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# Food neophobia in the elderly: evaluation of constipation, malnutrition, and nutrition

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## ABSTRACT

**Aims:** This study aimed to evaluate food neophobia, constipation, malnutrition, and nutritional status in elderly individuals.

**Methods:** The study was conducted on individuals aged ≥65 years selected by random sampling method and 406 individuals were reached. A questionnaire was used to collect demographic parameters (age, gender) of the participants. Anthropometric measurements were taken by researchers and then body-mass index (BMI) and waist-to-height ratio (WHR) were determined by standard methods, and a validated Food Neophobia Scale (FNS) was used to determine the food neophobia levels of individuals. One-day food consumption of individuals was determined by the 24-hour retrospective reminder method. Constipation was defined according to the modified Rome IV criteria.

**Results:** There was a statistically significant relationship between food neophobia levels and BMI classifications of women, men, and all elderly individuals ($p<0.001$). There was a statistically significant relationship between the level of food neophobia and waist/height ratio in women, men, and all elderly individuals ($p<0.001$). There was a statistically significant relationship between food neophobia levels and the constipation status of women and all elderly individuals ($p<0.05$). There was a statistically significant relationship between food neophobia levels and mini nutritional assessment (MNA) classifications of women, men, and all elderly individuals ($p<0.001$). While there was no statistically significant difference between malnutrition groups according to energy, carbohydrate, fat, protein, and pulp levels (median) ($p>0.05$), there was a statistically significant difference between malnutrition groups of neutral and non-constipated elderly individuals only according to water consumption levels (median) ($p<0.05$). The water consumption level (median) of the elderly in the malnourished group was significantly lower than the water consumption level of the elderly in the risk of malnutrition and normal nutritional status groups.

**Conclusion:** Treatments for age-related conditions such as constipation, malnutrition, and undernutrition that focus on novel foods need to be carefully designed. The elderly should be a market segment that promotes healthy products, where new products can be introduced and purchased without concern.

**Keywords:** Food neophobia, elderly, constipation, malnutrition, nutrition

## INTRODUCTION

The dictionary definition of "old age" is defined as the state of being old and showing the effects of increased age. The World Health Organization (WHO) defines people aged 65 and over as "elderly". The elderly population is also divided into subgroups, with the 65-74 age group labeled as "young elderly", the 75-84 age group as "old elderly" and the 85 and over age group as "very old".[1] As a physiological process, old age is a period that reduces or limits people's activity level and functionality, making them socially, physically, and emotionally dependent to varying degrees. With the advancement of age, changes may occur in physiological, psychological, cognitive, and social areas, while the cognitive and functional capacity of the individual decreases and the number of chronic diseases increases. The increase in risk factors associated with chronic diseases and the development of lifestyle-related diseases may lead to a fear of new foods.[2-4]

Fear of trying new foods, i.e. food neophobia (FN), is a behavioral definition that explains individuals' avoidance of experiencing and tasting unfamiliar/never-tried foods.[5] Age is an important determinant of FN.[6] It is known that elderly individuals who are satisfied with their lives are also satisfied with the food they consume and have low levels of food neophobia. Food Neophobia in the elderly is thought to change as senses such as taste, smell, and vision decline over time. As a result of all these effects, decreased canine consumption may cause various disorders such as constipation in the elderly.[7]

Constipation is generally defined as a decrease in the frequency of defecation, increased stool hardness, lower than normal number of stools, the need for intensive straining, incomplete emptying of stool, and dry stools.[8] Although the exact cause of constipation is not known, it is reported that the incidence increases with age, and 40% of elderly individuals

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aged 65 years and over experience constipation problems.[9] It is a common complaint, especially among geriatric patients, and may result in malnutrition among the elderly in nursing homes.[10]

Malnutrition refers to a persistent imbalance between the intake of nutrients (protein, energy, and other nutrients) consumed and meeting changing metabolic needs. Malnutrition affects approximately 28% of community-dwelling older adults in developed countries.[11] This results in loss of body mass and organ-system dysfunction. Malnutrition is an important and often neglected public health problem in the elderly. Malnutrition in the elderly is closely associated with pathological conditions leading to loss of autonomy, decreased quality of life, increased hospital admissions, prolonged hospital stays, infections, delayed wound healing, gait disturbances, falls and fractures, and untimely deaths.[12] Malnutrition has been defined as an imbalance between intake and requirements that causes changes in human metabolism, compromising the body's function and leading to loss of body mass. Malnutrition is a nutritional condition in which a deficiency, excess, or imbalance of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size, composition) and function and clinical outcome.[13] The causes of malnutrition in the elderly are factors such as reduced food consumption, gastrointestinal diseases, and digestive and absorption disorders. Ensuring adequate and balanced nutrition in old age is important in preventing diseases, protecting, improving, and developing health, organizing lifestyle habits, and increasing life span and quality of life.[14]

This study aimed to evaluate food neophobia, constipation, malnutrition, and nutritional status in elderly individuals.

