Evaluation of the Relationship Between Intuitive Eating Behavior and Cortisol Hormone Levels and Body Mass Index in University Students

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Abstract
The purpose of this study is to evaluate the relationship between intuitive eating behavior and cortisol hormone levels and body mass index (BMI) in university students in terms of some variables. The study was conducted on 150 university students (75 female, 75 male) of different genders who did not have any health problems and were studying at Bayburt University Faculty of Health Sciences Participants filled out the demographic data questionnaire and Intuitive Eating Scale-2 (IES-2) during a face-to-face interview. Cortisol hormone levels were examined in saliva samples taken from students participating in the study using the ELISA technique. Number, percentage, mean, chi-square, T Test, Pearson Correlation and ANOVA tests were used to evaluate the data. In all analyses, the significance value was taken as $p<0.05$. The total mean score of the participants from the intuitive eating scale was found to be 74.160±13.50. There is a strong negative correlation between intuitive eating and weight (-.784*) and a very strong negative correlation between BMI (-.968). There is a strong negative correlation between intuitive eating scale score and its sub-dimensions and cortisol hormone levels (-.640, -.582, -.560, -.565, -.419*). An increase in the levels of intuitive eating scale score and its sub-dimensions and a decrease in cortisol hormone levels were found ($p<0.05$). In addition, a strong positive correlation (.620**) was found between salivary cortisol hormone levels and BMI. It was found that as the intuitive eating scale score of the participants increased, there was a decrease in the participants' BMI and salivary cortisol hormone levels and this difference was statistically significant ($p<0.05$). As a result, it is thought that intuitive eating, which offers a healthy attitude about which food to consume in what amounts, will make a significant contribution and benefit to the strategies for preventing obesity and obesity-related diseases by gaining healthy eating behavior habits in obesity and healthy weight management and stress coping strategies.

Keywords: Intuitive Nutrition; Body Mass Index, Cortisol, Hormone, University Students

Introduction

Intuitive eating is a way of eating that advocates that the mind, body and food trio should be in harmony, in other words, that the individual should eat by knowing their own body (Babbott et al., 2024). Today, it is called mindful eating and is defined as "body wisdom".

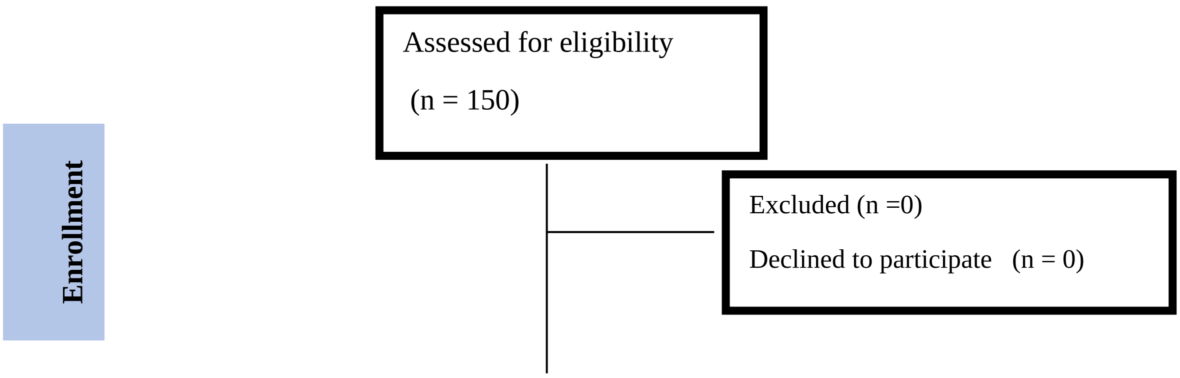
Individuals who eat intuitively know the effects of the food they consume on their body and tend to consume the best food for themselves (Suryo, 2024). Thus, they can achieve successful results in protecting themselves against diseases and controlling their weight (Cerea et al., 2024).The loss of intuitive eating awareness triggers the feeling of overeating, increasing the incidence of obesity and obesity-related diseases. Intuitive eating (i.e. eating based on physiological hunger and satiety cues rather than situational and emotional cues) has recently been accepted as an adaptable eating style (Giacone et al., 2024). Intuitive eating is a way of eating in which an individual listens to the physical hunger, satiety and satisfaction signals that their body naturally gives and adapts to these signals (Camilleri et al., 2015). Body wisdom is stated as the basic principle at the basis of intuitive eating (Dalen et al., 2010). Intuitive eating is defined as an adaptive eating style that is strongly linked to internal physiological cues of hunger and fullness. It has four elements: unconditional permission to eat whatever and whenever desired, eating for physical rather than emotional reasons, relying on hunger and fullness cues to decide when and how much to eat, and body-food choice congruence. The goal of intuitive eating is to help an individual regain confidence in their ability to understand how much food their body actually needs. Intuitive eating (i.e., relying on physiological hunger and fullness cues to guide eating) has been proposed as a healthier, more effective, and more innate alternative to current weight management strategies (Gast & Hawks, 1998).

