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Research Article

Hedonic Hunger in Individuals with Type 2 Diabetes: Associations with Glycemic Control and BMI - A Cross-sectional Study from Türkiye

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Abstract

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia and is frequently accompanied by obesity and altered eating behavior. This cross-sectional study included 90 adults aged 19–64 years with type 2 diabetes in Samsun, Türkiye. Data were collected through face-to-face interviews using a questionnaire and the Power of Food Scale (PFS); body weight and height were measured directly. For each biochemical variable, the most recent laboratory result available within the six months before the PFS assessment was recorded. Most participants were women (n = 56, 62.2%), married (n = 74, 82.2%), and employed (n = 86, 95.6%). Among participants with available laboratory data, median postprandial blood glucose was 155.5 mg/dL (interquartile range [IQR], 119.7–200.7; n = 62), and median HbA1c was 8.0% (IQR, 6.3–10.6; n = 49). Total and subscale PFS scores did not differ significantly across BMI categories (all $p > 0.05$). Significant positive correlations were found between postprandial blood glucose levels and diabetes duration ($\rho = 0.447$, $p < 0.001$) and between blood glucose and HbA1c levels ($\rho = 0.616$, $p < 0.001$). This study found no significant association between hedonic hunger and BMI, but did suggest that longer diabetes duration was associated with higher postprandial blood glucose levels. The limited sample size and missing biochemical data warrant cautious interpretation.

Keywords: Hedonic hunger, Obesity, Type 2 diabetes, Glycemic control, Power of Food Scale.

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1. Introduction

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia resulting from impaired insulin secretion, insulin resistance, or both (Schleicher et al., 2022). Diabetes is influenced by multiple factors, including daily physical activity, dietary habits, and psychological factors (International Diabetes Federation [IDF], 2021). According to the IDF Diabetes Atlas, it is estimated that in 2024, approximately 9.6 million adults aged 20–79 in Türkiye were living with diabetes, and the prevalence of diabetes in this age group was 16.3%. Approximately 45.5% of diabetes cases in this age group remained undiagnosed (IDF, 2025).

Medical nutrition therapy by a dietitian is an important component of diabetes management (American Diabetes Association Professional Practice Committee, 2024). The main goals of this treatment are to achieve and maintain body weight goals, reach individualized glycemic, blood pressure, and lipid goals and delay or prevent the complications of diabetes (American Diabetes Association Professional Practice Committee, 2024; Reynolds & Mitri, 2024). Obesity commonly coexists with type 2 diabetes (Reynolds & Mitri, 2024). Obesity is a complex, multifactorial disease, and a long-term imbalance between energy intake and energy expenditure is one of the primary mechanisms for increased body fat (World Health Organization [WHO], 2026). Today, urban and rural areas encourage people to eat too much and not move much – this is called an "obesogenic" environment. In addition, unhealthy, inexpensive foods that are high in calories are widely available, and there are fewer chances for people to get regular exercise (Ahmed & Mohammed, 2025). Beyond these lifestyle factors, disordered eating behaviors are also considered a significant risk factor for obesity and metabolic health. In particular, disordered eating behaviors such as binge eating and night eating are reported to be associated with increased body weight, obesity, and diabetes (American Diabetes Association Professional Practice Committee for Diabetes, 2026; McCuen-Wurst et al., 2018). In the treatment of people with diabetes, evaluating psychological factors is considered a helpful

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element in understanding the obstacles to achieving glycemic control and in replanning the treatment (American Diabetes Association Professional Practice Committee for Diabetes, 2026; Avcı & Tarı Selçuk, 2016).

Homeostatic mechanisms regulate food intake in response to physiological energy needs (Cifuentes & Acosta, 2022). However, the desire to eat can also occur in the absence of an energy deficit. The desire to eat without physiological hunger is defined as "hedonic hunger." Hedonic hunger refers to food consumption that is not regulated by metabolic feedback and is associated with cognitive, reward, and emotional factors (Ayyıldız et al., 2021; Espel-Huynh et al., 2018). Today, easy access to delicious foods leads individuals to eat not only to meet their energy needs, but often even when they feel full. The motivational processes that occur to consume these foods trigger overeating in a non-homeostatic way (Gündüz et al., 2020).

Evidence on hedonic hunger in individuals with diabetes remains limited. Previous studies have examined its associations with glycemic control and diabetes self-management (Cheung et al., 2018; Çamlı et al., 2026).

This study therefore aimed to evaluate the association between hedonic hunger and indicators of glycemic control in adults with type 2 diabetes, with additional analyses of BMI and diabetes duration.