## METHODS

### Subjects and Survey Method

The study was performed following the Declaration of Helsinki. Approval for the study was obtained from the Süleyman Demirel University Ethics Committee (Date: 07.11.2023, Decision No: 69/11).

This study was conducted as a descriptive study with elderly individuals living in Isparta province between 18.11.2023 and 27.06.2024. The study was conducted on individuals aged ≥65 years selected by snowball sampling method. There are 620.019 elderly individuals living in Isparta province. As a result of the statistical power analysis, it was determined that at least 384 individuals should be included in the study with a 95% confidence interval. In this study, 406 individuals were reached. Elderly individuals from the researcher's close circle and acquaintances who volunteered to participate in the study were included in the study. Elderly individuals with chronic gastrointestinal diseases, psychiatric disorders, and oral nutrition deficiencies were not included in the study. The questions in the questionnaire and measurements were obtained by the researcher by applying the face-to-face interview technique.

### Demographic Questionnaires

A questionnaire was used to collect demographic parameters (age, gender) of the participants.

### Assessment of Anthropometric Measurements

Height was measured (cm) with feet close together and the head in the Frankfort plane, using a portable stadiometer. Weight (kg) was measured using the Tanita Bc 601 brand electronic scale. Waist circumference was measured at the midpoint between the last rib and the iliac crest using an anthropometric tape measure. Participants' weight and height were measured following the method and body-mass index (BMI) was calculated based on the following formula. Body weight (kg) / height ($kg/m^2$). The WHO classification was used to evaluate BMI. Individuals with a BMI of <18.5 $kg/m^2$ are underweight, 18.5-24.9 $kg/m^2$ are normal weight, 25.0-29.9 $kg/m^2$ are overweight, and >30.0 $kg/m^2$ are obese (WHO, 2000). Waist-to-height ratio (WHR) was calculated by the circumference of the waist (cm) divided by the height (cm). According to the Ashwell classification, a waist circumference/height ratio of <0.4 is at risk, 0.4-<0.5 is normal, 0.5-<0.6 is at risk, and >0.6 need treatment.[15]

### Assessment of Food Neophobia

The Food Neophobia Scale (FNS) was used to determine the Food Neophobia levels of individuals. This scale was adapted to Turkish by Duman et al.[16] in 2020. The FNS is evaluated with a single-factor and 10-item 5-point Likert scale ("I totally agree" 5 points, "I Agree" 4 points, "I neither agree nor disagree" 3 points, "I disagree" 2 points, and "I totally disagree" 1 point). Items 2, 3, 5, 7, 8, and 9 are evaluated as "trust in new foods", and items 1, 4, 6, and 10 are reverse-scored and evaluated as "willingness to try new foods".[17] Since a 5-point Likert scale is used, total scores can vary between 10 and 50. Participants were divided into two separate groups as neophilic and neophobic individuals. High scores between 33-50 obtained from FNS indicate Food Neophobia and low scores between 10-25 indicate food neophilia (liking food).[18]

### Assessment of Nutrition

One-day food consumption of individuals was determined by the 24-hour retrospective reminder method.[19] Individuals' meal distribution and food consumption according to meal times were determined. Individuals' food consumption was obtained from the "food and nutrition photo catalog".[20] This information was entered into the "nutrition information system (BEBIS)" 8.1 full version program and the amounts of energy and nutrients taken by individuals in a day were determined.[21]

### Assessment of Constipation

The presence of constipation in elderly individuals was assessed according to the "Rome IV criteria" developed by Palsson et al.[22] in 2016. The Rome IV criteria consist of a series of yes/no questions about gastrointestinal conditions. According to Rome IV Criteria, symptoms must have started at least 6 months before the diagnosis and have persisted for the last 3 months. A diagnosis of constipation was made if at least two of the three findings were accompanied by abdominal pain or discomfort at least one day a week. Participants with two

or more positive items were classified into the constipation group and the remaining participants were classified into the non-constipation group.

