The Role of Hedonic Hunger as a Moderator and Mediator in Older Adults Obesity

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Abstract |

Objective: In the modern age, the pursuit of food is now a means of pleasure and of satisfying hunger. This study examined the role of hedonic hunger and eating behaviors on obesity in older adults.

Materials and Methods: This cross-sectional study was conducted on 400 older adults. The nutrition information system (BeBiS), bioelectrical impedance analysis, power of food scale-Turkish version (PFS-Tr), and Dutch eating behaviour questionnaire (DEBQ) were used to evaluate the subjects.

Results: The mean age of 400 people included in the study was 67.82 ± 2.77 years. It was found that the moderator effect of the interaction of daily energy intake and hedonic hunger behaviour (PFS-Tr) on the waist-to-hip ratio was significant. In particular, the regulatory effect of low hedonic hunger scores (PFS-Tr) was significant (p=0.019) and the waist-to-hip ratio decreased as the scores obtained from the scale decreased. The mediator effect of the restrained eating (ResE) sub-dimension (DEBQ) between the average daily energy intake and body fat mass was significant (estimate =0.221, p=0.021), and an increase in ResE behavior scores resulted in an increase in body fat mass. It was found that 89.4% of the effect of ResE behaviour on body fat mass was direct and large. There was a weak positive correlation between the average daily energy intake and food available subscale of PFS-Tr (r=0.157) and food present subscale (r=0.017). Total daily energy intake had a direct effect on body fat mass (estimate =0.008, p=0.005).

Conclusion: The results of our study support a positive relationship between hedonic hunger and abdominal obesity in older adults. Decreased ResE behaviour increases the whole-body fat mass. Evaluation of hunger and implementation of programmes that support ResE behaviour may be useful in controlling obesity and its negative consequences in older adults.

Keywords: Hedonism, obesity, hunger aging, geriatrics

Introduction

To a great extent, the history of humanity witnessed man's pursuit of food to maintain energy balance and to survive by preventing hunger. However, in societies of today that have easy access to food, food consumption may occur for reasons other than energy deficiency (1). Hedonic hunger can be defined as a person's interest in food for pleasure and the desire to consume it, although there is no physical hunger (2). The global dimension of obesity is gradually increasing, and food consumption shows an increasing trend toward pleasure and not only because of calorie need (3). There is evidence that obese individuals prefer and consume more tasteful foods than normal-weight individuals (3).

The combination of the obesity epidemic and aging raises concerns. Because there is no consensus on age-related physiological changes, there are uncertainties in the

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intervention. It has been shown that calorie restriction and/ or dietary modification may have favorable effects on obese older adults (4). Adequate and balanced dietary content is of great importance in combating obesity by reducing the risk of diseases that increase with ageing (4). Frequent and excessive consumption of tasteful foods because of hedonic hunger may lead to many diseases such as eating disorders, obesity, hypertension, diabetes mellitus, cardiovascular diseases, nonalcoholic fatty liver disease, obstructive sleep apnea, and some types of cancer (5). Our study investigated the relationship between dietary content, hedonic hunger behavior, and obesity in older adults.

Materials and Methods

Type, location, and time of the study

This cross-sectional study was conducted on individuals over 65 years of age and older who applied to the endocrinology outpatient clinic of Malatya Training and Research Hospital in 2023. Permission for this study was obtained from the Malatya Clinical Research Ethics Committee (approval number: E-23536505-619-221990829, date: 11.08.2023).

Sample size

The sample size analysis with a power of 95%, a confidence interval of 1%, and an effect size of 0.1 yielded 391 as the minimum number of participants to be reached, rounded to 400. Consent forms were obtained for individuals who accepted to participate in the study among those fulfilling the inclusion criteria.

Study exclusion criteria

People under 65 years of age, those who have any organic eating disorder, recent surgery, psychiatric illness, dementia, chronic kidney disease, heart failure, and those who follow a certain diet were excluded from the study.

