Haliç Üniversitesi Sağ Bil Derg 2025;8(1): 15-28
Halic Uni J Health Sci 2025; 8(1): 15-28

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Baygut H, ORCID:0000-0003-1703-1420
DOI: 10.48124/husagbilder.1590269 Geliş tarihi: 23 Kasım 2024 Kabul tarihi: 13 Şubat 2025

ISSN: 2618-625X
e-ISSN: 2667-5765

*Research Article*

# Investigation of Nutrition and Disease-Related Problem Areas in Individuals with Type 2 Diabetes Mellitus

# Tip 2 Diyabetli Bireylerde Beslenme ve Hastalıkla İlişkili Sorun Alanlarının Araştırılması

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## ÖZ

Bu çalışmanın amacı, tip 2 diabetes mellituslu (DM) bireylerin beslenme alışkanlıklarını ve hastalıklarıyla ilişkili sorun alanlarını ayrıntılı olarak inceleyerek diyabet yönetimini iyileştirmeye yönelik etkili stratejilerin geliştirilmesine katkıda bulunmaktır. Bu kesitsel çalışma Isparta, Burdur ve Antalya illerinde yürütülmüştür. Araştırmacı, rastgele örnekleme yöntemini kullanarak gönüllü tip 2 DM'li yetişkin bireylere ulaşmıştır. Bu çalışmanın örneklemi için yapılan güç analizi sonuçlarına göre 984 erkek ve kadın tip 2 DM'li yetişkin bireye ulaşıldı. Tip 2 DM'li yetişkin bireylerin demografik parametreleri bir anket formu ile kaydedilmiştir. Katılımcılardan yüz yüze görüşme tekniği kullanılarak antropometrik ölçümler alınmıştır. Araştırmaya katılan bireylere diyabetin sorun alanları ölçeği (The Problem Areas in Diabetes-PAID) uygulanmış ve "24 saatlik diyet hatırlama" yöntemi kullanılarak besin tüketim kaydı alınmıştır. Tip 2 diyabetli bireylerin enerji, protein, karbonhidrat, yağ, posa, A vitamini, C vitamini, E vitamini, B1 vitamini, B12 vitamini, sodyum, kalsiyum, demir, bakır, fosfor ve çinko ölçüm ortalamalarına göre PAID puanları arasında istatistiksel olarak anlamlı bir fark bulunmuştur ($p<0.05$). Buna göre, PAID puanı 33 ve üzeri olan tüm bireylerin bu ölçüm ortalamalarının, PAID puanı 33'ün altında olan bireylerin ölçüm ortalamalarından anlamlı derecede yüksek olduğunu söyleyebiliriz. Bu da beslenme yeterliliğinin ruh hali üzerindeki olumlu etkilerini göstermektedir.

**Anahtar Kelimeler:** Beslenme, PAID, Tip 2 diyabet.

## ABSTRACT

This study aimed to contribute to the development of effective strategies to improve diabetes management by examining the nutritional habits of individuals with type 2 diabetes mellitus (DM) and the problem areas associated with their disease in detail. This cross-sectional study was conducted in Isparta, Burdur and Antalya, Turkey. Using the random sampling method, the researcher reached volunteer adult individuals with type 2 DM. According to the results of the power analysis for the sample of this study, 984 male and female adults with type 2 DM were reached. Demographic parameters of the adult individuals with type 2 DM were recorded with a questionnaire. Anthropometric measurements were taken via face-to-face interviews. The Problem Areas in Diabetes (PAID) scale was applied and their food consumption record was taken using the 24-hour dietary recall method. There was a statistically significant difference between the PAID scores of individuals with type 2 diabetes according to the means of energy, protein, carbohydrate, fat, pulp, vitamin A, vitamin C, vitamin E, vitamin B1, vitamin B12, sodium, calcium, iron, copper, phosphorus, and zinc measurements ($p<0.05$). Accordingly, we can say that the mean values of these measurements those with a PAID score of 33 and above were significantly higher than those of the individuals with a PAID score below 33. The results demonstrate the beneficial impact of optimal nutritional intake on mood.