2. Materials and methods

2.1. Study design and participants

This cross-sectional study included 90 adults aged 19–64 years who attended the Ondokuz Mayıs University Health Practice and Research Center in Samsun, Türkiye between April and September 2024. During the recruitment period, 90 eligible adults with type 2 diabetes who agreed to participate were included in the study. Researchers collected data through face-to-face interviews using a questionnaire including demographic characteristics and the Power of Food Scale. Medication use (yes/no) and its duration were recorded, but specific diabetes treatment modalities and drug classes were not documented.

Available laboratory results included high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), total cholesterol, postprandial blood glucose, HbA1c (%), and triglycerides. For each biochemical variable, the most recent available result within the six months preceding the PFS assessment was recorded.

The study was conducted in accordance with the Helsinki criteria, using a voluntary consent form. Ethical approval for the study was obtained from the Ondokuz Mayıs University Clinical Research Ethics Committee (2023/391).

Inclusion criteria: Having been diagnosed with Type 2 diabetes at least one (1) year ago, and being between 19 and 64 years of age. Exclusion criteria were incomplete questionnaire responses, pregnancy, corticosteroid use, alcohol consumption, and a diagnosis of chronic liver disease, chronic kidney disease, or cancer.

2.2. Data collection

2.2.1. Power of Food Scale

The Power of Food Scale was developed by Lowe et al. (2009) to assess hedonic hunger. The original scale consists of 15 questions. The Turkish version, validated by Ülker et al. (2021), consists of 13 questions and three subscales. Each item is rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). An increased score indicates higher levels of hedonic hunger.

2.2.2. Anthropometric measurements

Body weight was measured with the lightest clothing using a smart scale (TANITA BC-401-WH). Height was measured with a portable height measuring device, with feet side by side and head in the Frankfort plane (Pekcan, 2008). Body mass index (BMI) (kg/m^2) was calculated by dividing body weight by the square of height in meters (body weight (kg) / [height (m)]^2) (WHO, 1995). According to the World Health Organization (WHO, 2000), individuals were classified as underweight (BMI < 18.50 kg/m^2), normal weight (18.50–24.99 kg/m^2), overweight (25.00–29.99 kg/m^2), and obesity (BMI ≥ 30 kg/m^2).

2.3. Statistical Analyses

Continuous variables were assessed for normality. Non-normally distributed continuous data are presented as medians and interquartile ranges (IQRs), and categorical data as frequencies and percentages. The Mann–Whitney U test was used for comparisons between two independent groups, and the Kruskal–Wallis test for comparisons among three or more independent groups. Categorical variables were compared using the chi-square test. A two-sided p-value < 0.05 was considered statistically significant. The internal consistency of the Power of Food Scale (PFS) was assessed using Cronbach's alpha. In the present study, Cronbach's alpha was 0.670, indicating modest internal consistency. All statistical analyses were performed using IBM SPSS Statistics version 22.0 (IBM, Armonk, NY, USA).

3. Results

The sociodemographic characteristics of the participants are presented in Table 1. The study included 90 participants, with a median age of 56.0 years (IQR: 50.0–62.25). The majority of participants were female (n=56, 62.2%), married (n=74, 82.2%), and employed (n=86, 95.6%). Primary school was the most frequently reported educational level (n=53, 58.9%), followed by high school (n=18, 20.0%) and a bachelor's degree or higher (n=11, 12.2%). Most participants reported an income level equal to their expenditures (n=65, 72.2%).

Table 1. Sociodemographic Characteristics of the Participants

Characteristics	*n (%)*
Gender	
Female	56 (62.2%)
Male	34 (37.8%)
Educational status	
Literate	8 (8.9%)
Primary school	53 (58.9%)
High school	18 (20.0%)
Bachelor's degree or higher	11 (12.2%)
Working status	
Unemployed	4 (4.4%)
Employed	86 (95.6%)
Income	
Less than expenditures	12 (13.3%)
Equal to expenditures	65 (72.2%)
Higher than expenditures	13 (14.4%)
Marital status	
Married	74 (82.2%)
Single	16 (17.8%)
Age (years), median (IQR)	56.00 (50.00-62.25)

n: number, IQR: Interquartile range

Table 2. Clinical and Biochemical Characteristics of Participants

Parameters	*Median (IQR)*
Diabetes duration (years)	10.0 (5.0-15.0)
Blood glucose (n = 62)	155.5 (119.7-200.7)
HbA1c (n = 49)	8.0 (6.3-10.6)
Total cholesterol (n = 43)	204.0 (149.0-234.0)
HDL (n = 43)	44.0 (35.0-50.0)
LDL (n = 42)	124.5 (74.5-145.0)
TG (n = 43)	171.5 (141.0-232.0)
Diabetes-related complications	*n (%)*
Yes	30 (33.3)
No	60 (66.7)
Total	90 (100)
*Type of diabetes-related complications**	
Retinopathy	22 (73.3)
Nephropathy	2 (6.6)
Neuropathy	3 (9.9)
Cardiovascular disease	2 (6.6)
Retinopathy + nephropathy	1 (3.3)
Total	30 (100)

Data are presented as median (IQR) or n (%). The number of participants varies for biochemical parameters because of missing laboratory data. IQR, interquartile range; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglycerides.
*Among participants with diabetes-related complications (n=30).