Dietary content analysis

A sociodemographic questionnaire form was applied to the individuals who applied to the outpatient clinic, and they were then asked to record the nutrition information form for two weekdays and one weekend day in a period of one week. A 3-day, 24-hour reminder method was used to assess food intake at home. How to keep the records and which days to fill in the forms were explained in detail. Completed nutrition record forms were obtained directly from the patient. Nutritional values for three days were calculated using the nutrition information system (BeBiS) software (6), which is coded for analyzing the nutritional content of foods and meals based on the data provided in the dietary record forms. The average amounts of carbohydrate, fat, protein (in grams and %), and daily energy (kilocalories) were calculated.

Bioelectrical impedance analysis

Body composition analyses were performed using the body composition analyzer BC-420MA device with metabolic measurements when the participants submitted their nutrition forms. The working principle of the device is bio-impedance measurement, consisting of comparing the input and output values of 50 kHz electric current sent to the body through foot electrodes and received by hand electrodes.

Power of food scale-Turkish version (PFS-Tr)

The power of food scale was developed by Lowe et al. (7) to assess the psychological impact of living in food-abundant environments, in other words, the evaluation of hedonic hunger status. It measures appetite for, rather than consumption of, palatable foods at three levels of food proximity [food available (FA), food present (FP), and food tasted (FT)]. The Turkish validity and reliability of the scale, i.e., PFS-Tr scale were determined by Ülker et al. (8). The scale consists of 13 items categorized into three subscales. The first one is the FA subscale, which assesses general thoughts about palatable food that is available but not physically present (items 1,2,9,10). The second subscale, the FP subscale, consists of items assessing the attractiveness of food that the individual has direct access to; i.e., palatable food is physically present but not tasted yet (items 3,4,5 and 6). The third subscale, the FT subscale, includes items that assess the desire/pleasure obtained from food when it is first tasted but not consumed yet (items 7,8,11,12 and 13). At the end of the evaluation, four scores were obtained as three subscale scores and one total scale score. Total and subscale scores were obtained by summing the related item scores and dividing by the number of related items. An increase in the score indicates a higher predisposition to hedonic hunger (8). PFS-Tr is not only a measure of the food environment but also measures individual differences in appetite-related thoughts, feelings, and desires in environments where palatable foods are abundant and continuously available. Beyond physiological needs, this approach defines an appetite model that shows individual differences in motivation to eat, and the presence of palatable food would further increase food consumption (9).

Dutch eating behaviour questionnaire (DEBQ)

DEBQ, a hedonic hunger scale, was first developed to evaluate eating behaviour by Van Strien et al. (10) in 1986. The Turkish validity and reliability of the scale were determined by Bozan et al. (11). The scale consists of three subscales evaluating emotional eating (EmoE) behaviour (e.g., do you eat sweets when you are unhappy?), externally induced eating (ExtE) behaviour (if the smell of what you eat is very good, do you eat more than you normally eat?) and restrained eating (ResE) behaviour (do you eat less than you want to eat to avoid getting fat?). The first 10 questions in the questionnaire are in the ResE subscale, questions 11-23 are in the EmoE subscale, and questions 24-33 are in the ExtE subscale. The total score of the questionnaire

Statistics

IBM SPSS Statistics 22 (SPSS, Inc., Chicago, IL, USA) and Jamovi ver.2.3.28 (12) software were used for data analysis. The Kolmogorov-Smirnov test was used to test the normality of the distribution test. Parametric tests were used in the analysis of normally distributed data, whereas non-parametric tests were used in the analysis of data that did not fit the normal distribution. The data were analyzed using the t-test, Mann-Whitney U test, Spearman and Pearson correlation analysis, chisquare test, binary logistic regression, moderation effect, and mediation effect analysis. The effect size was evaluated using the rank biserial correlation coefficient (with 0.10 indicating a small, 0.30 a medium, and 0.50 or greater a large effect size). Mediation analyses were performed using structural equation modeling path analysis in Jamovi. Direct and indirect effect coefficients (estimates) were accepted as low effect if close to 0.01, medium effect if close to 0.09, and high effect if close to 0.25 (13). p<0.05 was considered statistically significant.