**Keywords:** Nutrition, PAID, Type 2 diabetes mellitus.

## 1. Introduction

Quality of life is defined as the perception of individuals about their goals, expectations, standards, and concerns about the future. Quality of life is important because ignoring it can lead to frustration, lack of motivation, and reduced social, economic, cultural, and health functioning. Improving quality of life is a stage of health promotion (1). Anxiety about the potential future consequences of health issues can have a detrimental impact on numerous aspects of an individual's life. These concerns, which often stem from the fear of losing competence and becoming reliant on others, or of experiencing a decline in physical appearance, can have a significant effect on an individual's overall well-being (2).

Type 2 diabetes mellitus (type 2 DM) is a complex health problem that requires medical treatment aimed at reducing multifactorial risks beyond glycemic control (3). Emotional difficulties that develop in patients with type 2 DM can adversely affect hormonal balance and blood glucose levels, making the treatment of the disease difficult. Emotional stress affects treatment compliance, self-care, glycemic control, and quality of life in individuals with type 2 DM (4). Emotional stress and malnutrition associated with type 2 DM are common. The American Diabetes Association (ADA) states that the diabetes treatment team should routinely assess the individuals' psychosocial and nutritional status (3).

The objective of the treatment and control of type 2 DM is to provide individualized management of the condition and to prevent complications by maintaining blood glucose levels close to normal values, thereby improving quality of life. It is crucial for individuals to demonstrate a willingness to pursue these objectives and to exhibit proficiency in the management of their personal affairs. It is anticipated that a change in behavior, compliance with the diet, and blood glucose levels approaching normalcy will be observed. Individuals with type 2 DM should engage in regular planning regarding adherence to their medication, activity, and nutritional regimens (5, 6). However, the individual's perception of whether they can control their diabetes and the anticipated benefits of this control affect their compliance with nutrition and treatment (7). Severe dietary restrictions, the need for regular daily medication, insulin treatment, and symptoms and long-term complications of diabetes cause deterioration in the quality of life of diabetic individuals (8).

It is known that type 2 DM can be controlled with lifestyle changes such as nutrition therapy, weight loss, and physical activity. The aim of this study was to contribute to the development of effective strategies to improve diabetes management by examining the

nutritional habits of individuals with type 2 DM and the problem areas associated with their disease in detail.

## 2. Methods

### 2.1. Study design and population

This cross-sectional study was conducted in the provinces of Isparta, Burdur, and Antalya in Turkey between December 18, 2023 and July 11, 2024. The researcher employed the random sampling method to recruit volunteer participants with type 2 DM. The power analysis conducted to determine the sample size for this study indicated that a minimum of 984 male and female adults with type 2 DM were required to achieve a 95% confidence interval. The study population consisted of adult individuals diagnosed with type 2 DM at least one year prior to enrollment. Individuals with neurological diseases were excluded from the study due to the potential for communication difficulties and concerns about the accuracy of their responses. The data were collected by the researcher via face-to-face interviews.

### 2.2. Questionnaires

A questionnaire was utilized to document the demographic parameters of the adult individuals with Type 2 DM, including age, gender, educational status, marital status, place of residence, and the status of receiving dietary counseling.

### 2.3. Measures

#### *Anthropometric measurements*

Anthropometric measurements were taken from the participants via face-to-face interviews. Body weight (kg) was measured using an electronic scale and height was measured using a stadiometer. Body mass index (BMI) was calculated using the weight/height$^2$ (kg/m$^2$) equation and classified into four groups according to the World Health Organization (WHO): underweight (<18.5 kg/m$^2$), normal (18.5-24.9 kg/m$^2$), overweight (25.0-29.9 kg/m$^2$), and obese (≥30.0 kg/m$^2$) (9).

#### *Problem Areas in Diabetes (PAID) Scale*

Problem areas in the diabetes (PAID) scale were applied to the study participants. The PAID was introduced in 1995. Consecutive evaluations attested good psychometric properties (e.g. Cronbach's alpha ≥0.93 for the total scale) (10, 11). The PAID comprises

20 items assessing diabetes-related problems. The items contain statements regarding four domains of quality of life concerning diabetes (emotional distress, treatment issues, food-related problems, and lack of social support). They are rated on a scale from 0 (not a problem) to 4 (a serious problem). The validity and reliability of the PAID scale was established in Turkish (12). It is reported that the optimal cut-off points for the PAID is ≥33 with 76% sensitivity and 79% selectivity (13). In this study, the cut-off points for the PAID was taken as ≥33 points.