Stress is the emotional, mental and physical reaction caused by anxiety resulting from an event or thought that occurs momentarily, makes one feel in danger or requires a struggle. Stress can cause emotional swings and sudden mood changes (Kirbaş et al., 2024; Okur, 2024). Cortisol is a stress-related corticosteroid hormone synthesized in the zona fasciculus of the adrenal cortex (Bayraktar, 2020). Cortisol level in saliva reflects free cortisol in the blood (Kudielka et al., 2009; Kaushik et al., 2014; Orkun Erkılıç et al., 2024; Ozcan Böyük et al., 2024). BMI is a measure of a person's weight relative to their height, and is a value calculated by dividing the weight by the square of the height (kg/m²) (Nutall, 2015; Okumuş and Çelikel Taşci, 2024). There is limited research examining the relationship between intuitive eating and stress hormone levels, cortisol hormone levels, BMI and some other variables. In this context, it is aimed to evaluate the relationship between intuitive eating behavior and cortisol hormone levels and body mass index among university students in terms of some variables.

Methods

Participants and Procedures

The participants of this study consisted of 150 university students (75 female, 75 male) studying at the Faculty of Health Sciences and having no health problems, and distributed equally by gender (Figure 1). Ethics committee approval (2024/Decision no: 96/10) and institutional permission were obtained before starting the study. The participants were informed about the study in accordance with the Declaration of Helsinki and their consent was obtained with the Informed Consent Form. Volunteer participants were included in the study. The sample size of the study was calculated using the G*Power 3.1. 9.7 analysis program; It was determined as 150 with a 95% confidence interval, 5% margin of error, and 80% power. Data were collected through face-to-face interviews lasting an average of 15 minutes using a form including general information for university students and the Intuitive Eating Scale-2 (IET-2). Saliva samples were taken to determine the salivary cortisol hormone levels of the participants.



