



The relationship with self rated health status and the overall quality of dietary intake of Turkish females; Healthy Eating Index Study

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Abstract

Aim: Our objectives were to assess the relationship between HEI (Healthy Eating Index) scores – indicators of diet quality and healthy food intake patterns –daily nutrient intake -self rated health status and anthropometric measurements. **Materials and Methods:** The participants were 566 randomly selected Turkish healthy female university students aged 17-32 years. **Results:** The mean score of HEI was 66.8 ± 11.26 in female university students. 80.2, 11.7 and 8.1% of females diets were categorized into “needs improvement”, “good” and “poor” respectively. **Discussion:** The HEI score of those who don't have a health problem have been found to be higher than those who have health problems. Moreover, the cholesterol intake (through a diet) levels of those who have health problems are significantly higher than those who don't have health problems ($p < 0.05$).

Keywords: HEI; nutrient; anthropometric measurements

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Introduction

Healthy eating is vital in the maintenance of health, prevention of chronic diseases and weight management. It is a well-recognized fact that obesity is a major public health problem in the world, and its prevalence is increasing in both developed and developing countries (Reilly, 2006; Chinn & Rona, 2001). The prevalence of being overweight has risen from 10.3% to 12.0% and obesity from 1.6% to 3.6% among Turkish adolescents (Oner et al., 2004; Uckun Kitapci et al., 2004; Sur et al., 2004; Krassaset et al., 2004).

The Healthy Eating Index (HEI) is a measure of diet quality that assess conformance to the Dietary Guidelines for Americans, the US departments of Agriculture and Health, and Human Services. While HEI is primarily a measure of overall diet quality, it may also be a predictor of obesity. Some studies have examined the association of nutritional intake with body mass index (BMI) (Howarth et al., 2005; Gupta et al., 2004) and more specifically with being overweight and obesity (Stam et al., 1999; Scali et al., 2004; Davis et al., 2006). Several articles have examined the validity of the HEI as a measure of diet quality using a variety of health indicators (Hann et al., 2001; Weinstein et al., 2004, McCullough et al., 2000a and 2000b). The purpose of this study was to determine the relation between HEI and dietary nutrient intake and body measurements in a female population of university students in Ankara, Turkey.

1. Materials and Methods

1.1. Participants

The participants were selected randomly. Subjects consisted of 566 female students enrolled in Gazi University, located in the capital city of Turkey, Ankara. The mean age of study population was 21.2 ± 2.08 years (range 17-32 years). Data were collected through face to face interviews in a 6-month period.

1.2. The questionnaire

The questionnaire contained socio-demographic items including age, health status and body mass index (BMI).

1.3. Dietary intake

In this study, dietary intake data were gathered by using 24-hour dietary recalls. Participants were asked to complete a form of nutritional dietary intake. They recorded whatever they ate and drank, including water, during one day period. They were asked to provide as much information as possible about serving size (e.g., portion, cup, mug, traditional Turkish tea glass, teaspoon, dessert spoon, table-spoon), method of cooking (e.g., boiled, grilled, fried), and all details of food consumption. The average energy, total fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, vitamin E, vitamin B₆, folates, fiber, sodium and cholesterol content for each individual's diet were analyzed using computer programmes (BEBIS) for Turkish foods.

1.4. Healthy eating index (HEI) scores

As the healthy eating index (HEI) was originally developed as a measure of diet quality in the US, it was modified for Turkish youth. The HEI-2005 is a valid measure of diet quality. Potential uses include population monitoring, evaluation of interventions, and research (Guenther et al., 2008). HEI scores were derived from previous-day dietary intake data collected as part of the Mobile Examination Center interview/examination via an interviewer-administered 24-hour recall. HEI scores range from 0 to 100, with 10 equally weighted components, each with a score ranging from 0 to 10. The first five components of the HEI measure the degree to which a person's diet conforms to the dietary guidelines for Turkish people prepared by Turkish Ministry of Health and Hacettepe University in 2004. Food and Nutrition Council of United States of America stated that foods should be classified under four groups in 1958. This classification facilitates making daily food plan. Council has passed "Food Pyramid" usage in 1985 with the view of contributing consumer consciousness in nutrition. Countries make changes in pyramid according to their food habits

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and food availability. Clover with four leaves has been used for Turkey in expression of groups with shape since it is appropriate using four food groups in planning daily food intake [<http://www.bdb.hacettepe.edu.tr>].