***Food consumption***

The food consumption record was taken using the 24-hour dietary recall method (14). The amount of each nutrient was calculated. The food catalog (15) was used to determine participants' food recipes (calculation). The food consumption of the participants was recorded in the Nutrition Information System (BEBIS) 8 full version program (16).

### 2.4. Statistical analysis

The study data were transferred to IBM SPSS Statistics 26 (Armonk, NY, USA) for analysis. Frequency distributions are given for categorical variables and descriptive statistics (mean, standard deviation, minimum, maximum) are given for numerical variables. In order to determine the most appropriate analytical approach, the Kolmogorov-Smirnov test (n>30) was initially employed to assess the normality of the data distributions. As a result of the test, it was seen that all scores met the assumption of normal distribution. Therefore, parametric tests were used in comparisons. Whether there was a difference between two independent groups according to the measurements was analyzed by an independent sample t-test.

### 2.5. Limitations

The cultural and geographical characteristics of the place where the study was conducted may influence the dietary habits and health status of adult individuals with type 2 DM. This may limit the generalizability of the results.

## 3. Results

Table 1 shows the distribution of demographic characteristics and anthropometric measurements of the participants. The table illustrates that the mean age of individuals with type 2 DM was 49.7 years and 54.9% were female. Of the participants, 33.1% were

primary school graduates, 21.7% were high school graduates, 38.1% were university graduates, and 7.1% had a postgraduate degree. Of the participants, 62.2% were married, 37.8% were single, 70.7% lived in urban areas, and 29.3% lived in rural areas. In terms of the frequency of dietary consultancy, 8.1% of respondents indicated that they had never consulted a dietitian, 23.5% reported having consulted the dietitian on one occasion, 11.9% had consulted the dietitian between two and five times, 24.4% had consulted the dietitian every month, 20.6% had consulted the dietitian every three months, and 11.5% had consulted the dietitian at least once a year. The mean weight of the individuals was 49.7 kg, the mean height was 169.4 cm, and the mean BMI was 24.9 kg/$m^2$. Accordingly, only 3.2% of the individuals with type 2 DM were underweight, 43.6% were normal weight, 39.2% were overweight, and 14.0% were obese.

**Table 1.** General characteristics and anthropometric measurements of the adult individuals with type 2 DM.

| General characteristics and anthropometric measurements | Total Participants (n=984) |
|---|---|
| **Age, mean ± SD (min-max)** | 49.7±14.8 (21-59) |
| **Gender, n (%)** | |
| Female | 541 (54.9) |
| Male | 443 (45.1) |
| **Educational status, n (%)** | |
| Primary school | 326 (33.1) |
| High school | 214 (21.7) |
| University | 375 (38.1) |
| Postgraduate | 69 (7.1) |
| **Marital status, n (%)** | |
| Married | 612 (62.2) |
| Single | 372 (37.8) |
| **Place of residence, n (%)** | |
| Urban | 696 (70.7) |
| Rural | 288 (29.3) |
| **Consulting a dietitian, n (%)** | |
| Never consulted | 80 (8.1) |
| Consulted once | 231 (23.5) |
| Consulted 2-5 times | 117 (11.9) |
| I consult every month | 240 (24.4) |
| I consult every three months | 203 (20.6) |
| I consulted at least once a year | 113 (11.5) |
| **Anthropometric measurements, mean ± SD (min-max)** | |
| Weight (kg) | 71.4 ± 13.1 (119-48) |
| Height (cm) | 169.4 ± 8.4 (183-152) |
| BMI ($kg/m^2$) | 24.9 ± 3.0 (34.6-18.1) |
| **BMI classification, n (%)** | |
| Underweight | 31 (3.2) |
| Normal | 429 (43.6) |
| Overweight | 386 (39.2) |
| Obese | 138 (14.0) |

Table 2 illustrates the distribution of data about the dietary habits of the participants. A review of the data reveals that the mean number of main meals consumed by individuals with type 2 DM is 2.4. While 42.8% of the individuals skip the main meal, 31.4% do not skip meals, and 25.8% sometimes skip meals. Of those who skip meals, 31.1% skip breakfast, 57.4% skip lunch, and 11.5% skip dinner. A review of the reasons for skipping the main meal revealed that 17.2% did so to lose weight, 11.2% due to a lack of appetite, 37.6% cited time constraints, 15.6% stated that they forgot, and 18.4% noted that they were not in the habit of eating a main meal. The mean number of snacks consumed by the participants was 0.7. While 53.0% of the individuals skip snacks, 25.6% do not skip