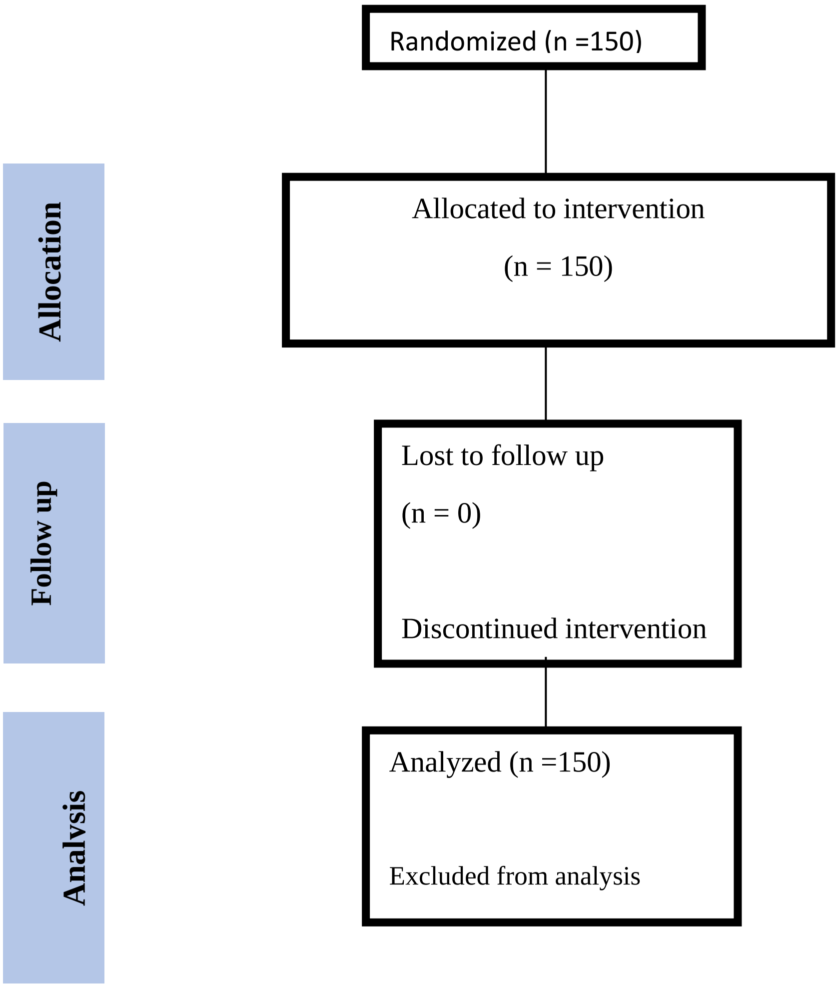


Figure 1. Study cohort flow chart.

The collection of research data: The data were collected face-to-face with the Personal Information Form and Intuitive Eating Scale-2 in university students (18-24 years) in an average of 15 minutes. Intuitive Eating Scale-2, which has four main components, is a 23-item Likert-type scale. Answers are evaluated as 'strongly disagree' 1, 'disagree' 2, 'undecided' 3, 'agree' 4 and 'strongly agree' 5 points. The scores obtained from the scale are calculated by dividing by the number of questions, and it is concluded that the higher the total score or sub-dimension scores, the higher the intuitive eating status. The scale has 4 sub-dimensions. These are; Unconditional Permission to Eat, Eating Due to Physical Reasons Rather than Emotional

Reasons, Eating Due to Hunger and Fullness Signals and Body Food Choice Adaptation (Baş et al., 2017). The validity and reliability study of the Intuitive Eating Scale-2 was conducted by Baş et al. (2017) and the Cronbach α coefficient was reported as 0.82.

Collection of Saliva Samples: Saliva samples were collected from the participants. Saliva samples were collected between 08:00 and 09:00 in the morning, using the passive salivation method, in 5 cc Salivette tubes (Sarstedt, Germany). After centrifugation at 2000 g for 20 minutes in a refrigerated centrifuge (NF 1200R, NUVE, Ankara, Türkiye) in the laboratory, the saliva samples were stored at -80°C until cortisol hormone levels were analyzed.

Measurement of salivary cortisol hormone levels: The study utilized the Human Cortisol ELISA Kit (BT LAB, Cat.No E 1 003Hu, China) to quantify the amounts of cortisol hormone in saliva samples. The ELISA kit was used to determine concentrations ranging from 31.25 to 2000 pg/mL. The intra-assay coefficients were 8.0% and the inter-assay coefficients were 10.0%. The protocol followed was as indicated in the manufacturer's catalog.

Statistical analysis:

The data obtained through survey forms in the study were processed and analyzed by the researcher using the SPSS 26.0 package program. As a result of the analysis performed for the normality test of the data, the skewness and kurtosis (Skewness and Kurtosis) values of all scales and sub-dimensions were found to be between -2 and +2 and it was assumed that the normality assumption was accepted. In the analyses for the variables of gender and BMI status from the demographic questions, T-test, which is a parametric test for two-group comparisons, and ANOVA tests were applied for comparisons of more than two groups. In this context, independent sample T-Test was applied for the variables with two groups, and ANOVA analyses were applied for the variable with more than two groups. The groups that caused the significant difference as a result of the comparison of more than two groups were determined with Tukey HSD, which is a Post-Hoc test. Pearson Correlation Analysis was applied to examine the relationships between the scale and its sub-dimensions used in the study and the cortisol measurements with age, height, weight and BMI. In all analyses, the significance (p) value was taken as 0.05. In the results of the applied tests, when $p<0.05$, the difference was considered statistically significant, and when $p>0.05$, the differences were considered statistically insignificant.

