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Effect of Eating Rate on Energy Intake and Body Mass Index in University Students

Benan SEMERCİOĞLU

Lecturer Doctor, SANKO University, Faculty of Health Science, Nutrition and Dietetics Gaziantep, Turkey

Correspondence

Benan SEMERCİOĞLU

SANKO University, Faculty of Health Science, Nutrition and Dietetics Gaziantep, Turkey
ORCID id: 0000-0002-7072-7673

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Abstract

This study aims to evaluate the effect of eating speed on energy intake and body mass index in university students. Changing eating habits today have made the effects of fast food consumption, in particular, on obesity and weight management more important. The study was conducted on 109 students studying at the Health Sciences and Medical Faculties of a university in Gaziantep between February 5 and May 5, 2024. The participants' eating speeds, energy intakes, and body mass index values were evaluated in the study. Data were collected using questionnaires, 24-hour food consumption records, and bioelectrical impedance analysis. It was observed that male students ate faster than female students and that this was associated with higher energy intake ($p<0.05$). It was determined that individuals who ate slowly generally had lower BMI, but the relationship between eating speed and body mass index varied by gender ($p<0.05$). No statistically significant difference was found between daily eating speed and meal duration and the amount of energy taken ($p>0.05$). A significant relationship was found between eating speed and body mass index ($p<0.05$), and it was determined that individuals who ate fast had higher BMI values. As a result, it is seen that eating speed can be an important factor in individuals' body weight management. It has been observed that men tend to eat faster and this situation is associated with higher body mass index. However, more research is needed on whether eating speed is a determining factor in terms of energy intake. This study provides important data to understand and improve the eating habits of university students.

Introduction

Today, with the developing technology, foods are offered for consumption in different ways, containing both beneficial and harmful elements for human health. As a result, it becomes complicated and difficult for individuals to choose the right and needed food among this excessive variety of foods. In addition, with the increased fast-paced lifestyles, eating habits are also changing. Accordingly, changing eating behaviors (eating ready-made food, eating fast, eating unconsciously, etc.) lead to the deterioration of healthy nutrition, which is one of the most basic requirements for the continuation of life [1]. The concept of eating behavior in individuals and the dietary behaviors and food choice have been extensively researched in recent years [2,3]. These dietary behaviors include modern consumer behaviors related to dietary lifestyles, including elements such as food consumption time, food preparation time and methods [4,5]. These issues are closely related to the speed of eating, which is one of the elements accompanying modern consumer life under time pressure. With the increase in the number of institutions providing mass nutrition services worldwide, individuals generally prefer highly processed, easy-to-prepare meals and spend long hours eating in front of the screen both at work and in their free time. With this change in the eating behavior of today's consumers, the terms 'eating speed' and 'eating rate' have come to the fore. While eating speed is defined as the length of eating time, eating rate is defined as a concept indicating total food consumption for specific foods in grams per minute (min) or kilocalories per min (kcal) [6,7]. Eating rate is a simple tool that can be used in cohort studies because, unlike eating rate, it does not require equipment, laboratory visits or financial resources; this makes eating rate suitable for use in large population studies as an indicator of obesity.

Obesity is a growing public health problem that needs to be monitored. Anthropometric indicators such as body fat percentage and body mass index (BMI), waist circumference, waist/hip and waist/height ratio are used to determine obesity [8]. Despite the proven relationships between obesity and these indicators, new parameters are constantly being investigated to manage and slow down the current obesity epidemic. The most critical factor in obesity, the individual's dietary behavior, plays an important role in body weight management and obesity prevention through its effect on energy balance and its close interaction with other factors such

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as nutrigenomics and psychology [9]. These indicators reflect the effects of individuals' long-term eating behaviors on the body [10-11]. Eating speed is considered an early indicator of these long-term eating behaviors due to social and cultural influences. In Japan, eating speed behavior is widely used as part of studies to determine the risk factors of obesity. However, eating speed is still a missing component of nutrition studies in countries where modifiable obesity risk factors are being sought, and it is stated that its use may reduce the risk of obesity. Therefore, the effect of consuming food quickly or slowly as a behavioral pattern on energy intake should be evaluated. It is also thought that the interaction between body weight gain and eating speed may be part of dietary recommendations and may be useful in balancing energy intake [8].