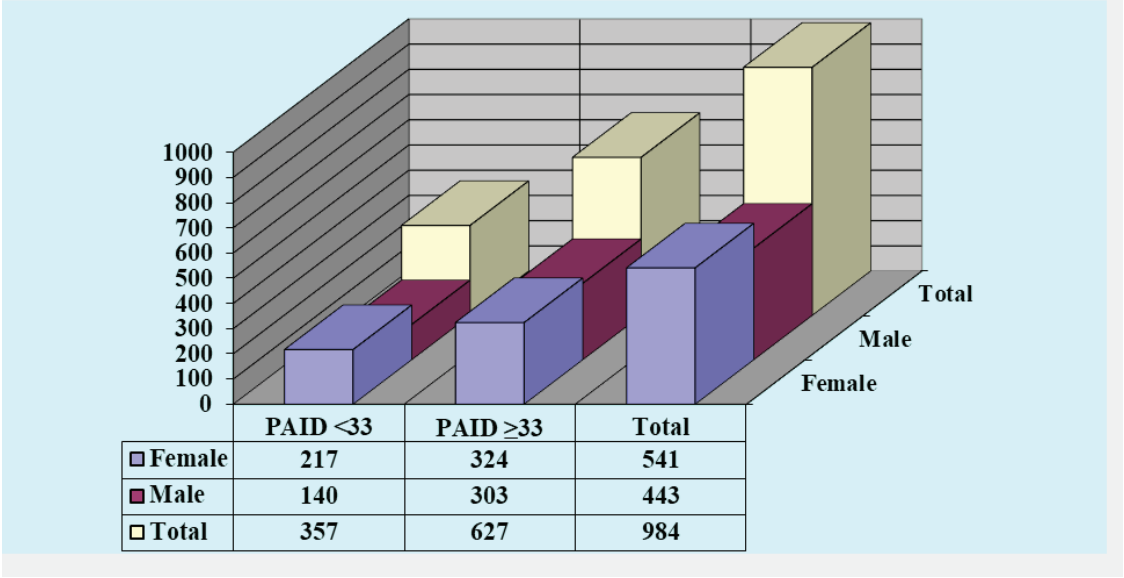
snacks, and 21.4% sometimes skip snacks. Of the individuals, 35.3% skipped the first snack, 30.6% skipped the second snack, and 34.1% skipped the third snack. An analysis of the reasons for skipping snacks revealed that 8.1% lost weight, 31.4% reported a lack of appetite, 14.8% cited time constraints, 14.8% stated that they forgot, and 8.2% noted that they were not in the habit of snacking.

**Table 2.** Information on eating habits of the type 2 DM adult individuals.

| Nutritional Habits | Total Participants (n=984) |
|---|---|
| **The number of main meals, mean ± SD (min-max)** | 2.4±0.5 (1.0-3.0) |
| **Skipping main meals, n (%)** | |
| Yes | 421 (42.8) |
| No | 309 (31.4) |
| Sometimes | 254 (25.8) |
| **Skipped main meals, n (%)** | |
| Breakfast | 306 (31.1) |
| Lunch | 565 (57.4) |
| Dinner | 113 (11.5) |
| **Reason for skipping main meals, n (%)** | |
| For weight loss | 169 (17.2) |
| No appetite | 109 (11.2) |
| Lack of time | 369 (37.6) |
| Forgotten | 157 (15.6) |
| No habit | 180 (18.4) |
| **The number of snacks, mean ± SD (min-max)** | 0.7±0.8 (0-3.0) |
| **Skipping snacks, n (%)** | |
| Yes | 521 (53.0) |
| No | 253 (25.6) |
| Sometimes | 210 (21.4) |
| **Skipped snacks, n (%)** | |
| First snack | 347 (35.3) |
| Second snack | 301 (30.6) |
| Third snack | 336 (34.1) |
| **Reason for skipping snacks, n (%)** | |
| For weight loss | 79 (8.1) |
| No appetite | 309 (31.4) |
| Lack of time | 369 (37.5) |
| Forgotten | 146 (14.8) |
| No habit | 81 (8.2) |