Results

The mean age of 400 older adults included in the study was 67.82 ± 2.77 (min:65-max:80). The male-to-female ratio was 58:42, and 50% of the participants were obese. Participants with a value of body mass index (BMI) >18.5kg/m² and <30 kg/m² were accepted as "normal BMI", while those with BMI \geq 30 kg/m² were accepted as "obese BMI" or shortly "obese" (14). No significant difference was found between the age and comorbidity distributions of the patients according to the BMI categories. Obese patients were more common in women (Table 1).

The total daily dietary energy intake was significantly higher in obese individuals than in individuals with normal BMI, and the effect size was moderate. It was found that fat consumption was significantly higher in obese individuals, and the effect size was low (Table 2).

When the correlations between hedonic hunger behaviour,

Table 1. Characteristics of participants according to age, sex, and comorbidities							
	BMI groups (Mean ± SD or n)						
Characteristics	Obese* (n=200)	Normal* (n=200)	p-value				
Age	67.77±2.57	67.50±4.42	0.657				
Sex (male/female)	62/138	106/94	0.002**				
Chronic disease (yes/no)	196/4	194/6	0.844				
Hypertension (yes/no)	138/62	118/82	0.141				
Diabetes mellitus (yes/no)	154/46	126/74	0.061				
Cardiovascular diseases (yes/no)	16/184	32/168	0.082				
COPD or asthma (yes/no)	28/172	14/186	0.166				
Cancer (yes/no)	1/199	8/192	0.369				
Rheumatological disease (yes/no)	14/186	12/188	1.000				
*Normal BMI: 18.5 kg/m ² < BMI <30 kg/m ² , obese BMI: BMI ≥30 kg/m ² , **Statistically significant difference							

BMI: Body mass index, SD: Standard deviation of the mean, COPD: Chronic obstructive pulmonary disease

Table 2. Comparison of the dietary content according to the presence of obesity								
Obesity								
Obese BMI Normal BMI								
Nutrient content	Median (IQR)	Median (IQR)	p-value	Effect size				
Energy (kcal)	1330 (374.5)	1131 (348.3)	<0.001*	0.385				
Protein (g)	45 (17.8)	48.9 (17)	0.406	0.067				
Percent protein (%)	15 (6)	16 (7)	0.070	0.147				
Fat (g)	58.4 (25.5)	53.5 (27)	0.006*	0.206				
Percent fat (%)	43 (12.8)	42.5 (13.8)	0.789	0.039				
Carbohydrate (g)	119 (55.9)	115 (36.8)	0.334	0.093				
Percent carbohydrate (%)	43 (13)	42 (14)	0.315	0.002				
Fibre (g)	17.8 (8.1)	16.35 (11.2)	0.133	0.255				
*Statistically significant difference								

IQR: Interquartile range, g: Gram, kcal: Kilocalories

eating behaviour and the main food groups in the diet were examined, no correlation was found between behaviours and the amount of carbohydrates or fat taken daily. EmoE subscale scores of DEBQ showed a positive correlation with daily protein intake but a weak negative correlation with fibre intake; i.e. conditions with emotional effects led to higher protein intake but lower fibre-rich food intake. Regarding PFS-Tr, average daily energy intake showed a weak positive correlation with the FA and FP subscale scores of PFS-Tr, whereas fat intake showed a weak positive correlation with only the FP subscale scores (Table 3).

When the correlations between hedonic hunger behavior, eating behavior, and body composition were examined, the ResE subscale score of DEBQ was found to show a weak positive correlation with both body fat mass and body fat percentage; i.e., ResE behavior led to an increase in body fat. The FA subscale score of PFS-Tr showed a weak positive correlation with muscle mass; i.e., when palatable food was available but not physically present, muscle mass increased. The waist-to-hip ratios showed a weak negative correlation with EmoE and ExtE subscale scores of the DEBQ scale; i.e., conditions with emotional effects and external factors such as attractive smell of the food etc. led to a decrease in the waist-to-hip ratio (Table 4).

When the mediator effect of the DEBQ subscales between average daily energy intake and body fat mass was analyzed, it was found that only ResE behaviour had a significant direct effect (path a) on body fat mass, comprising 89.4% of the total effect of ResE on body fat mass increase (p=0.021), i.e. an increase in ResE subscale scores of the DEBQ scale resulted in an increase in body fat mass, and this effect was found to be large (Table 5, Figure 1).