### Assessment of Malnutrition

The mini nutritional assessment short form (MNA-SF) tool was used as a marker of malnutrition in the elderly. The MNA-SF was developed and validated by Rubenstein et al.[23] in 2001 and revised in 2009. This form consists of six items and is scored according to factors such as change in appetite, weight loss in the last 3 months, mobility in the last 3 months, psychological distress or acute illness, neuropsychological problems, and body-mass index. According to the MNA-SF score, individuals with a score of 11-14 are categorized as normally fed, individuals with a score of 7-10 are categorized as at risk and individuals with a score of <7 are categorized as severely malnourished.

### Statistical Analysis

The study data were transferred to IBM SPSS Statistics 26 (IBM, Armonk, NY, USA), and the analysis was completed. When evaluating the data, frequency distributions were given for categorical variables, and descriptive statistics (mean, standard deviation, median, minimum, maximum) were given for numerical variables. To decide on the analyses to be applied, firstly, the Kolmogorov Smirnov test (n>30) was applied for the assumption of normal distribution of nutrient variables. As a result of the test, it was seen that the measurements did not meet the assumption of normal distribution. Therefore, nonparametric tests were used in comparisons. The Kruskal-Wallis Test was used to determine whether there was a difference between more than two independent groups according to the scores, and the Bonferroni Test was used to determine which groups were different. The relationship between two independent categorical variables was examined with the Chi-square test, and if the Chi-square test did not meet the assumption, Freeman Halton Fisher's Exact Chi-square test (Fisher's exact test) was used in nxm tables.

## RESULTS

Table 1 shows the results examining whether there is a relationship between the gender of elderly individuals and food neophobia status. Accordingly, there was no statistically significant relationship between the gender of the elderly and food neophobia (p>0.05).

**Table 1. Comparison of food neophobia status prevalence according to gender**

| Food neophobia status | Women (n=203) | Men (n=203) | Total (n=406) | Chi-square, p-value |
|---|---|---|---|---|
| | n (%) | n (%) | n (%) | |
| Neophilic | 57 (28.1) | 58 (28.6) | 115 (28.3) | 0.090, 0.965 |
| Neutral | 139 (68.5) | 137 (67.5) | 276 (68.0) | |
| Neophobic | 7 (3.4) | 8 (3.9) | 15 (3.7) | |

$x^2$: Chi-square test, p: Significance level

Table 2 also shows the results of the examination of the relationship between neophobia levels and age, BMI, waist/height ratio, constipation status, and MNA assessment of elderly individuals according to their gender.

The mean age of women in the neophilic group was 75.91 (±6.666), the mean age of women in the neutral group was 75.9 (±6.579), and the mean age of women in the neophobic group was 74.88 (±8.114). The mean age of men in the neophilic group was 75.77 (±6.614), the mean age of neutral men was 76.03 (±6.616), and the mean age of neophobic men was 72.71 (±6.626). The mean age of the elderly individuals in the neophilic group was 75.84 (±6.612), the mean age of the neutral males was 75.96 (±6.586), and the mean age of the neophobic males was 73.87 (±7.279).

There was a statistically significant relationship between food neophobia levels and BMI classifications of women, men, and all elderly individuals (p<0.001). Accordingly, neophilic women were significantly more likely to be obese (87.9%), neutral women were significantly more likely to be overweight (65.0%) and neophobic women were significantly more likely to be underweight (37.5%). Neophilic men were significantly more likely to be obese (89.5%), neutral men were significantly more likely to be overweight (66.2%) and neophobic men were significantly more likely to be underweight (28.6%). Neophilic older adults were significantly more likely to be obese (88.7%), neutral older adults were significantly more likely to be overweight (65.5%) and neophobic older adults were significantly more likely to be underweight (33.3%).

There was a statistically significant relationship between the level of food neophobia and waist/height ratio in women, men, and all elderly individuals (p<0.001). Accordingly, the proportion of neophilic women in the treatment group (86.2%), neutral women in the risk group (59.9%), and neophobic women in the normal group (62.5%) were significantly higher. The proportion of neophilic men in the treatment group (82.5%), neutral men in the risk group (64.0%), and neophobic men in the normal group (57.1%) were significantly higher. The proportion of neophilic older adults in the treatment group (84.3%), neutral older adults in the risk group (62.0%), and neophobic older adults in the normal group (60.0%) were significantly higher.