It is generally recommended to consume food slowly for body weight management, because eating more slowly causes the individual to consume less food and feel full faster. It is also suggested that eating slowly prolongs the time to feel full and reduces total energy intake. In a study conducted by Kokkinos et al., it was shown that consuming the same meal in 30 minutes instead of 5 minutes resulted in the emergence of higher concentrations of anorexigenic intestinal peptides and a feeling of fullness earlier. In another study conducted by Hawton et al., [12] twenty one participants were randomly assigned to consume a 600 kilocalorie (kcal) meal at a “normal” or “slow” pace (6 to 24 minutes), and it was stated that consuming the meal slowly can affect satiety and appetite. Although there are studies that have linked fast food consumption with higher energy intake, data on the effect of eating slowly on body weight are very limited and its role in satiety is not fully known [13].

Research Questions

1. Is there a significant relationship between eating speed and energy intake of individuals?
2. Is there a significant relationship between eating speed and body mass index of individuals?

Materials and methods

This is a descriptive researh. The universe of the study consisted of students studying at the Faculty of Health Sciences and Medicine of a university in Gaziantep between February 5, 2024 and May 5, 2024. No sample calculation was made in the study, and 109 students studying at the Faculty of Health Sciences and Medicine in the 1st, 2nd, 3rd, 4th, 5th and 6th grades and participating in the study voluntarily were included in the study. University students between the ages of 18-25 were included in the study, and individuals with diagnosed eating disorders and those who engaged in intense physical activity were not included in the study. A questionnaire form consisting of 29 questions was used as the data collection tool in the study. The survey form was applied to students who agreed to participate in the study by the researcher using a face-to-face survey method. The first part of the survey form includes demographic information and eating disorder status of individuals, the second part includes eating habits, the third part includes a vas saka based on the individuals' own statements regarding the measurement of their eating speed and questions regarding the determination of eating speed, the fourth part includes questions regarding physical activity status, and the fifth and final part includes a 24-hour food consumption record.

International Physical Activity Questionnaire (IPAQ) measures the frequency, duration and intensity of physical activity in the last 7 days across all contexts, allowing the calculation of metabolic equivalent (MET) and presents the amount of weekly physical activity. It is calculated as weekly working hours (MET-hours/week) (IPAQ, 2005). MET divides people into physical activity groups according to frequency and intensity of physical activity. Accordingly, the calculated MET can be classified as low, moderate and high level. The low (sedentary, inactive) group is classified as less than 600 MET-min/wk, moderate level as 601-3000 MET-min/wk, and the amount of physical activity is defined as high when it is more than 3000 MET min/wk. There are 2 versions of the IPAQ questionnaire developed by Craig et al., but the short Turkish version, the validity and reliability of which was studied by Öztürk (2005), was used in this study [14,15]. Bioelectrical Impedance Analysis (BIA) and Body Weight Measurement

The body weight (kg), body fat and muscle mass (kg) and BMI values of the individuals participating in the study were determined with the Tanita MC780 MA, which is sensitive to ± 0.1 kilograms [16]. During the measurements, individuals were asked to wear light clothing and were asked to pay attention to the specified conditions before coming to the body composition measurement with BIA. These conditions are: 1) No heavy physical activity in the 24 hours before coming to the analysis, 2) No alcohol consumption in the 24 hours before coming to the analysis, 3) The last meal before coming to the analysis should have been eaten at least 2-4 hours before coming to the analysis, 4) No water should be drunk before the analysis, 5) No caffeine-containing tea, coffee, etc. should be consumed in the 4 hours before the analysis, 6) No metal objects should be used and used before the analysis [17].

24-Hour Food Consumption Record is a frequently used method. The individual is asked about all foods and beverages consumed in the last 24 hours or more. It is often repeated for three consecutive days (two weekdays, one weekend). The questionnaire can be written by the individual himself or herself, or it can be recorded on a form prepared by a dietician/nutrition and diet specialist who has received training in food and nutrition. Recall; The portion models of foods are provided using household measurements (water glass, tea glass, coffee cup, mug, tablespoon (wipe, heap), ladle, dessert spoon, small, medium, large, etc.) and known net quantities. The amounts of energy and nutrients provided by each food are calculated using the Nutrition Information System (BeBiS) Program [18]. The sum of all days is divided by the number of days to find the average daily amount of food types and nutrients. The values found are calculated using the Turkey Nutrition Guide (TUBER) 2022 to determine how much of the individual's needs are met according to age, gender and physiological status [19].

The data were evaluated using the Statistical Package for the Social Sciences (SPSS) 25.0 Program. As descriptive statistics; mean and standard deviation values are given for quantitative variables. The conformity of quantitative variables to normal distribution was evaluated with the Kolmogorov-Smirnov test. In case the parametric test conditions are met in two independent group comparisons in terms of quantitative variables, independent samples The t-test was used when the parametric test conditions were not met, and the Mann-Whitney U test was used. In comparisons of more than two independent groups in terms of quantitative variables, one-way ANOVA was used when the parametric test conditions were met, and the Kruskal-Wallis test was used when the parametric test conditions were not met. The chi-square test was used in the comparison of qualitative variables. The relationship between two continuous variables was evaluated with Pearson or

Spearman rank correlation coefficients.