A detailed analysis of Figure 1 reveals that among a cohort of 541 females with type 2 DM, 217 exhibited a PAID score of less than 33, while 324 demonstrated a PAID score of 33 or above. Of the 443 male subjects with type 2 diabetes, 140 exhibited a PAID score below 33 and 303 demonstrated a PAID score of 33 or above. Of the 984

individuals diagnosed with type 2 DM, 357 exhibited a PAID score below 33, while 627 demonstrated a PAID score of 33 or above.




| | PAID <33 | PAID ≥33 | Total |
|---|---|---|---|
| Female | 217 | 324 | 541 |
| Male | 140 | 303 | 443 |
| Total | 357 | 627 | 984 |

**Figure 1.** The number of adult individuals with type 2 diabetes mellitus in the problem areas in the diabetes (PAID) group, stratified by gender.

It can be stated that the mean values of the measurements taken from the female subjects with a PAID score of 33 and above were found to be significantly higher than those obtained from the female subjects with a PAID score below 33. A statistically significant difference was observed between the PAID scores of male patients with type 2 DM according to the means of energy, protein, carbohydrate, fat, fiber, vitamin A, vitamin C, vitamin E, vitamin B12, sodium, calcium, iron, copper, phosphorus, and zinc measurements. It can be stated that the mean of all these measurements for males with a PAID score of 33 and above was significantly higher than the mean of males with a PAID score below 33. A statistically significant difference was observed between the PAID scores of individuals with type 2 diabetes according to the means of energy, protein, carbohydrate, fat, fiber, vitamin A, vitamin C, vitamin E, vitamin B1, vitamin B12, sodium, calcium, iron, copper, phosphorus, and zinc measurements ($p < 0.05$). It can thus be stated that the mean values of the measurements taken from individuals with a PAID score of 33 and above are markedly higher than those obtained from individuals with a PAID score below 33.