Clinical and biochemical characteristics of the participants are presented in Table 2. The median duration of diabetes was 10.0 years (IQR: 5.0–15.0). Among participants with available laboratory data, the median blood glucose level was 155.5 mg/dL (IQR: 119.7–200.7; n=62), while the median HbA1c level was 8.0% (IQR: 6.3–10.6; n=49). The median levels of total cholesterol, HDL-C, LDL-C, and triglycerides were 204.0 mg/dL (IQR: 149.0–234.0; n=43), 44.0 mg/dL (IQR: 35.0–50.0; n=43), 124.5 mg/dL (IQR: 74.5–145.0; n=42), and 171.5 mg/dL (IQR: 141.0–232.0; n=43), respectively. Diabetes-related complications were reported in 30 participants (33.3%). Among participants with complications, retinopathy was the most common complication (n=22, 73.3%).

The PFS scores, postprandial blood glucose, and HbA1c levels according to BMI categories are presented in Table 3. There were no statistically significant differences among the normal-weight, overweight and obesity groups in food available (H=0.725, p=0.696), food present (H=2.228, p=0.328), food taste (H=1.007, p=0.604), or total PFS scores (H=0.500, p=0.779). Similarly, postprandial blood glucose (H=2.819, p=0.244) and HbA1c levels (H=0.743, p=0.690) did not differ significantly across BMI categories.

Postprandial blood glucose was positively correlated with diabetes duration ($\rho = 0.447$, $p < 0.001$; n = 62) and HbA1c ($\rho = 0.616$, $p < 0.001$; n = 48) (Table 4). PFS scores were not significantly correlated with postprandial blood glucose ($\rho = 0.236$, $p = 0.065$; n = 62) or HbA1c ($\rho = 0.195$, $p = 0.179$; n = 49).

Table 3. Comparison of PFS Scores, Blood Glucose, and HbA1c Across BMI Categories

Parameters	*BMI groups*			*H*	*p*
	Normal weight (n = 15)	*Overweight (n = 25)*	*Obesity (n = 50)*		
Food available	2.75 (1.75-3.75)	2.50 (2-3.5)	2.75 (2-3.5)	0.725	0.696
Food present	2.50 (1.75-3.75)	3.00 (2.5-3.25)	3.00 (2.5-3.5)	2.228	0.328
Food taste	3.20 (2.80-4.20)	3.20 (2.4-3.6)	2.80 (2.6-3.6)	1.007	0.604
PFS	2.90 (2.18-3.58)	2.83 (2.53-3.20)	2.98 (2.53-3.3)	0.500	0.779
Postprandial blood glucose (mg/dL) (n = 62)	181.0 (134.0-304.0)	134.0 (114.0-193.0)	151.0 (120.0-189.0)	2.819	0.244
HbA1c (%) (n = 49)	8.0 (6.0-11.0)	7.0 (6.0-11.0)	8.0 (7.0-11.0)	0.743	0.690

Data are presented as medians (interquartile ranges [IQRs]). Comparisons were performed using the Kruskal–Wallis test (df = 2); p-values are based on asymptotic significance. Sample sizes for postprandial blood glucose and HbA1c were smaller because of missing laboratory data. PFS, Power of Food Scale; HbA1c, glycated hemoglobin. A p-value <0.05 was considered statistically significant.

Table 4. Correlations among diabetes duration, postprandial blood glucose, HbA1c, PFS scores, and BMI

Variables	*Spearman's ρ*	*p-value*	*n*
Diabetes duration–Postprandial blood glucose	0.447**	<0.001	62
Diabetes duration–HbA1c	0.129	0.379	49
Diabetes duration–PFS score	0.063	0.558	90
Diabetes duration–BMI	−0.026	0.810	90
Postprandial blood glucose–HbA1c	0.616**	<0.001	48
Postprandial blood glucose–PFS score	0.236	0.065	62
Postprandial blood glucose–BMI	−0.146	0.257	62
HbA1c–PFS score	0.195	0.179	49
HbA1c–BMI	0.017	0.905	49
PFS score–BMI	−0.003	0.981	90

Spearman's rank correlation coefficients (ρ) are reported. All p-values are two-tailed. ** p < 0.01. Sample sizes (n) represent the number of participants with available data for both variables in each analysis. HbA1c, glycated hemoglobin; PFS, Power of Food Scale; BMI, body mass index.

