this study, food neophobia was higher in women, in the age group between 51 and 64 years old, and those with a lower education level. Studies on marital status and food neophobia are limited, and in one study, food neophobia was found to be higher in married people than in singles (18). This result suggests that married individuals approach new foods more cautiously in terms of safety and health since they carry the responsibility of nutrition for themselves and their family members. However, more comprehensive and detailed studies are needed to investigate this issue.

The lack of diversity in foods consumed by individuals with high food neophobia can lead to nutritional and health problems. Therefore, it is important to determine the effects of food neophobia on nutrition and health (20). In a systematic review by Rabadan and Bernabeu, it was reported that food neophobia and diet quality were associated but had no significant effect on obesity and macronutrient intake (3). In another study, food neophobia was associated with low diet quality and increased BMI (8). Food neophobia was found to be higher in celiac patients and individuals with chronic diseases over 60 years of age compared to healthy individuals, and it was reported that this might be due to their thought that eating new foods would negatively affect their health status (25). In this study, the food neophobia score was found to be higher in those with chronic diseases. Among the diseases, those with type 2 diabetes score higher than those without diabetes. This result can be interpreted as a disease state and being diabetic affect food neophobia.

Although food neophobia is reported to be common in children (26) and adults (27), its level varies. It has been reported that 30.9% of adults in New Zealand (2) and 12.2% in Poland have high food neophobia (28). In this study, 24.2% of individuals were found to be highly neophobic. These differences in neophobia levels may be due to the culture, traditions, familial reasons, lack of access of individuals to new foods, etc. thought to be caused by factors.

Although meal frequency and timing are discussed today, it is recommended to consume three main meals and not to skip meals in order to ensure adequate and balanced nutrition in the national dietary guidelines (29). The differences between the number of main/snack meals, skipping meals, and food neophobia scores were not statistically significant. However, it is thought that for a healthy diet, meal frequency and skipping meal habits of all individuals with low, moderate, and high neophobia should be improved.

In addition to the meal frequency and timing, providing food variety is one of the basic principles in adequate and balanced nutrition (29,30). However, it is known that neophobic individuals do not prefer protein-rich foods of animal origin, especially meat and fish, and fruits and vegetables (2,7,31,32). In this study, it was observed that total fruit and vegetable consumption was lower than the recommended amount as at least 5 portions (400 g/day) for a healthy diet (29,30), but the difference between the amounts consumed according to the neophobia levels of the individuals was not found statistically significant. In addition, it was found that dry fruit/vegetable consumption was higher in neophilics than in neophobics; fresh fruit consumption was higher in high neophobics than in moderate neophobics. These results suggest that low fruit/vegetable consumption may be caused by factors such as individuals' access to food, the price of food, and parental dietary habits, as well as food neophobia against fruit/vegetables.

In a study, it was reported that neophobia to animal foods (meat) is more common than plant foods (31). In another study, it was stated that elderly individuals with high food neophobia consumed meat products more frequently and sweets less. This situation has been explained as food neophobia, which is especially against vegetable-fruit consumption in childhood, may change due to health conditions, especially in advanced ages (28). In this study, regardless of gender and age, it was determined that the daily consumption of "total meat, egg, legumes" group lower in neophobics than neutrals and neophilics. In particular, meat and poultry consumption in this group was found to be higher in neophilic individuals than in neophobics. There was no significant difference between food neophobia levels in terms of fish, offal, and processed meat consumption.

It has been reported that frequent consumption of foods with high energy value and low nutritional value should be avoided and simple sugar consumption should be limited in order to prevent chronic diseases such as diabetes and cardiovascular diseases, especially obesity (29,30). In a study, it was stated that neophobic individuals consume less vegetables, and probably prefer more high-energy, sugary, salty, and fatty foods and this predisposes them to weight gain (8). On the other hand, Prosperio et al. stated that food neophobia is not associated with nutritional status, and obese individuals prefer foods with high energy value because their taste sensitivity is different from those of normal weight (33). It has been reported that there are studies that find the consumption of high-energy, salty, sugary foods to be associated with food neophobia or not (17,22). In this study, it was determined that the consumption of "other foods" group with high energy value, low nutritional value and mostly containing simple sugar was higher in neutrals and neophilics than in high neophobics.

5. Conclusion

It is important for individuals and health professionals to be informed about this issue so that food neophobia does not adversely affect the nutritional status and therefore the health status.

For a healthy diet, it is important to eat regular meals, not to skip meals, and to make the right choice of food. Although no significant results were obtained between food neophobia and meal order in this study, it was thought that the meal consumption behaviors of individuals should be improved. It was concluded that food neophobia affects the choice of some foods and thus the nutritional status. In addition, it was determined that food neophobia was higher in individuals with chronic diseases, as expected. However, large-scale studies investigating the relationship between food neophobia and health status are needed. It is important to reveal new food fears first in order to improve the nutritional habits of individuals and expand their food choices. Dietitians should cooperate with other health professionals in order for neophobic individuals to develop nutritional habits suitable for their health conditions.

Limitations of the study

The food consumption of the individuals participating in the study was evaluated based on the frequency of food consumption and the answers given to the amounts. It is thought that using a 24-hour food record will present more reliable results in determining the amount of food consumption.

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Ethics Committee Approval: The study was performed in accordance with the Helsinki Declaration. The study protocol was approved by the Non-Interventional Research Ethics Committee of Kırıkkale University (protocol number: 2019.10.02 dated 23.10.2019).

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Authorship Contribution:

BÇ: The idea/scope, data collection, literature review, manuscript writing.

SED: The idea/scope, data collection, literature review, manuscript writing.

FNK: The idea/scope, literature review, control/supervision, critical review.

ÇÖ: The idea/scope, data collection, literature review, manuscript writing.

ABG: Data collection and processing, analysis and interpretation, literature review, manuscript writing.

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