The research permission was obtained from the SANKO University Non-Interventional Research Ethics Committee (dated 10.01.2024 and 2024/01). Informed consent forms were obtained from the participants who agreed to participate in the study.

Results

When the daily eating speed of individuals was evaluated according to gender, it was observed that 8.5% (n=7) of women ate very slowly, 47.6% (n=39) slowly, 39% (n=32) fast, and 4.9% (n=4) very fast; and 6.7% (n=2) of men ate very slowly, 13.3% (n=4) slowly, 60% (n=18) fast, and 20% (n=6) very fast. The relationship between gender and eating speed was found to be significant (p<0.05).

When the meal consumption time of individuals was examined, 35.4% (n=29) of women ate in 20 min (normal), 39% (n=32) in >20 min (slow), and 25.6% (n=21) in <20 min (fast); It was observed that 26.7% (n=8) of men ate in 20 minutes (normal), 13.3% (n=4) in >20 minutes (slow), and 60% (n=18) in <20 minutes (fast). It was determined that the duration of meal consumption of individuals created a significant difference between genders (p<0.05) (Table 1).

When the change in eating speed of individuals according to gender was examined, it was determined that 37.5% of women (n=30) and 41.4% of men (n=12) changed their eating speed when they were angry/nervous; 27.5% of women (n=22) and 13.8% of men (n=4) changed their eating speed when they were sad; 26.3% of women (n=21) and 10.3% of men (n=3) changed their eating speed when they were unhappy, and 8.8% of women (n=7) and 24.1% of men (n=7) changed their eating speed when they were happy. 10.3% of men (n=3) did not answer this question. It was observed that there was a significant difference in the change in eating speed according to gender (p<0.05) (Table 2).

When the energy value taken by individuals depending on their daily eating speed (1-day weekday) was examined, it was determined that the participants with a very slow daily eating speed took an average of 925.5±505.1 kcal, those with a slow daily eating speed took 792.2±451.2 kcal, those with a fast daily speed took 973.1±576.6 kcal and those with a very fast daily speed took 1075.4±417.5 kcal. When we look at the meal consumption time of the individuals, it was seen that those who consumed their meals in 20 min (normal) took an average of 904.6±554.1 kcal, those who consumed their meals in >20 min (slow) took 845.9±453.5 kcal and those who consumed

Table 1. *Eating speed status by gender*

		Female		Male		p
		(n)	%	(n)	%	
Eating speed status	Very slow	7	8,5	2	6,7	0,002*
	Slow	39	47,6	4	13,3	
	Fast	32	39,0	18	60,0	
	Very fast	4	4,9	6	20,0	
Meal consumption time (minute)	20 (Normal)	29	35,4	8	26,7	0,001*
	>20 (slow)	32	39,0	4	13,3	
	<20 (fast)	21	25,6	18	60,0	
Total		82	100,0	30	100,0	

Table 2. *Changes in eating speed according to gender*

			Female	Male	Toplam	p
Changes in eating speed	Angry	(n)	30	12	42	0,04*
		%	37,5	41,4	38,5	
	Sad	Sayı (n)	22	4	26	
		%	27,5	13,8	23,9	
	Unhappy	(n)	21	3	24	
		%	26,3	10,3	22,0	
	Happy	(n)	7	7	14	
		%	8,8	24,1	12,8	
Total		(n)	80	29	109	
		%	100,0	100,0	100,0	

Table 3. *Daily eating rate status according to energy intake*

		Energy (1 day weekday) (kcal)		
		X̄	±SS	p
Daily eating speed	Very slow	925,5	±505,1	0,215
	Slow	792,2	±451,2	
	Fast	973,1	±576,6	
	Very fast	1075,4	±417,5	
Meal consumption time (minute)	20 (Normal)	904,6	±554,1	0,607
	>20 (slow)	845,9	±453,5	
	<20 (fast)	971,4	±537,3	

Table 4. *Relationship between eating speed and body mass index (BMI)*

		BMI		
		X̄	±SS	p
Daily eating speed	Very slow	20,06	±1,57	0,027*
	Slow	21,68	±2,98	
	Fast	22,87	±4,29	
	Very fast	25,10	±4,55	
Meal consumption time (minute)	20 (Normal)	22,38	±4,08	0,519
	>20 (slow)	21,79	±3,35	
	<20 (fast)	22,91	±4,02	

them in <20 min (fast) took 971.4±537.3 kcal. No significant difference was found between the daily eating speed and meal consumption time of the individuals and the energy value they took (p>0.05) (Table 3).

