Original Article

Is intuitive eating linked to waist circumference and the waist-to-height ratio, both of which are risk factors for cardiometabolic disease?

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Abstract. *Background and aim:* Intuitive eating is related to lower BMI, blood triglyceride levels and cardiovascular risk and also it decreases the symptomatology of eating disorders and improves psychological health criteria. In this study, it was aimed to examine the relationship between the intuitive eating, waist circumference and waist-to-height ratio of college students. *Methods:* This study was conducted on 1708 students. A questionnaire was used for socio-demographic characteristics, and nutritional habits. the Intuitive Eating Scale-2. Anthropometric measurements were measured by researcher and body mass index and waist-to-height ratio were calculated. *Results:* Total intuitive eating scores and eating for physiological rather than emotional reasons subscale scores were significantly higher in the normal waist circumference and the risk groups than in the high-risk group. Total intuitive eating scores and eating for physiological rather than emotional reasons subscale scores were significantly higher in the non-increased risk and increased risk groups, compared to very-high risk group. *Conclusions*: As the waist circumference and waist-to-height ratio values approach the normal limits, the intuitive eating score also increases. Waist circumference and waist-to-height ratio may be considered as indicators of intuitive eating.

Key words: Intuitive Eating Scale-2; waist circumference; waist-to-height ratio; body mass index; college students

Introduction

Obesity is an inflammatory, progressive and chronic condition with a multifactorial etiology. inducing many physical, emotional and economic problems. Obesity is also one of the major risk factors for chronic diseases such as cardiovascular diseases, type 2 diabetes and hypertension (1). An important risk factor for obesity-related diseases is body fat distribution. Abdominal obesity is increased risk of cardiometabolic diseases independently of general obesity. Abdominal obesity indicates high visceral adipose tissue (VAT), a well-known cardiometabolic risk factor, and high subcutaneous adipose tissue (SAT) in the abdomen. However, precise measurement of abdominal obesity requires the use of expensive radiological imaging techniques (2). Due to the expensiveness of radiological techniques, anthropometry is used in the determination of abdominal obesity with low cost and reliable, easy to use and applicable to all body sizes. Waist circumference (WC), waist-to-hip ratio, and waist-to-height ratio (WHtR) are the measurements used to determine abdominal obesity (3).

Traditional practice for weight loss involves restricting food intake and exercising more. However, such an approach is often unsuccessful in the long-term (4). There is also evidence that dieting, and particularly repeated dietary attempts, may be harmful to both physical and mental health (5,6). Recently, there are studies showing that the rates of eating disorders have increased in individuals on a very low-energy diet (7,8).

Eating disorders are serious mental disorders affecting all aspects of human life such as social life, individual situation and life quality at home and work. Generally, it is chronic and the treatment is difficult (9). The majority of individuals diagnosed with eating disorders are under 25 years of age (more than %90) (10). Studies on eating behaviours have increased rapidly in the last decade. However, researches mainly focus more on identifying and predicting eating disorders, with less emphasis on identifying and supporting adaptive eating attitudes and behaviors (11).

Intuitive eating (IE) is a way of eating food by relying on the physically hunger and satiety cues, adapting to these cues, not emotionally. In order to evaluate this eating behavior, Tylka (2006) established Intuitive Eating Scale (IES) in 2006 and IES-2 was developed in 2013 by the same researcher (13). Minds of people eating intuitively are not preoccupied with food or diet; these people do not distinguish specific foods as good or bad. Generally, they tend to consume foods that increase body function. They know the cues of hunger and satiety of their body and rely on these cues. They use these cues to determine when or how much they eat (13). The philosophy underlying IE may be explained as being aware of, and respecting, the cues of innate hunger and satiety. IE is based on the principle that "Eat when you are hungry and stop eating when you are full" (14). In intervention studies, IE effects positively psychological health data, such as self-esteem and body perception, decreases depressive symptoms and supplies improvement in health indicators such blood pressure and level of blood cholesterol (15–17). IE programs also help maintain weight in the obese and overweight women in the long-term (18,19). In cross-sectional studies, it is suggested that IE not only support lower BMI, blood triglyceride levels and cardiovascular risk, however also related to decrease the symptomatology of eating disorders and to improve psychological health criteria (13,20,21). Considering that there is a relationship between obesity and eating disorders and obesity, especially abdominal obesity, as a risk factor for cardiovascular diseases, the relationship between eating behaviors and abdominal obesity indicators (WC, WHtR) requires to be investigated. Studies have shown that there is a relationship between skipping breakfast, other eating habits, WHtR and cardiovascular diseases (22,23).