The total score of the PFS-Tr had a significant regulatory effect on the relationship between daily energy intake and waist-tohip ratio, and the effect of the interaction of daily energy intake and PFS-Tr on the waist-to-hip ratio was significant (Table 6, Figure 2).

While the regulatory effect of high scores obtained from the scale was not significant (p=0.996), the regulatory effect of low scores was significant (p=0.019) and the waist-to-hip ratio was observed to decrease as the scores obtained from the scale decreased (Figure 3).

Table 3. Correlations between dietary content and subscale scores of DEBQ and PFS-Tr scales									
Subscales (Scale)	Energy (kcal)	Protein (g)	Protein (%)	Fat (g)	Fat (%)	Carbohydrate (g)	Carbohydrate (%)	Fibre (g)	
ResE (DEBQ)	-0.069	-0.087	0.029	-0.010	0.044	-0.054	-0.060	0.080	
EmoE (DEBQ)	-0.028	0.177*	0.155*	0.033	0.021	0.083	-0.080	-0.186*	
ExtE (DEBQ)	0.12	0.115	-0.018	0.117	0.079	0.056	-0.037	-0.011	
FA (PFS-Tr)	0.157*	0.007	-0.117	0.077	0.010	0.041	0.032	0.067	
FP (PFS-Tr)	0.017*	0.410	0.054	0.012*	0.011	0.020	0.036	-0.113	
FT (PFS-Tr)	0.115	-0.009	-0.057	0.038	-0.023	0.079	0.049	0.105	
Total score (PFS-Tr)	0.117	-0.026	-0.106	0.047	-0.008	0.077	0.058	0.042	

*p<0.05, **p<0.01, ***p<0.001

DEBQ: Dutch eating behaviour questionnaire, PFS-Tr: Power of food scale-Turkish version, ResE: Restrained eating subscale score of DEBQ, EmoE: Emotional eating subscale score of DEBQ, ExtE: Externally induced eating subscale score of DEBQ, FA: Food available subscale score of PFS-Tr, FP: Food present subscale score of PFS-Tr, FT: Food tasted subscale score of PFS-Tr, g: Gram, kcal: Kilocalories

Table 4. Correlations between body composition and subscale scores of the DEBQ and PFS-Tr scales								
	ResE	EmoE	ExtE	FA	FP	FT	Total score	
	(DERO)	(DERG)	(DERG)	(PFS-II)	(PFS-Tr)	(PFS-Tr)	(PFS-Ir)	
Body mass index (BMI)	0.103	-0.104	-0.081	0.038	0.014	-0.022	0.021	
Waist-to-hip ratio	0.092	-0.154*	-0.160*	0.012	0.060	-0.063	-0.006	
Body fat (%)	0.174*	-0.078	-0.069	0.047	0.056	0.030	0.055	
Body fat mass (kg)	0.141*	-0.097	-0.051	0.070	0.050	-0.053	0.023	
Lean body (%)	0.109	-0.056	0.028	0.023	-0.010	0.012	0.010	
Muscle mass (kg)	-0.094	-0.060	0.067	0.151*	0.012	-0.025	0.051	
Internal organ adiposity	0.013	-0.010	0.014	0.074	0.108	-0.058	0.046	

*p<0.05,**p<0.01,***p<0.001

DEBQ: Dutch eating behaviour questionnaire, PFS-Tr: Power of food scale-Turkish version, ResE: Restrained eating subscale score of DEBQ, EmoE: Emotional eating subscale score of DEBQ, ExtE: Externally induced eating subscale score of DEBQ, FA: Food available subscale score of PFS-Tr, FP: Food present subscale score of PFS-Tr, FT: Food tasted subscale score of PFS-Tr, kg: Kilogram