There was a statistically significant relationship between food neophobia levels and the constipation status of women and all elderly individuals (p<0.05). Accordingly, the rate of constipation was significantly higher in neophilic and neutral women (98.3%, 94.9%) and in neophobic women (25.0%). The rate of no constipation was significantly higher in neophilic and neutral older adults (93.0%, 94.2%), while the rate of constipation was significantly higher in neophobic older adults (26.7%).

There was a statistically significant relationship between food neophobia levels and MNA classifications of women, men, and all elderly individuals (p<0.001). Accordingly, neophilic women were significantly more likely to be in the risk of malnutrition group (67.2%), neutral women were significantly more likely to be in the normal nutritional status group (50.4%) and neophobic women were significantly more likely to be in the malnourished group (62.5%). Neophilic men were significantly more likely to be in the risk of malnutrition group (71.9%), neutral men were significantly more likely to be in the normal nutritional status group (51.1%) and neophobic men were significantly more likely to be in the malnourished

**Table 2. Investigation of the relationship between neophobia levels according to gender and age, BMI, waist/height ratio, constipation status, and MNA assessment**

| | Women (n=203) | | | Men (n=203) | | | Total (n=406) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Neophilic | Neutral | Neophobic | Neophilic | Neutral | Neophobic | Neophilic | Neutral | Neophobic |
| **Food neophobia status** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** | **Mean±SD** |
| Age | 75.91±6.666 | 75.9±6.579 | 74.88±8.114 | 75.77±6.614 | 76.03±6.616 | 72.71±6.626 | 75.84±6.612 | 75.96±6.586 | 73.87±7.279 |
| | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** | **n (%)** |
| **BMI classification** | | | | | | | | | |
| Underweight | $0_a$ (0.0) | $0_a$ (0.0) | $3_b$ (37.5) | $0_a$ (0.0) | $0_a$ (0.0) | $2_b$ (28.6) | $0_a$ (0.0) | $0_a$ (0.0) | $5_b$ (33.3) |
| Normal | $0_a$ (0.0) | $48_b$ (35.0) | $2_b$ (25.0) | $0_a$ (0.0) | $47_b$ (33.8) | $3_b$ (42.9) | $0_a$ (0.0) | $95_b$ (34.4) | $5_b$ (33.3) |
| Overweight | $7_a$ (12.1) | $89_b$ (65.0) | $3_{a,b}$ (37.5) | $6_a$ (10.5) | $92_b$ (66.2) | $2_{a,b}$ (28.6) | $13_a$ (11.3) | $181_b$ (65.5) | $5_a$ (33.3) |
| Obese | $51_a$ (87.9) | $0_b$ (0.0) | $0_b$ (0.0) | $51_a$ (89.5) | $0_b$ (0.0) | $0_b$ (0.0) | $102_a$ (88.7) | $0_b$ (0.0) | $0_b$ (0.0) |
| Chi-square; p-value | | 197.971; 0.000*** | | | 197.948; 0.000*** | | | 404.354; 0.000*** | |
| **Waist/height ratio** | | | | | | | | | |
| Normal | $0_a$ (0.0) | $25_b$ (18.2) | $5_c$ (62.5) | $0_a$ (0.0) | $25_b$ (18.0) | $4_c$ (57.1) | $0_a$ (0.0) | $50_b$ (18.1) | $9_c$ (60.0) |
| Risk | $8_a$ (13.8) | $82_b$ (59.9) | $3_{a,b}$ (37.5) | $10_a$ (17.5) | $89_b$ (64.0) | $3_{a,b}$ (42.9) | $18_a$ (15.7) | $171_b$ (62.0) | $6_{a,b}$ (40.0) |
| Treatment | $50_a$ (86.2) | $30_b$ (21.9) | $0_b$ (0.0) | $47_a$ (82.5) | $25_b$ (18.0) | $0_b$ (0.0) | $97_a$ (84.3) | $55_b$ (19.9) | $0_b$ (0.0) |
| Chi-square; p-value | | 85.258; 0.000*** | | | 83.328; 0.000*** | | | 172.899; 0.000*** | |
| **Constipation status** | | | | | | | | | |
| Constipation | $1_a$ (1.7) | $7_{a,b}$ (5.1) | $2_b$ (25.0) | 7 (12.3) | 9 (6.5) | 2 (28.6) | $8_a$ (7.0) | $16_a$ (5.8) | $4_b$ (26.7) |
| Non-constipation | $57_a$ (98.3) | $130_{a,b}$ (94.9) | $6_b$ (75.0) | 50 (87.7) | 130 (93.5) | 5 (71.4) | $107_a$ (93.0) | $260_a$ (94.2) | $11_b$ (73.3) |
| Chi-square; p-value | | 6.002; 0.037* | | | [d]5.114; 0.066 | | | [d]9.651; 0.016* | |
| **MNA classification** | | | | | | | | | |
| Malnourished | $4_a$ (6.9) | $12_a$ (8.8) | $5_b$ (62.5) | $3_a$ (5.3) | $13_a$ (9.4) | $4_b$ (57.1) | $7_a$ (6.1) | $25_a$ (9.1) | $9_b$ (60.0) |
| Risk of malnutrition | $39_a$ (67.2) | $56_b$ (40.9) | $1_b$ (12.5) | $41_a$ (71.9) | $55_b$ (39.6) | $1_b$ (14.3) | $80_a$ (69.6) | $111_b$ (40.2) | $2_b$ (13.3) |
| Normal nutritional status | $15_a$ (25.9) | $69_b$ (50.4) | $2_{a,b}$ (25.0) | $13_a$ (22.8) | $71_b$ (51.1) | $2_{a,b}$ (28.6) | $28_a$ (24.3) | $140_b$ (50.7) | $4_{a,b}$ (26.7) |
| Chi-square; p-value | | 25.745; 0.000*** | | | 27.812; 0.000*** | | | [d]71,895; 0.000*** | |