4. Discussion

The main findings of this study were significant positive correlations between diabetes duration and blood glucose levels and between blood glucose and HbA1c levels, whereas hedonic hunger was not significantly associated with BMI, diabetes duration, blood glucose, or HbA1c.

Obesogenic food environments provide frequent exposure to highly palatable and high-calorie foods. Individual differences in responsiveness to these cues may contribute to susceptibility to excessive weight gain and efforts to control body weight (Espel-Huynh et al., 2018). Weight gain related to consumption of palatable and high-calorie foods is associated with the development of health problems related to diet, such as type 2 diabetes, heart disease, and high blood pressure (Ahmed & Mohammed, 2025). In a study from Türkiye, a weak positive correlation was found between hedonic hunger, assessed using the PFS, and BMI (r=0.157; p=0.003) among university students (Akçil Ok & Hayzaran, 2020). Lipsky et al. (2019) reported no consistent relationship between PFS scores and weight outcomes. These results suggest that there may be conflicting findings in the literature regarding the relationship between PFS and BMI. Similarly, Espel-Huynh et al. (2018) reported mixed findings regarding the association between hedonic hunger and BMI. These findings provide context for the nonsignificant correlation between PFS scores and BMI observed in the present study. Nevertheless, it should not be interpreted as evidence that hedonic hunger has no relevance to body weight. Eating behavior is multifactorial, and unmeasured factors, sample characteristics, and measurement imprecision may contribute to differences across studies.

Controlling appetite and identifying its influencing factors is a crucial building block for glycemic management and weight control in individuals with diabetes (Cheung et al., 2018). Patients with type 2 diabetes and obesity might experience overeating due to a desire to consume palatable foods without hunger, suggesting the effect of hedonic hunger (Cheung et al., 2018; Çamlı et al., 2026). Recognizing the characteristics of these interactions might help prevent overeating and manage hedonic hunger (Cheung et al., 2018). Cheung et al. (2018) found that higher PFS scores were associated with higher HbA1c levels and poorer glycemic control in patients with type 2 diabetes and obesity, while these associations were not observed in patients with normal BMI. More recently, a Turkish study involving 400 adults with type 2 diabetes reported that higher hedonic hunger was associated with greater digital obesity and poorer diabetes self-management, with digital obesity partially mediating this association (Çamlı et al., 2026). These studies differ in their populations and outcomes, limiting direct comparisons with the present findings.

5. Conclusion

The prolonged duration of diabetes, associated with impaired glycemic control, indicates the need for effective disease management and medical nutrition therapy in individuals with chronic diabetes. In this cross-sectional sample, hedonic hunger scores were not significantly correlated with postprandial blood glucose or HbA1c. However, the limited sample size, missing laboratory data, and potential confounding by factors not accounted for in the analyses limit interpretation. Further studies with larger samples, complete biochemical data, and adjustment for potential confounders are warranted.

6. Strengths and limitations

This study provides important data for the research of diabetes and hedonic hunger, which have been studied in limited areas. Furthermore, the face-to-face data collection and the fact that anthropometric measurements were taken by the researcher are strengths of the study. The small sample size and the exclusion of potential confounding variables from the study design are limitations. Biochemical

data were available for only a subset of participants, reducing the sample sizes and statistical power of the corresponding analyses. Participants with and without available laboratory results were not compared; therefore, systematic differences between these groups and bias associated with missing data cannot be excluded. Furthermore, the correlation analyses were not adjusted for potential confounders, including age, sex, BMI, and diabetes duration. The absence of statistically significant correlations should therefore not be interpreted as evidence of no relationship between hedonic hunger and glycemic control. Laboratory measurements obtained within the preceding six months were also not necessarily concurrent with the PFS assessment, which may have affected the observed associations.

Declarations

Competing Interests

The authors declare that they have no financial or non-financial competing interests.

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Ethics Statement

The study was conducted in accordance with the Helsinki criteria, using a voluntary consent form. Ethical approval for the study was obtained from the Ondokuz Mayıs University Clinical Research Ethics Committee (2023/391).

Data Availability Statement

Data are available from the corresponding author upon reasonable request.

AI Statement

ChatGPT (OpenAI) tools were used only in a limited and controlled manner for language editing. All content was reviewed and approved by the authors.

Author Contributions

B. Söylemez-Yavuz: Methodology, Investigation, Writing, Review and Editing

M. S. Macit-Çelebi: Conceptualization, Methodology, Investigation, Data Provision, Writing, Review and Editing, Supervision.

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