College period (usually 18-22 years of age in Turkey) is a very important life period for shaping some lifestyle behaviors and maintaining them throughout life. In general, nutritional habits may worsen at college period, may lead to an increased risk of chronic diseases in the later life (24). Especially, when the students leave their families, they express more risky behaviors in terms of health as fast-food style nutrition, spending the whole day with a single meal, omitting important meals (mainly breakfast), and an unhealthy nutritional profile due to economic problems (10). Since college students are a high-risk group in terms of eating behaviour disorders; in this study, it was aimed to evaluate the relationship between IE, WC and WHtR among college students.

Methods

This cross-sectional study was conducted between October 2017 and April 2018 on college students aged between 18-38 years. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by a local college social and human sciences ethics committee (dated 10.07.2017, numbered 35138650-100/415). Written informed consent was obtained from all subjects. Volunteer 1708 students were randomly selected for the study. At the end of the study, the power was 93.63% with α=0.05 error margin. Volunteers over 18 years of age, without any chronic illness or mental problems, were included. Those who did not meet the inclusion criteria and who were pregnant and lactating, those with hypo-/hyperthyroidism, and those taking medications such as metformin that could affect eating habit parameters were excluded.

The data were collected via a questionnaire including questions regarding socio-demographic characteristics, nutritional habits and IES-2. The questionnaire was filled in by face-to-face interview method.

Anthropometric Measurements

Body weight, height and WC measurements were also taken by the researcher. WC was measured at the mid-axillary line at the midpoint between the costal margin and the iliac crest by a non-stretch measuring

tape. WHtR was calculated by dividing the WC measurement by the height (1). BMI and waist circumference measurements were classified according to WHO standards (25,26). In addition, WHtR was calculated. The cut-off point used in all age groups is based on the WHtR grouping. WHtR was classified as the following: <0.5 was "no-increased risk", ≥0.5 and <0.6 was "increased risk" and ≥0.6 was "very-high risk" (27).

Intuitive Eating Scale-2

The IES-2, consisting of four basic features, contains a total of 23 items. These are unconditional eating permits (UEP), eating for physiological rather than emotional reasons (EPR), reliance on hunger and satiety cues (RHSC), and body-food choice congruence (BFCC). The questions were graded with a five-point Likert scale. In the scoring of the scale, some items are inversely scored. When calculating the total scale score, the total scores in the items are divided by 23, which is the number of items in the scale. Higher scores indicate better intuitive eating level or its size. In addition, the individual scores in the four subgroups are summed and each final score is divided by the number of items in each subscale. Thus, the score in each subgroup is calculated (28). Validity and reliability of the Turkish version of the scale was performed by Bas et al. (29). In this study, Cronbach's alpha value was 0.87.

Statistical Analysis

Statistical analysis of the data was conducted using SPSS 22.0 (Statistical Package for Social Sciences for Windows). The Kolmogorov-Smirnov test was used to determine whether the data showed normal distribution. Mean and standard deviation ($\bar{x}$ ±SD) were used for descriptive statistics. For descriptive statistics of numerical variables that do not show normal distribution, median and minimum-maximum (med-min-max) were used. Number (n) and percentage (%) were used as descriptive statistics for categorical variables. Chi-square test was used to examine the relationship between categorical variables. In the case of two groups, independent samples t-test was used for numerical variables with normal distribution, and in the case of more than two groups, Kruskal-Wallis test was used for analysis of numerical variables that did not show normal distribution. In the analysis of variance, post-hoc analysis of pair-wise comparisons was evaluated by Bonferroni correction and the groups differed are indicated by letters. Spearman correlation analysis was used to examine the relationship between variables in the calculation and interpretation of all data, $p<0.05$ was considered as statistically significant.

Results

Of the 1708 students; 52.6% were females (n=899) and 47.4% were males (n=809). The distribution of socio-demographic characteristics and nutritional habits of the study sample were showed in Table 1.

The relationship between BMI, WC, WHtR, IES-2 total and subscale scores was shown in Table 2. There was not any significant relationship between BMI and IES-2 score. However, EPR and BFCC subscale scores were significantly lower in the underweight group than in the overweight and normal weight groups ($p<0.05$). The IES-2 total score was lower in the high-risk WC group than in the normal and risk groups and EPR subscale scores were significantly higher in the risk group than in the high-risk WC group ($p<0.05$).

The median IES-2 total score and EPR subscale scores were significantly lower in the very-high risk group than in the no-increased risk and increased risk groups. BFCC subscale score was also higher in the increased risk group than in the no-increased risk and very-high risk groups ($p<0.05$) (Table 2).

There is a significant positive correlation between total IES-2 score, EPR, BFCC and WC. Similar relation was detected between EPR, BFCC and WHtR. A significant positive correlation was observed between BMI and only BFCC ($p<0.05$) (Table 3).