Results

Table 1, which examines the demographic information of the research participants, shows that according to gender, 75 were female (%50.0), 75 were male (%50.0); according to their grades, 58 were in the 1st grade (%38.7), 29 were in the 2nd grade (%19.3), 55 were in the 3rd grade (%36.7), and 8 were in the 4th grade (%5.3); and according to BMI groups, 12 were underweight (%8), 113 were normal (%75.33), and 25 were pre-obese (%16.67). It was determined that the average age of the participants was 21.07±1.34; their average height was 171.57±8.72 cm; their average weight was 66.39±11.53 kg; and their average BMI was 22.45±2.86.

Table 1: Demographic variables

Variables	Groups	f	%
Gender	Female	75	50
	Male	75	50
Grade	1st	58	38,7
	2nd	29	19,3
	3rd	55	36,7
	4th	8	5,3
BMI Groups	Underweight	12	8
	Normal	113	75,33
	Overweight	25	16,67
	Obese	-	-

	Min.	Max.	Mean	SD.
Age	18	24	21,07	1,349
Height(cm)	153	189	171,57	8,729
Weight(kg)	47	90	66,39	11,535

BMI	17,4	29,9	22,45	2,861

Table 2 shows the intuitive eating scale and its sub-dimensions used in the study, as well as the mean, standard deviation, minimum-maximum and skewness-kurtosis values of salivary cortisol results. If the skewness and kurtosis values are between -2 and +2, the normality assumption is accepted. In this case, parametric tests were used for the scale and its sub-dimensions where the normality assumption was provided.

Table 2: Descriptive statistics of the intuitive eating scale and its sub-dimensions

Scale	Min.	Max.	$\overline{X}$	sD	Skewness	Kurtosis	Cronbach Alfa
Intuitive eating	**71,98**	**76,34**	**74,160**	**13,507**	**,185**	**-,396**	**0,879**
Eating for Physical Reasons	26,61	27,98	27,30	4,248	-,093	-,343	0,547
Unconditional Eating Permission	17,89	19,30	18,60	4,347	,032	-,113	0,705
Relying on Hunger and Fullness Cues	17,32	18,81	18,06	4,628	,185	-,275	0,742
Body-Food Choice Compatibility	9,76	10,62	10,19	2,681	-,228	-,524	0,685
Cortisol(ng/ml)	3,535	3,869	3,702	1,036	1,236	1,973	

The total average score that the participants received from the intuitive eating scale was calculated as 74.160±13,50. When its sub-dimensions were examined, the highest score was obtained from the sub-dimension of eating for physical reasons rather than emotional reasons, and the lowest score was obtained from the sub-dimension of body-food choice compatibility. According to the results of the normality analysis of the scale and its sub-dimensions, it was seen that a normal distribution was provided. According to the results of the reliability analysis of the scale and its sub-dimensions; the overall internal consistency coefficient of the scale was calculated as 0.879, 0.547 for eating for physical reasons, 0.705 for unconditional eating, 0.742 for trusting hunger and satiety cues, and 0.685 for body-food choice compatibility. The average value in the salivary cortisol level taken from the participants was calculated as 3.702.

Table 3: Comparison of intuitive eating scale and other measurement scores by gender

	Gender	N	$\bar{X}$	sD	t	p
Intuitive eating	Female	75	77,05	14,416	2,677	,008*
	Male	75	71,27	11,939		
Eating for Physical Reasons	Female	75	28,21	4,390	2,687	,008*
	Male	75	26,38	3,921		
Unconditional Eating Permission	Female	75	19,25	4,429	1,856	,065
	Male	75	17,94	4,191		
Relying on Hunger and Fullness Cues	Female	75	18,93	4,844	2,327	,021*
	Male	75	17,20	4,258		
Body-Food Choice Compatibility	Female	75	10,65	2,758	2,126	,035*
	Male	75	9,73	2,538		
Cortisol (ng/ml)	Female	75	3,932	1,361	2,777	,006*
	Male	75	3,472	,452		

According to the T-Tests examining the statistical differences in the intuitive eating scale and cortisol measurements of the participants according to gender groups; statistical significance was found in the general scores of the scale (p<.05). It is seen that the average score of the female participants from the scale is higher than that of the male participants. It is seen that there is a difference according to gender in the sub-dimensions of the scale except for the unconditional permission to eat sub-dimension (p<.05). As in the general score of the scale, the scores of the female participants were also high in the sub-dimensions of the scale. When the salivary cortisol levels were examined, a significant difference was found according to gender (p<.05). As in the intuitive eating scale and its sub-dimensions, the average salivary cortisol levels of the female participants were high.