Table 5. Mediation estimates of restrained eating on body fat mass									
Mediation effect	Paths in figure 1	Mediation estimates*	SE	95% Cl	Z	p-value	Mediation %		
Indirect	axb	-0.0263	0.0211	0.06763-0.0150	-1.25	0.212	10.6		
Direct	с	0.2214	0.0956	0.03390-0.4088	2.31	0.021	89.4		
Total	c+a×b	0.1951	0.0970	0.00486-0.3853	2.01	0.044	100.0		
*Estimates: 0.01: Small, 0.01-0.09: Medium, 0.09-0.025: Large effect									

SE: Standard error of mediates, CI: Confidence interval

Table 6. Moderation estimates of energy intake and power of food scale on waist-to-hip ratio								
		95% Cl						
	Estimate	SE	Lower	Upper	Z	p-value		
Energy intake	-7.66e-5	3.83e-5	-1.52e-4	-1.46e-6	-1.998	0.046*		
PFS-Tr	0.00394	0.00484	-0.00555	0.0134	0.814	0.416		
Energy * PFS-Tr	3.79e-5	1.89e-5	8.90e-7	7.49e-5	2.007	0.045*		
*Statistically significant difference								

*Statistically significant difference

CI: Confidence interval, PFS-Tr: Power of food scale-Turkish version, SE: Standard error of mediates



Figure 1. Path estimates of the mediation between restricted eating and body fat mass



Figure 2. Moderation estimates of energy intake and power of food scale on waist-to-hip ratio





Name: Power of food scale scores, Low estimate: p=0.019, High estimate: p=0.996, Average: p=0.048, SD: Standard deviation of the mean. The graphic shows the effect of the predictor (energy intake) on the dependent variable (waist-to-hip ratio) at different levels of the moderator (power of food scale-Tr)

Discussion

Obesity is a condition mediated by complex neuronal and hormonal systems resulting from gene-environment interactions (15). Overeating behavior is important in the emergence of obesity, and food sensitivity among individuals may affect this condition. These may lead to the emergence of different tendencies toward obesity (16). Frequent consumption of highenergy and tasty foods in the absence of energy needs may trigger overeating behavior (17). Although hedonic differences associated with obesity have been reported, a strong relationship between BMI and hedonic hunger has not been shown (18). In our study, the relationship between hedonic hunger behavior and obesity in older adults was examined. There was a weak positive correlation between "EmoE" behavior (DEBQ) and daily protein intake, a weak positive correlation between "FA" subscale (PFS-Tr) and average daily energy intake, and a weak positive correlation between "FP" subscale (PFS-Tr) and energy and fat intake. There was a weak positive correlation between "ResE" behaviour (DEBQ) and body fat percentage and fat mass and a weak positive correlation between the FA subscale (PFS-Tr) and muscle mass. There was a mediating effect of ResE behaviour (DEBQ) between average daily energy intake and body fat mass, with impaired ResE resulting in an increase in body fat mass. When the relationship between daily energy consumption and waist-to-hip ratio was examined, it was found that the regulatory effect of low scores obtained from the PFS-Tr scale was significant, and as the scores obtained from the scale decreased (as hedonic hunger behaviour decreased), the waist-to-hip ratio decreased.

In the study by Ribeiro et al., (18) a weak positive relationship was found between the hedonic hunger score and BMI. A relationship was found between the FP subscale and obesity, and each unit increase in FP scores increased the risk of obesity approximately 2-fold (Odds ratio: 2.1). In a study conducted on young adults in the United States of America, the relationship between hedonic hunger and weight and dieting behaviors was examined. No relationship was found between weight and hedonic hunger, whereas a positive relationship was found between frequency of dieting, FP and FA sub-dimensions of the hedonic hunger scale and total score. High scores obtained from the hedonic hunger scale were found to be associated with more dieting cross-sectionally, but it was reported that it was not a good indicator of weight gain and dieting in the long term (19). In the study conducted by Dikyol et al., (20) it was found that the risk of being overweight/obese was higher in women who showed eating behavior even when full. The relationship between high food sensitivity and obesity is associated with unfavorable physical, social, and psychological outcomes. In the study conducted by Cappelleri et al., (9) a weak positive relationship was found between BMI and hedonic hunger sub-dimensions, and it was reported that the risk of obesity increased between 1.6 and 2.3 times as the scores obtained from the hedonic hunger scale increased. In the study conducted by Vainik et al., (21) the relationship between eating behaviors and obesity in women was examined, and the findings reflected the same basic feature: that uncontrolled eating behavior was related to weight. It was emphasised that the neurobehavioural characteristics associated with obesity should be better understood. In the study conducted by Schultes et al., (22) it was found that obese patients had a significant increase in appetite for palatable foods and that patients who underwent gastric bypass surgery had lower scores in the sub-dimension

of "FT" of PFS. The occurrence of this difference in patients after surgery shows the importance of excessive appetite in the pathophysiology of obesity.