*p<0.05, **p<0.001; a-a, b-b, c-c: No difference between the groups; a-b, a-c, b-c: There is a difference between the groups, $x^2$: Chi-square test, $dx^2$: Freeman Halton Fisher's exact Chi-square test, p: Significance level, SD: Standard deviation, BMI: Body-mass index

group (57.1%). The proportion of neophilic older adults in the risk of malnutrition group (69.6%), neutral older adults in the normal nutritional status group (50.7%), and neophobic older adults in the malnourished group (60.0%) were significantly higher.

Table 3 shows the results of the examination of whether there is a difference between the malnutrition status of elderly individuals in terms of their neophobia levels and constipation status according to their nutrient levels (median). While there was no statistically significant difference between malnutrition groups according to energy, carbohydrate, fat, protein, and pulp levels (median) (p>0.05), there was a statistically significant difference between malnutrition groups of neutral and non-constipated elderly individuals only according to water consumption levels (median) (p<0.05). Accordingly, the water consumption level (median) of the elderly in the malnourished group was significantly lower than the water consumption level of the elderly in the risk of malnutrition and normal nutritional status groups.

## DISCUSSION

Scientific studies evaluating the health and nutritional status of the elderly in improving the quality of life of the elderly are important today when the elderly population is increasing rapidly. Changes in individuals' opinions about new foods and various diseases that occur with aging affect nutrition and health status.[24]

Elderly individuals exhibit mostly neutral and neophobic attitudes towards unfamiliar foods.[25] The percentages of neophilic, neutral, and neophobic attitudes of all elderly individuals participating in our study were 28.3%, 68.0%, and 3.7%, respectively. In a study, one-third of older adults were neophobic, more than half were neutral and very few were neophilic towards novel foods.[26] Communication messages to older adults about the benefits of consuming novel foods (e.g., exposure to new cultures and flavors, dietary diversity, health benefits, etc.) should also be targeted at neophobic older consumers, thus increasing their numbers by making their attitudes more positive.

Food neophobia is generally thought to differ by age and increases with age. Considering demographic characteristics, higher age is associated with food neophobia.[27] The mean ages of all elderly individuals who participated in our study were 75.84, 75.96, and 73.87, respectively, according to their neophilic, neutral, and neophobic status. In another study, neophilic attitudes towards new foods were mostly observed in people aged 61-70 years, while neophobic attitudes were mostly observed in people older than 70 years. Neutral