When looking at the relationship between the daily eating speed of the participants and BMI, it was found that the average BMI value of those with a very slow daily eating speed was 20.06±1.57 kg/m², those with a slow daily eating speed was 21.68±2.98 kg/m², those with a fast daily eating speed was 22.87±4.29 kg/m², and those with a very fast daily eating speed was 25.10±4.55 kg/m². When looking at the relationship between the BMI value of the individuals and meal consumption time, it was determined that the average BMI value of those who consumed their meals in 20 min (normal) was 22.38±4.08 kg/m², those who consumed their meals in >20 min (slow) was 21.79±3.35 kg/m², and those who consumed them in <20 min (fast) was 22.91±4.02 kg/m². While a significant relationship was found between the daily eating speed of the participants and BMI value (p<0.05); No significant relationship was found between the participants' meal consumption time and BMI value (p>0.05) (Table 4).

When the relationship between the participants' daily eating speed and body fat percentage (%) was examined, it was determined that the daily body fat percentage of those with very slow eating speed was 21.38±7.42%, those with slow speeds were 24.64±6.2%, those with fast speeds were 24.53±6.16%, and those with very fast speeds were 23.76±6.53%. When the individuals' body fat percentage and meal consumption time were examined, it was determined that the body fat percentage of those with a meal consumption time of 20 min (normal) was 24.15±5.68%, those with a meal consumption time of >20 min (slow) was 24.53±6.47%, and those with a meal consumption time of <20 min (fast) was 24.11±6.75%. No significant relationship was found between the participants' body fat percentage and daily eating speed and meal consumption time (p>0.05) (Table 5).

When the relationship between the physical activity status of the participants and the meal consumption time was examined, it was determined that 30.6% (n=19) of the participants who reported their meal consumption time as 20 min (normal) had an inactive physical activity status, 37.8% (n=14) had a minimally active physical activity status, and 30.8% (n=4) had a very

Table 5. *Relationship between eating speed and body fat percentage*

		Body fat (%)		
		X̄	±SS	p
Daily eating speed	Very slow	21,38	±7,42	0,909
	Slow	24,64	±6,20	
	Fast	24,53	±6,16	
	Very fast	23,76	±6,53	
Meal consumption time (minute)	20 (Normal)	24,15	±5,68	0,787
	>20 (slow)	24,53	±6,47	
	<20 (fast)	24,11	±6,75	

Table 6. *Relationship between meal consumption time and physical activity status*

			Physical activity status			Total	p
			Inactive	Minimal active	Very active		
Meal consumption time (minute)	20 (Normal)	Number (n)	19	14	4	37	0,019*
		%	30,6	37,8	30,8	33,0	
	>20 (slow)	Number (n)	25	11	0	36	
		%	40,3	29,7	0,0	32,1	
	<20 (fast)	Number (n)	18	12	9	39	
		%	29,0	32,4	69,2	34,8	
Total		Number (n)	62	37	13	112	
		%	100,0	100,0	100,0	100,0	

active physical activity status. It was determined that 40.3% (n=25) of the participants who reported their meal consumption time as >20 min (slow) had an inactive physical activity status, 29.7% (n=11) had a minimally active physical activity status, while no participant was observed to have a very active physical activity status. It was determined that 29% (n=18) of those who reported their meal consumption time as <20 min (fast) had an inactive physical activity status, 32.4% (n=12) had a minimally active physical activity status, and 69.2% (n=9) had a very active physical activity status. It was determined that there was a significant relationship between the participants' meal consumption time and physical activity status ($p<0.05$) (Table 6).

Discussion and conclusion

The findings obtained from this study revealed that eating speed varies according to gender. It was observed that male participants ate faster than women and therefore had higher energy intake. Andrade et al.'s study also found that consuming meals quickly caused high energy intake [20]. It was determined that women tended to consume their meals more slowly and this was associated with lower BMI. In contrast to this finding, Alshurafa et al.'s study found that BMI increased with decreasing eating speed [21]. In addition, the effect of eating speed on BMI showed a significant difference according to gender ($p<0.05$).

Contrary to other studies in the literature, Shah et al.'s study did not find a significant relationship between eating speed and body weight (22]. However, it was determined that individuals with a meal consumption time of >20 minutes (slow eaters) generally had lower energy intake and better metabolic health indicators.

These results highlight the effects of gender on eating speed and the possible consequences of this speed on individuals' energy intake and BMI. This research provides an important basis for understanding and improving the eating habits of university students. However, large and long-term studies are needed to better understand the relationship between eating speed, energy intake and BMI.

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