Appelhans et al. (23) tested the interaction between palatable food, reward sensitivity, and inhibition control in overweight and obese women. They found that high palatable food reward sensitivity predicted greater consumption of palatable food at low levels of inhibition control but was not associated with food intake at high levels of inhibition control. The findings support a model between palatable food reward sensitivity and overeating, and it was emphasised that overeating was triggered when there was insufficient inhibition in the control. Burger et al. (24) reported that hedonic hunger was not a significant predictor of weight gain, but individuals reporting high hedonic hunger showed increased neuronal and perceptual responses to palatable foods, were more motivated to consume such foods, and were more likely to overeat. In the study by Witt et al., (25) the effect of hunger and exposure to palatable foods on hedonic appetite was evaluated. It was found that "ExtE" and "ResE" behaviours had no effect on hedonic hunger under hunger and food exposure conditions. Hedonic hunger represented a relatively constant structure that was not significantly affected by daily hunger changes. In our study, it was found that the mediator effect between ResE behavior and average daily energy intake and body fat mass was significant, and impairment in ResE resulted in an increase in body fat mass. In the literature, the relationships between hedonic hunger and weight were not consistent in studies conducted in different sexes, ages, and populations. A strong and positive relationship between hedonic hunger and obesity was not clearly demonstrated. The difference between our study and other studies was that it was one of the rare studies examining the relationship between hedonic hunger and obesity among older adults. The results of our study indicated a relationship between hedonic hunger and abdominal obesity. In particular, low hedonic hunger scale scores had a strong regulatory effect on abdominal obesity. ResE had a direct effect on body fat mass as a mediator and resulted in an impairment in ResE scores with an increase in fat mass.

Study Limitations

The strength of our study was that it was one of the rare studies investigating the relationship between hedonic hunger and obesity in older adults, while its limitations were that it was a single-center, hospital-based study.

Conclusion

The results of our study support a positive relationship between hedonic hunger and abdominal obesity in older adults. A decrease in restrictive eating behavior increased whole-body fat mass. There was a positive correlation between average daily energy intake and FA and a positive correlation between FP and energy and daily fat intake. Total daily energy intake had a direct effect on the amount of body fat. In older adults, after a good clinical evaluation, assessment of hyperhedonic hunger and implementation of programs that support restrictive eating behaviour may be useful in controlling obesity and its negative consequences.

Ethics

Ethics Committee Approval: Permission for this study was obtained from the Malatya Clinical Research Ethics Committee (approval number: E-23536505-619-221990829, date: 11.08.2023).

Informed Consent: Informed consent was obtained from all participants.

Authorship Contributions

Concept: B.M., L.K., H.D., C.K.Ş., E.D.M., E.B., Design: B.M., L.K., H.D., C.K.Ş., E.D.M., E.B., Data Collection or Processing: L.K., Analysis or Interpretation: B.M., H.D., Literature Search: B.M., L.K., H.D., C.K.Ş., Writing: B.M., L.K., H.D., C.K.Ş., E.D.M., E.B.,