**Table 3. Investigation of the relationships between malnutrition status and dietary intake levels according to food neophobia levels and constipation status**

| Food neophobia | | Neophilic | | Neutral | | Neophobic | |
|---|---|---|---|---|---|---|---|
| Constipation status | | Constipation | Non-constipation | Constipation | Non-constipation | Constipation | Non-constipation |
| Dietary intake | MNA classification | Median (min-max) | Median (min-max) | Median (min-max) | Median (min-max) | Median (min-max) | Median (min-max) |
| Energy (kcal) | Malnourished | 2182.67 | 1292.88 (766.18-2421.73) | 1565.09 (1085.21-1817.14) | 1661.96 (893.72-3067.44) | 936.30 (903.43-96.11) | 968.09 (786.12-2029.72) |
| | Risk of malnutrition | 1624.42 (1207.65-3112.11) | 1740.81 (725.14-3068.44) | 1417.23 (1287.68-1785.12) | 1552.05 (818.94-2713.02) | - | 1659.68 (1518.91-1800.46) |
| | Normal nutritional status | 2112.36 (1541.51-2683.20) | 1631.76 (1017.92-3632.41) | 1416.81 (874.73-2696.9) | 1646.33 (606.91-3038.22) | - | 1766.19 (1206.68-2035.71) |
| KW; p | | 0.450; 0.799 | 3.678; 0.159 | 0.240; 0.887 | 1.646; 0.439 | - | 3.455; 0.178 |
| Carbohydrate (g) | Malnourished | 269.71 (269.71-269.71) | 157.65 (82.15-326.22) | 143.73 (113.04-226.67) | 183.59 (88.87-389.83) | 107.34 (80.51-124.94) | 124.94 (94.56-195.84) |
| | Risk of malnutrition | 224.00 (141.34-344.46) | 209.32 (96.07-389.83) | 180.62 (149.63-205.22) | 170.22 (62.52-354.07) | - | 184.64 (146.43-222.86) |
| | Normal nutritional status | 281.21 (219.67-342.75) | 193.04 (72.38-411.28) | 130.39 (94.56-245.56) | 189.84 (29.09-483.69) | - | 209.9 (118.17-229.30) |
| KW; p | | 0.450; 0.799 | 1.954; 0.376 | 0.722; 0.697 | 3.810; 0.149 | - | 4.041; 0.133 |
| Fat (g) | Malnourished | 92.60 | 46.08 (18.97-79.08) | 63.07 (33.91-79.07) | 57.14 (27.16-127.40) | 37.85 (27.16-45.06) | 28.83 (18.97-96.17) |
| | Risk of malnutrition | 53.54 (37.57-113.90) | 67.56 (8.20-147.67) | 58.11 (34.99-70.35) | 61.29 (24.96-122.54) | - | 68.37 (62.52-74.22) |
| | Normal nutritional status | 79.755 (44.37-115.14) | 63.36 (22.00-153.80) | 51.59 (29.56-147.67) | 61.18 (26.82-127.67) | - | 64.22 (59.89-96.30) |
| KW; p | | 0.667; 0.717 | 3.925; 0.141 | 0.045; 0.978 | 0.655; 0.821 | - | 3.364; 0.186 |
| Protein (g) | Malnourished | 60.86 (60.86-60.86) | 53.56 (35.97-92.12) | 81.83 (47.07-98.27) | 68.85 (34.28-116.71) | 35.86 (33.78-65.80) | 35.97 (33.71-88.41) |
| | Risk of malnutrition | 59.46 (35.84-147.21) | 65.50 (24.36-137.21) | 61.8 (31.64-85.41) | 60.55 (26.76-185.53) | - | 69.79 (51.52-88.06) |
| | Normal nutritional status | 58.13 (53.64-62.63) | 56.295 (25.71-140.34) | 64.87 (21.49-113.30) | 63.41 (24.01-147.21) | - | 68.18 (47.80-82.73) |
| KW; p | | 0.450; 0.799 | 1.421; 0.491 | 0.765; 0.682 | 0.645; 0.724 | - | 0.723; 0.697 |
| Fiber (g) | Malnourished | 25.08 | 24.43 (9.78-36.33) | 12.91 (10.81-20.35) | 21.17 (10.32-54.73) | 16.77 (7.52-25.07) | 14.26 (10.80-27.27) |
| | Risk of malnutrition | 23.30 (18.27-32.01) | 23.29 (10.04-54.73) | 20.69 (8.16-48.77) | 19.46 (6.14-179.17) | - | 31.64 (27.99-35.29) |
| | Normal nutritional status | 26.80 (24.99-28.61) | 28.06 (11.2-62.03) | 17.93 (8.02-27.47) | 20.60 (3.30-102.70) | - | 27.155 (15.36-33.00) |
| KW; p | | 0.583; 0.747 | 0.883; 0.643 | 0.467; 0.792 | 0.556; 0.757 | - | 4.791; 0.091 |
| Water (ml) | Malnourished | 1250 | 1600 (1000-1600) | 1200 (1100-1650) | 1100 (650-1750) | 715 (500-860) | 950 (720-1800) |
| | Risk of malnutrition | 1200 (1200-1600) | 1300 (900-1800) | 1375 (1200-1600) | 1350 (650-2100) | - | 1050 (1000-1100) |
| | Normal nutritional status | 1300 (1200-1400) | 1250 (900-1800) | 1100 (900-1800) | 1300 (0-2300) | - | 1500 (1300-1800) |
| KW; p | | 0.058; 0.972 | 0.915; 0.633 | 1.409; 0.494 | 7.667; 0.022* | - | 4.118; 0.128 |
| Difference | | - | - | - | 1-2.3 | - | - |