Table 4: Comparison of intuitive eating scale and other measurement scores with BMI groups (ANOVA)

	BMI	**N**	**x̄**	**sD**	**F**	**p**	**Post Hoc (Tukey)**
Intuitive eating	Underweight[a]	12	97,25	4,535	99,06	,000*	c>b>a
	Normal[b]	113	75,88	9,756			
	Overweight[c]	25	55,32	5,367			
Eating for Physical Reasons	Underweight[a]	12	33,66	1,922	43,795	,000*	c>b>a
	Normal[b]	113	27,61	3,556			
	Overweight[c]	25	22,8	3,082			
Unconditional Eating Permission	Underweight[a]	12	25,08	2,108	65,098	,000*	c>b>a
	Normal[b]	113	19,15	3,362			
	Overweight[c]	25	13	2,72			
Relying on Hunger and Fullness Cues	Underweight[a]	12	25,08	3,26	64,029	,000*	c>b>a
	Normal[b]	113	18,61	3,608			
	Overweight[c]	25	12,2	2,327			
Body-Food Choice Compatibility	Underweight[a]	12	13,41	1,164	34,287	,000*	c>b=a
	Normal[b]	113	10,48	2,36			
	Overweight[c]	25	7,32	1,951			
Cortisol (ng/ml)	Underweight[a]	12	2,29	,2774	31,899	,000*	c>b>a
	Normal[b]	113	3,64	,682			
	Overweight[c]	25	4,66	1,563			

According to one-way ANOVA analyses examining statistical differences in intuitive eating scale and cortisol measurements of participants according to BMI groups; significant differences were found in the results of salivary cortisol, intuitive eating scale and its sub-dimensions according to BMI groups (p>.05). In the Post-Hoc analyses conducted to determine which options caused significant differences according to Tukey, all options were significant. A significant relationship was observed between eating behaviors and cortisol levels of BMI groups, especially pre-obese individuals tended to exhibit less healthy eating behaviors and have higher cortisol levels.

Table 5: Relationships between continuous demographic variables, intuitive eating scale, its sub-dimensions and salivary cortisol levels of the participants

		1	2	3	4	5	6	7	8	9	10
1.Age	r	1									
2.Height(cm)	r	,172*	1								
3.Weight(kg)	r	,187*	,703**	1							
4.BMI	r	0,124	.161*	,811**	1						
5.Intuitive eating	r	-0,131	-0,151	-,784**	-,968**	1					
6.Eating for Physical R.	r	-,140·	-0,159	-,682**	-,822**	,851**	1				
7.Uncond. Eating Per.	r	-,082·	-0,086	-,676**	-,868**	,889**	,661**	1			
8.Relying on H. and F. Cues	r	-0,143	-0,146	-,688**	-,841**	,880**	,601**	,756**	1		
9. Body-Food Choice Compatibility	r	-,057	-,116	-,585**	-,714**	,729**	,595**	,503**	,529**	1	
10.Cortisol (ng/ml)	r	,082	-,207*	,290*	,620**	-,640**	-,582**	-,560**	-,565**	-,419**	1

a. Cannot be calculated because all values are the same in at least one of the variables
** : Correlation is significant at the 1% level
* : Correlation is significant at the 5% level

According to the correlation analysis examining the relationships between the continuous demographic variables of the participants, the intuitive eating scale, its sub-dimensions, and cortisol levels; a strong negative relationship was found between intuitive eating and weight (-.784**) and a very strong negative relationship between BMI (-.968**). In other words, as the participants' weight and BMI measurements increase, there will be a decrease in their scores from the intuitive eating scale. When we look at the relationship between intuitive eating and its sub-dimensions and cortisol, it will be seen that there is a strong negative relationship (-.640**, -.582**, -.560**, -.565**, -.419**). In other words, an increase in the level of intuitive eating and its sub-dimensions will cause a decrease in cortisol levels. On the other hand, a strong positive relationship (.620**) was found between cortisol and BMI.