**Table 3.** Mean values of energy and nutrient intakes according to PAID scores of the type 2 DM adult individuals.

| Energy and nutrients | Female (n=541) | | t; p | Male (n=443) | | t; p | Total (n=984) | | t; p |
|---|---|---|---|---|---|---|---|---|---|
| | PAID <33 | PAID ≥33 | | PAID <33 | PAID ≥33 | | PAID <33 | PAID ≥33 | |
| | Mean ± SD (min-max) | Mean ± SD (min-max) | | Mean ± SD (min-max) | Mean ± SD (min-max) | | Mean ± SD (min-max) | Mean ± SD (min-max) | |
| Energy (kcal/day) | 1152.8±209.0 (505.3-1444.6) | 2087.6±467.3 (1447.8-3632.4) | -32.144; **0.000**$^{***}$ | 1155.3±207.2 (506.1-1446.9) | 1851.9±252.1 (1449.2-2376.0) | -31.72; **0.000**$^{***}$ | 1154.1±207.8 (505.3-1446.9) | 1988.5±408.2 (1447.8-3632.4) | -42.426; **0.000**$^{***}$ |
| Protein (g/day) | 45.8±13.3 (15.8-88.2) | 80.4±25.7 (34.7-199.9) | -20.561; **0.000**$^{***}$ | 47.2±15.7 (14.2-98.2) | 70.5±17.8 (35.7-172.9) | -14.114; **0.000**$^{***}$ | 46.5±14.6 (14.2-98.2) | 76.2±23.2 (34.7-199.9) | -24.589; **0.000**$^{***}$ |
| Carbohydrates (g/day) | 137.0±36.5 (40.6-237.6) | 249.3±70.5 (76.7-483.6) | -24.414; **0.000**$^{***}$ | 135.1±35.8 (29.0-238.6) | 222.0±47.7 (88.1-335.9) | -21.808; **0.000**$^{***}$ | 136.1±36.1 (29.0-238.6) | 237.8±63.3 (76.7-483.6) | -32.068; **0.000**$^{***}$ |
| Fat (g/day) | 45.0±13.8 (8.2-83.9) | 81.1±24.5 (18.5-169.0) | -21.771; **0.000**$^{***}$ | 45.4±15.0 (8.2-102.9) | 72.9±18.0 (30.9-123.3) | -17.347; **0.000**$^{***}$ | 45.2±14.4 (8.2-102.9) | 77.6±22.4 (18.5-169.0) | -27.515; **0.000**$^{***}$ |
| Fiber (g/day) | 15.9±6.5 (4.1-37.4) | 29.5±17.3 (6.9-179.1) | -13.12; **0.000**$^{***}$ | 16.2±6.5 (3.3-36.7) | 25.1±9.2 (7.0-83.2) | -11.958; **0.000**$^{***}$ | 16.1±6.5 (3.3-37.4) | 27.7±14.6 (6.9-179.1) | -17.09; **0.000**$^{***}$ |
| Vitamin A (mcg/day) | 873.0±750.1 (50.4-3992.0) | 1084.0±1139.4 (191.1-10488.1) | -2.243; **0.025**$^{*}$ | 814.4±757.5 (50.4-4716.7) | 1229.4±1511.0 (181.6-10488.1) | -3.809; **0.000**$^{***}$ | 843.7±753.3 (50.4-4716.7) | 1145.1±1309.4 (181.6-10488.1) | -4.583; **0.000**$^{***}$ |
| Vitamin C (mg/day) | 99.1±70.8 (3.4-429.3) | 135.8±90.4 (2.5-740.1) | -5.155; **0.000**$^{***}$ | 112.9±97.7 (7.2-929.5) | 142.4±110.9 (2.5-866.4) | -2.868; **0.004**$^{**}$ | 106.0±85.5 (3.4-929.5) | 138.5±99.5 (2.5-866.4) | -5.399; **0.000**$^{***}$ |
| Vitamin E (mg/day) | 11.4±7.0 (1.3-39.4) | 19.5±10.0 (2.8-53.6) | -10.903; **0.000**$^{***}$ | 11.6±7.0 (1.4-39.4) | 18.6±9.4 (1-51.5) | -8.911; **0.000**$^{***}$ | 11.5±7.0 (1.3-39.4) | 19.1±9.7 (1-53.6) | -14.138; **0.000**$^{***}$ |
| Vitamin B1 (mg/day) | 0.6±0.2 (0.1-1.3) | 1.0±0.3 (0.3-2.4) | -17.136; **0.000**$^{***}$ | 0.6±0.2 (0.2-1.2) | 1.3±5.7 (0.4-93.8) | -1.556; 0.120 | 0.6±0.2 (0.1-1.3) | 1.1±3.7 (0.3-93.8) | -2.647; **0.008**$^{**}$ |
| Vitamin B2 (mg/day) | 0.9±0.3 (0.2-2.3) | 1.4±0.5 (0.3-3.6) | -12.519; **0.000**$^{***}$ | 0.9±0.4 (0.1-2.3) | 6.5±84.5 (0.2-1374.4) | -0.883; 0.378 | 0.9±0.4 (0.1-2.3) | 3.5±54.7 (0.2-1374.4) | -0.909; 0.364 |
| Vitamin B6 (mg/day) | 0.9±0.3 (0.1-2.4) | 1.4±0.4 (0.3-3.9) | -13.894; **0.000**$^{***}$ | 0.9±0.4 (0.2-2.7) | 4.8±57.1 (0.2-929.6) | -0.915; 0.361 | 0.9±0.3 (0.1-2.7) | 2.8±37.0 (0.2-929.6) | -0.993; 0.321 |
| Vitamin B12 (mcg/day) | 2.6±1.8 (0-8.0) | 5.2±11.5 (0.1-211.3) | -4.102; **0.000**$^{***}$ | 2.9±2.3 (0-15.6) | 5.0±11.2 (0.3-170.0) | -2.926; **0.004**$^{**}$ | 2.8±2.1 (0-15.6) | 5.1±11.4 (0.1-211.3) | -4.976; **0.000**$^{***}$ |
| Sodium (mg/day) | 1650.8±1144.1 (429.2-13502.6) | 2912.9±6696.6 (609.2-128788.8) | -2.495; **0.013**$^{*}$ | 1943.7±3852.1 (344.9-52198.7) | 2452.7±993.1 (0-9087.2) | -2.049; **0.041**$^{*}$ | 1797.3±2841.2 (344.9-52198.7) | 2719.4±5140.8 (0-12878.8) | -3.124; **0.002**$^{**}$ |
| Calcium (mg/day) | 606.6±247.1 (88.0-1629.1) | 972.0±510.2 (299.6-4906.8) | -11.232; **0.000**$^{***}$ | 611.6±247.7 (99.5-1444.6) | 858.2±314.3 (327.7-2317.6) | -9.196; **0.000**$^{***}$ | 609.1±247.0 (88.0-1629.1) | 924.2±441.9 (299.6-4906.8) | -14.342; **0.000**$^{***}$ |
| Iron (mg/day) | 7.5±3.6 (1.8-20.4) | 12.5±4.8 (3.0-39.0) | -13.323; **0.000**$^{***}$ | 7.3±3.8 (2.0-20.8) | 11.3±3.8 (4.0-32.2) | -10.696; **0.000**$^{***}$ | 7.4±3.7 (1.8-20.8) | 12.0±4.4 (3.0-39.0) | -17.11; **0.000**$^{***}$ |
| Copper (mg/day) | 0.9±0.3 (0.3-1.8) | 1.7±0.6 (0.4-5.4) | -18.812; **0.000**$^{***}$ | 0.9±0.3 (0.2-1.9) | 1.5±0.5 (0.5-4.5) | -15.427; **0.000**$^{***}$ | 0.9±0.3 (0.2-1.9) | 1.6±0.5 (0.4-5.4) | -24.343; **0.000**$^{***}$ |
| Phosphorus (mg/day) | 755.0±231.3 (277.1-1315.5) | 1314.0±477.3 (567.4-4974.4) | -18.366; **0.000**$^{***}$ | 765.7±257.8 (221.9-2051.3) | 1152.1±279.4 (609.3-2379.5) | -14.695; **0.000**$^{***}$ | 760.3±244.6 (221.9-2051.3) | 1246.1±413.7 (567.4-4974.4) | -23.128; **0.000**$^{***}$ |
| Zinc (mg/day) | 6.3±2.3 (2.0-14.0) | 11.1±4.2 (4.2-32.0) | -16.731; **0.000**$^{***}$ | 6.2±2.3 (1.7-13.7) | 9.7±2.7 (4.1-21.9) | -14.313; **0.000**$^{***}$ | 6.2±2.3 (1.7-14.0) | 10.5±3.7 (4.1-32.0) | -21.98; **0.000**$^{***}$ |