*p<0.05; 1: Malnourished, 2: Risk of malnutrition, 3: Normal nutritional status, MNA: Mini nutritional assessment, Min: Minimum, Max: Maximum, KW: Kruskal Wallis test, Difference: Bonferroni test, p: Significance level

attitudes were found mostly in individuals aged 51-60 years.[28] In another study, an increase in the level of Food Neophobia was observed with increasing age.[4] It is thought that the fact that older individuals have not grown up exposed to various food sources and are less familiar with different foods may be associated with higher levels of food neophobia.

Food neophobia is considered a behavioral trait that affects BMI by being associated with inadequate eating habits and poor diet quality.[4] In our study, 88.7% of elderly obese individuals were neophilic, 65.5% of overweight individuals were neutral, and 33.3% of underweight individuals were neophobic. In a study, it was determined that obese individuals showed higher levels of food neophobia than normal-weight individuals and obese men had lower taste sensitivity.[30] However, in another study, neophobic individuals had lower BMI values than neophilic individuals.[31] In another study, when individuals were divided into neophilic, neutral, and neophobic groups according to their new food neophobia levels, the mean BMIs were found to be 24.62, 25.47, and 25.35 kg/m$^2$, respectively. However, the group with the lowest number of obese individuals was determined as neophobic.[27] It can be suggested that neophobia tendency may increase if BMI levels go beyond the normal range in old age. In addition, the disease anxiety brought about by weight gain in elderly individuals increases the likelihood of fear of trying new foods.

Anthropometric measurements are of critical importance in determining nutritional status, and measurement of height and waist circumference are among the most commonly used methods. The waist/height ratio helps to evaluate the risk of chronic diseases that may occur in individuals.[32] In the waist/height ratios of the elderly individuals in our study, it was found that 60% of neophobic individuals were normal, 62% of neutral individuals were risky, and 84.3% of neophilic individuals needed treatment. In a study, the mean waist/height ratio was calculated as 0.50±0.08 for neophilic individuals, 0.51±0.09 for neutral individuals, and 0.52±0.09 for neophobic individuals.[27] To optimize the waist/height ratios of elderly individuals and reduce their neophobia levels, it would be beneficial to develop comprehensive nutrition education programs and support services to increase physical mobility.

Constipation is not a disease but a symptom. Constipation may develop due to idiopathic causes or may occur due to various factors including diet, sports habits, medications, and disease processes.[33] Most of the elderly neophilic (93%), neutral (94%) and neophobic (73.3%) individuals in our study did not have constipation. Adherence to the adaptation of healthy and sustainable diets is low among food neophobics, increasing their risk of diet-related chronic diseases.[34] In a study, elderly individuals stated that they did not like the food given in the nursing home, that it did not contain much fiber, and that such a diet caused irregular bowel habits.[35] If neophobia is present in elderly individuals, constipation is likely to be seen with inadequate fiber intake and inactivity that may occur due to inadequate food intake.

In elderly individuals, inadequate nutrient intake causes malnutrition, especially with losses in lean body mass. In the early diagnosis of malnutrition, screening tests such as Mini Nutritional Assessment and anthropometric measurements such as calf circumference and upper mid-arm circumference are important to determine nutritional status.[16] Most of the elderly neophobic individuals in our study were malnourished (60%). In one study, Food Neophobia in older adults was found to be significantly associated with the risk of malnutrition and has been reported to significantly reduce the intake of 20 nutrients.[36] In another study, the food consumption habits of 139 individuals aged 18 years and over were examined and it was found that the consumption of fruit, protein drinks, and water consumption decreased with increasing neophobia levels, while the consumption of starch, snacks, sweets, milk, and soda increased. This revealed that neophobic individuals tended to turn to less nutritious foods and dietary diversity was limited.[37] It is possible to say that neophobia negatively affects the healthy eating habits of elderly individuals, decreasing the quality of their diet and creating a risk of malnutrition.