Discussion

In this study, the relationship between WC and WHtR, the anthropometric indicators of abdominal obesity, and IE, which evaluates adaptive eating behavior, were investigated.

Since obesity and cardiovascular diseases are the problems of this century, their treatment is also being researched in many studies Current treatment for obesity

Table 1. The Distribution of Socio-Demographic Characteristics and Nutritional Habits of the Study Sample

Characteristics	Males (n=809)		Females (n=899)		Total (n=1708)		*p*
	n	%	n	%	n	%	
Age*	21.28±1.92		20.39±1.67		20.81±1.85		***<0.001***
Age categories							
18-21	506	62.5	707	78.6	1213	71.0	
22-25	270	33.4	178	19.8	448	26.2	***<0.001***
>25	33	4.1	14	1.6	47	2.8	
Marital status							
Married	10	1.2	19	2.1	29	1.7	*0.225*
Single	799	98.8	880	97.9	1679	98.3	
Place of residence							
At home with family	557	68.9	495	55.1	1052	61.6	
At home with friends	80	9.9	49	5.5	129	7.6	***<0.001***
At dormitory	172	21.3	355	39.5	527	30.9	
Monthly income							
Income less than expense	26	3.2	49	5.5	75	4.4	
Income equal to expense	494	41.1	637	70.9	1131	66.2	***<0.001***
Income more than expense	289	35.7	213	23.7	502	29.4	
Number of meals							
Less than 3 meals	181	22.4	210	23.3	391	22.9	
3 meals	424	52.4	507	56.4	931	54.5	*0.215*
More than 3 meals	196	25.2	180	20.3	386	22.6	

*Numerical variables were shown as $\bar{x}$ ±SD.

Table 2. The Relationship between BMI, WC, WHtR, IES-2 Total and Subscale Scores

Variables	IES-2 total score	UPE	EPR	RHSC	BFCC
	Median (min-max)	Median (min-max)	Median (min-max)	Median (min-max)	Median (min-max)
BMI					
Underweight	3.83 (2.61-4.65)	4.00 (1.83-5.00)	3.75 (1.50-5.00)	4.00 (2.33-5.00)	3.33 (1.33-5.00)[a]
Normal weight	3.87 (2.04-4.91)	3.83 (1.33-5.00)	4.00 (1.00-5.00)	4.00 (1.00-6.67)	3.67 (1.00-5.00)[b]
Overweight	3.83 (2.04-4.91)	3.67 (1.67-5.00)	4.00 (1.00-5.00)	4.00 (1.00-5.00)	3.67 (1.00-5.00)[b]
Obese	3.70 (1.43-4.70)	4.00 (2.00-5.00)	3.75 (1.25-5.00)	4.00 (1.00-5.00)	4.00 (1.00-5.00)
p	*0.213*	*0.646*	***0.033***	*0.770*	***0.001***
WC					
Normal	3.87 (2.04-4.91)[a]	3.83 (1.33-5.00)	4.00 (1.00-5.00)	4.00 (1.00-6.67)	3.67 (1.00-5.00)
Risk	3.87 (1.43-4.74)[a]	3.83 (1.67-5.00)	4.00 (1.00-5.00)[a]	4.00 (1.00-5.00)	4.00 (1.00-5.00)
High-risk	3.70 (1.43-4.74)[b]	3.67 (1.83-5.00)	3.75 (1.25-5.00)[b]	4.00 (1.00-5.00)	3.67 (1.00-5.00)
p	***0.030***	*0.215*	***0.016***	*0.138*	*0.414*
WHtR					
No-increased risk	3.87 (2.04-4.87)	3.83 (1.33-5.00)	4.00 (1.00-5.00)	4.00 (1.00-5.00)	3.67 (1.00-5.00)[a]
Increased risk	3.87 (1.43-4.91)[a]	3.83 (1.67-5.00)	4.00 (1.00-5.00)[a]	4.00 (1.00-5.00)	4.00 (1.00-5.00)[b]
Very-high risk	3.56 (2.35-4.70)[b]	3.5 (2.00-5.00)	3.87 (1.25-5.00)[b]	4.00 (1.17-5.00)	3.67 (2.00-5.00)[a]
p	***0.043***	*0.143*	***0.043***	*0.161*	***0.003***

Kruskal Wallis test was used for analysis of data. Bonferroni correction was used for Post-Hoc test. According to Bonferroni test, there is a significant relationship between a and b

BMI: Body Mass Index, WC: Waist Circumference, WHtR: Waist to height ratio, IES: Intuitive Eating Scale, UPE: Unconditional Eating Permits, EPR: Eating for Physiological Rather than Emotional Reasons, RHSC: Reliance on Hunger and Satiety Cues, BFCC: Body-Food Choice Congruence.