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References

- Herman CP, Fitzgerald NE, Polivy J. The influence of social norms on hunger ratings and eating. Appetite 2003;41:15-20.
- Herman C, Polivy J. Normative influences on food intake. Physiol Behav 2005;86:762-772.
- Lowe MR, Butryn ML. Hedonic hunger: A new dimension of appetite? Physiol Behav 2007;91:432-439.
- Bales CW, Porter Starr KN. Obesity Interventions for Older Adults: Diet as a Determinant of Physical Function. Advances in Nutrition 2018;9:151–159.
- Gunduz N, Akhalil M, Sevgi EN. Hedonik açlık (Hedonic Hunger). Izmir Democracy University Health Sciences Journal 2020;3:80-96.
- Bebis. BeBiS Ver.9 (Nutritional Information System). Ümraniye, İstanbul, Türkiye, https://bebis.com.tr/anasayfa (2021, accessed 7 October 2023).
- Lowe MR, Butryn ML, Didie ER, Annunziato RA, Thomas JG, Crerand CE, Ochner CN, Coletta MC, Bellace D, Wallaert M, Halford J. The Power of Food Scale. A new measure of the psychological influence of the food environment. Appetite 2009;53:114-118.
- Ulker I, Ayyildiz F, Yildiran H. Validation of the Turkish version of the power of food scale in adult population. Eat Weight Disord 2021;26:1179-1186.

- Cappelleri JC, Bushmakin AG, Gerber RA, Leidy NK, Sexton CC, Karlsson J, Lowe MR. Evaluating the Power of Food Scale in obese subjects and a general sample of individuals: development and measurement properties. Int J Obes 2009;33:913-922.
- Van Strien T, Frijters JER, Bergers GPA, Defares PB. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. International Journal of Eating Disorders 1986;5:295–315.
- Bozan N, Bas M, Asci FH. Psychometric properties of Turkish version of Dutch Eating Behaviour Questionnaire (DEBQ). A preliminary results. Appetite 2011;56:564–566.
- 12. Jamovi Org. The jamovi project 2023.
- Preacher KJ, Kelley K. Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. Psychol Methods 2011;16:93-115.
- 14. W.H.O. Obesity and overweight. 2021.
- Karatsoreos IN, Thaler JP, Borgland SL, Champagne FA, Hurd YL, Hill MH. Food for Thought: Hormonal, Experiential, and Neural Influences on Feeding and Obesity. The Journal of Neuroscience 2013;33:17610-17616.
- Felsted JA, Ren X, Chouinard-Decorte F, Kucuk DM. Genetically Determined Differences in Brain Response to a Primary Food Reward: Figure 1. The Journal of Neuroscience 2010;30:2428-2432.
- 17. Witt AA, Lowe MR. Hedonic hunger and binge eating among women with eating disorders. International Journal of Eating Disorders 2014;47:273-280.
- Ribeiro G, Camacho M, Santos O, Pontes C, Torres S, Oliveira-Maia A. Association between hedonic hunger and body-mass index versus obesity status. Sci Rep 2018;8:5857.
- Lipsky LM, Nansel TR, Haynie DL, Liu D, Colman HE, Simons-Morton B. Lack of prospective relationships of the Power of Food Scale with Body Mass Index and dieting over 2 years in U.S. emerging adults. Eat Behav 2019;34:101302.
- Dikyol Mutlu A, Cihan H, KÖKSAL Z. The perceived role of food and eating among Turkish women with obesity: A qualitative analysis. Current Psychology 2023;42:27485–27496.
- 21. Vainik U, Neseliler S, Konstabel K, Fellows LK, Dagher A. Eating traits questionnaires as a continuum of a single concept. Uncontrolled eating. Appetite 2015;90:229-239.
- Schultes B, Ernst B, Wilms B, Thurnheer M, Hallschmid M. Hedonic hunger is increased in severely obese patients and is reduced after gastric bypass surgery. Am J Clin Nutr 2010;92:277-283.
- Appelhans BM, Woolf K, Pagoto SL, Schneider KL, Whited MC, Liebman R. Inhibiting Food Reward: Delay Discounting, Food Reward Sensitivity, and Palatable Food Intake in Overweight and Obese Women. Obesity 2011;19:2175-2182.
- Burger KS, Sanders AJ, Gilbert JR. Hedonic Hunger Is Related to Increased Neural and Perceptual Responses to Cues of Palatable Food and Motivation to Consume: Evidence from 3 Independent Investigations. J Nutr 2016;146:1807-1812.
- Witt AA, Raggio GA, Butryn ML, Lowe MR. Do hunger and exposure to food affect scores on a measure of hedonic hunger? An experimental study. Appetite 2014;74:1-5.