It has also been reported that energy intake decreases by 25% from the age of 40 to 70 years old.[38] In a healthy diet, it is of great importance that protein, carbohydrate, and fat ratios are balanced. It is recommended that 55-60% of the daily energy requirement should come from carbohydrates, 10-15% from proteins, and a maximum of 30% from fats. These ratios play a fundamental role in meeting the body's energy balance and nutritional requirements.[34] Inadequate fiber and fluid intake and a sedentary lifestyle increase the risk of constipation, and low energy intake, low meal consumption, and depression also support this risk. Constipation can generally be alleviated by increasing fiber and fluid intake and physical activity.[9] In a study, the rates of meeting the energy requirements of the participants were calculated as 69.82% for neophilic individuals, 71.90% for neutral individuals, and 83.20% for neophobic individuals and it was found that there was a difference between the groups.[17] In another study, it was stated that increased food neophobia may lead to a decrease in fruit and vegetable consumption in individuals. It was observed that increasing neophobia level decreased vegetable consumption, but did not affect fruit consumption. A decrease in fiber intake was also observed in parallel with increased fear levels. Therefore, it was recommended to support individuals with high Food Neophobia to increase their vegetable consumption and diversity.[16] A study conducted in Poland showed that neophobic individuals consumed meat products more frequently and desserts less frequently. In addition, the limited consumption of vegetables and fruits by neophobics was associated with food preferences acquired in childhood, and it was stated that these preferences may change with health problems in old age. The importance that neophobes attach to health in their food choices may affect their dietary compliance. It has been stated that being neophobic should be taken seriously in terms of nutritional counseling and it has been thought that this situation may lead to nutritional deficiencies and chronic disease risk.[31] In our study, the mean energy, carbohydrate, fat, protein, fiber, and water consumption of neophobic and constipated malnourished individuals were 936.30 kcal, 107.34 g, 37.85 g, 35.86 g, 16.77 g, and 715 ml, respectively. Inadequate energy intake affects the quality of life of the individual as seen in general studies. Fear of food at a level that affects the health of individuals may cause malnutrition and increase the likelihood of constipation. Therefore, attention should be paid to energy intake, adequate macro and micronutrients, and fiber and fluid intake in elderly individuals with food neophobia.

### Limitations
Due to the difficulties encountered by elderly individuals in the recall process, 24-hour retrospective food consumption records could not be obtained for three days. The cultural and geographical characteristics of the place where the study was conducted may influence the dietary habits and health status of individuals. This may limit the generalizability of the results.

## CONCLUSION
Physiological changes and diseases seen in the increasing elderly population both in the world and in our country affect the nutrition and health status of elderly individuals. While appetite and sensory abilities are known to decrease with age, physical barriers that may affect eating, food preparation, and food supply may increase with age. The FNS is a valid and reliable measurement tool used to determine food neophobia, adapted to Turkish for individuals aged 19-64 years, and can be used in Turkey. Confirmatory Factor Analysis was used to evaluate the usability of the FNS in individuals aged 65 years and over, and it was shown that the instrument is a valid and reliable measurement tool for the elderly population. In conclusion, treatments for age-related conditions such as constipation, malnutrition, and undernutrition that focus on novel foods need to be carefully designed. Novel food products with balanced nutrient content and high digestibility should be carefully designed to meet the specific nutritional needs of older people. The elderly should be a market segment that promotes healthy products, where new products can be introduced and purchased without concern. In addition, a multidisciplinary approach should be adopted for the success of treatment approaches and effective cooperation between nutritionists, dietitians, clinicians, and food technologists should be ensured.

## ETHICAL DECLARATIONS

### Ethics Committee Approval
The study was carried out with the permission of the Süleyman Demirel University Ethics Committee (Date: 07.11.2023, Decision No: 69/11).

### Informed Consent
All patients signed and free and informed consent form.

### Referee Evaluation Process
Externally peer-reviewed.

### Conflict of Interest Statement
The author has no conflicts of interest to declare.

### Financial Disclosure
The author declared that this study has received no financial support.

### Author Contributions
Author declares that participated in the design, execution, and analysis of the paper, and that have approved the final version.

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