*$^{*}$p<0.05, $^{**}$p<0.01, $^{***}$p<0.001, t=Independent samples t-test*

## 4. Discussion

The etiology of type 2 DM is multifactorial. Several different factors are involved, including demographic characteristics, physiological features, lifestyle habits, and genetics. (17). The mean age of the participants was found to be 49.7 years. Most of these individuals were university graduates (38.1%), married (62.2%), residing in urban areas (70.7%), and consulted with a dietitian every month (2.4%). The BMI classification of the individuals in the study was found to be within the normal range. In other studies, there have been differences in the demographic characteristics of the participants, including their education levels, marital status, place of residence, and whether they have consulted with a dietitian. Additionally, there have been variations in the individuals' BMI values (2, 18, 19). The demographic characteristics, anthropometric measurements, and lifestyle factors of individuals with type 2 DM provide an important basis for determining individual needs in diabetes management. For individuals with type 2 DM, their weight status, nutritional status, and consultation with a dietitian are important for their health status. It is therefore recommended that individuals with type 2 DM who aspire to enhance their quality of life should give due consideration to these criteria.

One of the most important factors of a healthy lifestyle is to follow a healthy diet. The recommended approach to managing type 2 DM is to adhere to a regular meal schedule and maintain a diet of high nutritional quality (20, 21). In the study, it was found that 42.8% of the participants with type 2 DM were 'skipping meals'. The main meals skipped were lunch (57.4%), breakfast (31.1%), and dinner (11.5%), respectively. It was determined that the most common reason for skipping main meals was 'lack of time'. Considering skipping snacks, it was found that individuals mostly (53.0%) skipped snacks and the most common snack they skipped was the first snack. The most important reason for skipping snacks was determined as lack of time (37.5%). In another study involving individuals with type 2 DM, it was found that 40.7% of them skipped their main meals. The most frequently skipped main meal in males (78.3%) and females (69.6%) was lunch. In the present study, 37.0% of the females skipped meals to lose weight, while 8.7% of all individuals stated that they skipped meals because they had no appetite (22). Another study involving individuals with type 2 DM showed that the risk of type 2 DM increased 1.2 to 1.3 times in males who skipped breakfast and consumed two main meals a day. The researchers concluded that breakfast consumption has a significant effect on the prevention and control of type 2 DM (23). In studies conducted on the meal skipping status of individuals diagnosed with type 2 DM, it was determined that most of them did not consume three main meals and three snacks regularly. It is therefore imperative that