Discussion

Obesity and obesity-related diseases are an important public health problem due to their increasing prevalence all over the world. Intuitive eating is the process of deciding which food, how much and when to consume according to the body's hunger and satiety signals (Tapper, 2022). Intuitive eating principles are a way of eating that aims to develop a healthy relationship between food, mind and body. It also encourages awareness of emotions and the pleasure of eating (Warren et al., 2022). In the Intuitive eating approach, making conscious food choices, recognizing internal hunger and satiety signals with awareness of emotions, and suppressing hunger allow the body to decide on the amount and type of food consumed. Negative emotional states such as stress and depression lead to negative changes in eating habits, increasing the likelihood of individuals having a higher BMI (Dalen et al., 2010; Miller et al., 2014). Ruzanska and Warschburger, (2019) reported that BMI and intuitive eating scores have a negative significant relationship, that is, as BMI increases, intuitive eating scores decrease in individuals. Denny et al. (2013) although weight loss is not observed in people who follow the intuitive eating model, data suggest that eating according to hunger and fullness signals may be associated with lower BMI. Our current results are consistent with research results that have been reported in the literature that people who follow the intuitive eating model will be associated with lower BMI values (Denny et al., 2013; Richard et al., 2019). Murray et al. (2023) reported in their study examining the indirect effects between intuitive eating differences in body image and negative and positive body image in individuals of different genders that body image leads to gender differences in intuitive eating, controlling for age and BMI. Deny et al. (2013) reported in their study examining the relationships between intuitive eating and intuitive and disordered eating behaviors among young adults according to socio-demographic characteristics and BMI that there was no significant difference in both aspects of intuitive eating behavior in men and women depending on age. It was determined that the intuitive eating scale score average of female participants was higher than male participants ($p<0.05$). Our current results are consistent with the research results reporting that female participants have higher intuitive eating levels than male participants, as stated in the literature (Winkens, 2019; Durukan and Gül, 2019).

Intuitive eating is a flexible eating behavior model that is based on naturally knowing the amount and type of food that is healthy for the body and can help maintain an appropriate body weight, and aims to make food choices that support health and body functioning (Tylka et al., 2013). Stress is associated with negative health outcomes, including negative eating behaviors and obesity (Owens et al., 2024). Intuitive eating improves hunger and fullness response signals, preventing overeating when faced with stress (Linardon et al., 2021). An increase in the intuitive eating scale score and its sub-dimensions and a decrease in cortisol hormone levels were detected ($p<0.05$). In addition, a positive strong relationship between salivary cortisol hormone levels and BMI was determined (.620**). Moss et al. (2021) reported an association between mean cortisol levels and greater emotional eating in girls with high stress levels. Owens et al. (2024) reported that higher morning cortisol was associated with lower intuitive eating behavior in middle-aged women. Our current results are consistent with research results reporting that salivary cortisol hormone levels are low in individuals with high intuitive eating scale scores, as reported in the literature (Järvelä-Reijonen et al., 2016; Jayne et al., 2020; Moss et al., 2021; Owens et al., 2024).

Conclusion

In conclusion, this study has revealed the relationship between Intuitive Eating Behavior and Cortisol Hormone Levels and Body Mass Index among University Students. It is thought that the information obtained will contribute and benefit to obesity management strategies and researchers and research to be conducted in this field by illuminating the relationship between university students' eating habits, stress levels and BMI.

Declarations

Ethical considerations

The research was approved by the Bayburt University Research Ethics Committee (2024/ Decision no: 96/10). Before the data were collected by the researchers, participants were informed about the study in accordance with the Declaration of Helsinki and their written/verbal consent was obtained. All methods were conducted in accordance with relevant guidelines and regulations.

Authors' Contribution

T.O.E. and B.B. designed the study. T.O.E collected data. T.O.E and B.B. analyzed the data. T.O.E prepared the draft plan. All authors contributed to writing the manuscript. All authors read and approved the final manuscript.

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