Table 3. The Correlation between BMI, WC, WHtR, IES-2 Total and Subscale Scores

Variables	BMI		WC		WHtR	
	r	*p*	r	*p*	r	*p*
IES-2 total score	0.002	*0.929*	0.048	***0.050***	0.023	*0.347*
UPE	-0.033	*0.170*	-0.017	*0.476*	-0.038	*0.120*
EPR	0.024	*0.329*	0.084	***0.001***	0.058	***0.017***
RHSC	-0.012	*0.615*	0.017	*0.494*	0.002	*0.937*
BFCC	0.054	***0.026***	0.055	***0.023***	0.072	***0.003***

Spearman correlation test used for analysis of the data.
BMI: Body Mass Index, WC: Waist Circumference, WHtR: Waist to height ratio, IES: Intuitive Eating Scale, UPE: Unconditional Eating Permits, EPR: Eating for Physiological Rather than Emotional Reasons, RHSC: Reliance on Hunger and Satiety Cues, BFCC: Body-Food Choice Congruence.

is lifestyle changes that include reducing energy intake and increasing physical activity (30). However, this approach may sometimes cause psychosocial problems such as serious concerns about body shape and negative attitudes and behaviors in food choice. Therefore, the regulation of eating behaviors should also be included in the treatment (31). Recently, studies on adaptive eating behaviours and IE have gained importance to evaluate eating behaviours (13). IE has been associated this eating behaviour with numerous indices of physical (blood cholesterol levels, blood pressure and insulin sensitivity) and psychological well-being (15–17).

The main premise of IE is to correctly interpret and apply instinctive feedback related to the consumption of nutrients in the required content and amount. Therefore, IE shows a positive correlation with lower weight and BMI (32). In a study conducted in France with 632 participants with a mean age of 48 years, IE scores of the non-obese participants were significantly higher than those of the obese participants (28). Similarly, in a study conducted with 149 adult women in Canada, IE scores of normal-weight women were significantly higher than those of overweight and obese (11). In the current study, IE score was higher in students with normal weight than those with underweight, overweight and obese, however the relationship was not significant. Schoenefeld et al. (33) found a significant negative correlation between IE score and BMI in 322 female college students. In a study conducted in Germany, there was a significant negative correlation between IE score and BMI of 120 female college students (34). Tylka et al. (13) showed a negative and significant correlation between IE score and BMI in their study including 1200 college students. In a study conducted to evaluate the relationship between eating disorders and BMI among college students, IE scores were examined and a, negative and non-significant correlation was detected between the IE scores and BMI (35). Contrary to these studies, there was a positive however not significant relationship between IES score and BMI in our study. When we examine the median comparisons of the BMI and IE score in our study, the correlation may seem positive since median of the underweight and overweight groups were similar. Similar to our study, Peschel et al. (36) detected no significant relationship between BMI and IE score.

In epidemiological studies, obesity, especially abdominal obesity, is a risk factor for cardiovascular diseases and related mortality and morbidity (37–40). Since body fat distribution is also important in determining abdominal obesity, other anthropometric measurements such as WC and WHtR in addition to BMI, are recommended (41). Moreover, in a meta-analysis conducted in 2012 that included data from more than 300 thousand individuals, WHtR is a more effective assessment tool than WC and BMI in determining the cardiometabolic risk factor (42). To the best of our knowledge, there was no study with a large sample examining the relationship between IE, and WC and WHtR in the current literature. Higher IES-2 scores indicate better intuitive eating and obesity is inversely related to IE (28,32). As WC and WHtR are indicators of abdominal obesity (3,27), the same relationship is also expected between WC and WHtR. One study found a negative correlation between WC and WHtR and the IES-2 total score, however the results are conflicted (43). In our study, both the IES-total

scores and the EPR scores were the lowest in the WC high-risk group. In addition, the total IES-2 score and EPR score were also the lowest in the very high-risk group. In other words, people with WC and WHtR values close to the normal limits, seem to have higher IE total and subscale scores.

Conclusion

In conclusion, the intuitive eating score indicating adaptive eating behaviour was also associated with the symptomatology of eating disorders. For students with low intuitive eating scores, the anthropometric measurements were also far from the normal limits. In line with these results, college students in the risk group for eating disorders should be screened at regular intervals. Students should be educated on eating disorders and related conditions and gaining adaptive eating behaviours. Gaining adaptive eating attitudes and behaviours such as intuitive eating in college students may be beneficial in preventing chronic diseases related with nutrition in the future. Therefore, it may be beneficial to conduct more intervention studies in larger groups on intuitive eating among college students and to evaluate the results.

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