individuals diagnosed with type 2 DM adopt a diet that is conducive to their health and do not skip meals. It is thought that this approach may contribute to reducing the negative effects of diabetes and helping individuals lead healthier lives.

The emotional stress that occurs during type 2 DM disease significantly affects individuals' treatment compliance processes, glycemic control levels, and general quality of life. These psychological conditions reduce the capacity of an individual to adapt to drug treatment and lifestyle changes, making the management of the disease difficult and increasing the risk of complications (24). According to the PAID scale, 443 male and 541 female individuals had high levels of emotional stress, while 140 male and 217 female individuals had low levels of emotional stress in the study. In another study, according to the PAID scale, 37.3% of the participants had high levels of emotional stress and 62.7% had low levels of emotional stress (25). Integrating not only biological parameters but also psychological support and interventions in the treatment of diabetes increases individuals' commitment to treatment, contributes to the improvement of glycemic control, and contributes significantly to improving the overall quality of life. In this context, multidisciplinary approaches and the implementation of individualized treatment plans are critical to minimize the effects of emotional stress in diabetes management.

Managing macro- and micro-vascular disease risk factors is important to improve prognosis and quality of life in type 2 DM. The principal method for attaining this objective is through the implementation of a DM self-management program, the fundamental element of which is medical nutrition therapy. Therefore, nutritional guidance given by registered dietitians is an effective method, as described in many guidelines worldwide (26). The findings of this study indicate that the mean values of the measurements taken from female subjects with a PAID score of 33 and above were significantly higher than those obtained from female subjects with a PAID score below 33. It can thus be stated that the mean values for energy, protein, carbohydrates, fat, fiber, vitamins A, C, E, B1, B12, sodium, calcium, iron, copper, phosphorus, and zinc are significantly higher in individuals with a PAID score of 33 or above compared to individuals with a PAID score below 33. In a study, it was found that energy intake, protein, carbohydrate, saturated fat and vitamin A intake of individuals with a PAID score of 33 or more were higher than individuals with a PAID score less than 33 ($p<0.01$, $p<0.05$). Furthermore, it was established that there was a positive correlation between energy intake and PAID score, as well as between carbohydrate intake and PAID score ($p<0.01$) (22). In addition to ensuring regular monitoring of individuals with type 2 DM, it is recommended that a comprehensive investigation into the relationship between nutrition and emotional stress may facilitate more effective

glycemic control and provide a valuable opportunity for the development of strategies to enhance the adherence of individuals to nutritional therapy.

## 5. Conclusion

It was determined that the macro and micronutrient intakes of the individuals with a PAID score of 33 and above were significantly higher than those of the individuals with a PAID score below 33. This shows the positive effects of nutritional adequacy on mood. Type 2 DM has become an important public health problem with increasing prevalence worldwide. Nutrition education and medical nutrition therapy for individuals with type 2 DM increase the level of knowledge of patients about disease management and play a critical role in the acquisition of healthy eating habits. Psychological parameters include individuals' ability to adapt to treatment, stress management skills, and the overall quality of life. It is anticipated that the implementation of nutrition education and medical nutrition therapy for individuals diagnosed with type 2 DM will yield favorable outcomes with respect to psychological parameters.

## Acknowledgments

Not applicable.

## Funding

Not applicable.

## Availability of data and materials

The dataset generated and analyzed during the current study is available from the corresponding author upon reasonable request.

## Ethics and consent to participate

This study was performed following the Declaration of Helsinki. Approval for the study was obtained from the Süleyman Demirel University Ethics Commission with the study code no:69/13 on 07.11.2023.

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