The maximum score of 10 indicates that the recommended servings were reached, while a zero indicates that no foods in that group were consumed. Intermediate scores are calculated proportionally. The next four components measure compliance to recommended intakes of total fat, saturated fat, cholesterol, and sodium. The score of 10 on these components is reached by consuming at or below the recommended maximum levels. See Table 1 for the scoring criteria for each component (Weinstein et al., 2004). HEI scores were analyzed continuously and were categorized into three groups (≤ 50 , 51 to 80 and > 80). A total score of more than 80 was considered “good”, scores of 51-80 indicated “needs improvement”, and scores of less than 50 were considered “poor” (USDA, CNPP; 1995).

Table 1. Criteria for minimum and maximum scores for each HEI^a component^{bc}

Component	Dietary guidelines for Turkey ^e		Dietary guidelines for USA ^f		HEI scores mean (X±SD)
	Criteria for minimum score (0)	Criteria for maximum score (10) ^d	Criteria for minimum score (0)	Criteria for maximum score (10) ^d	
Grain consumption	0 servings ^e	6-11 servings ^e	0 servings ^f	6-11 servings ^f	6.7±2.99
Vegetable consumption	0 servings ^e	3-5 servings ^e	0 servings ^f	3-5 servings ^f	6.1±2.81
Fruit consumption	0 servings ^e	2-4 servings ^e	0 servings ^f	2-4 servings ^f	7.6±2.81
Milk consumption	0 servings ^e	2 servings ^e	0 servings ^f	3-4 servings ^f	7.0±2.93
Meat consumption	0 servings ^e	2 servings ^e	0 servings ^f	2-3 servings ^f	7.8±2.63
Total fat intake	$\geq 45\%$ of kcal ^f	$\leq 35\%$ of kcal ^e	$\geq 45\%$ of kcal ^f	$\leq 30\%$ of kcal ^f	3.1±3.24
Saturated fat intake	$\geq 15\%$ of kcal ^f	$< 8\%$ of kcal ^e	$\geq 15\%$ of kcal ^f	$< 10\%$ of kcal ^f	6.5±3.38
Cholesterol intake	≥ 450 mg ^f	≤ 300 mg ^e	≥ 450 mg ^f	≤ 300 mg ^f	9.3±1.94
Sodium intake	≥ 4800 mg ^f	≤ 2400 mg ^e	≥ 4800 mg ^f	≤ 2400 mg ^f	9.5±1.52
Food variety	≤ 3 items/d ^f	≥ 8 items/d ^f	≤ 3 items/d ^f	≥ 8 items/d ^f	3.1±3.20
HEI score (0–100)					66.8±11.26

^aHEI= Healthy Eating Index.

^bProportional scores were assigned to consumption levels between the minimum and maximum range.

^cSource: reference (Bowman et al., 1998)

^dMaximum total HEI score is 100.

^eNumber of servings depend on recommended Food Guidelines for Turkish (<http://www.bdb.hacettepe.edu.tr/dokumanlar/dietaryguidelines.pdf>).

^fNumber of servings depend on recommended Food Guidelines for USA

1.5. Anthropometric measurements

All anthropometric measurements were conducted according to World Health Organization standards and made in triplicate by nutritionists. The body mass index (BMI) was calculated from measurements of height and weight. Participants were classified according to BMI; those between 18.5 to 24.9 kg/m² were classified as normal weight, 25 or greater as overweight [WHO, 1987]. Fat mass and lean body mass were determined by bioelectrical impedance analysis with a TBF-300 Body Composition Analyzer (TANITA, Tokyo, Japan) according to the manufacturer's internal algorithm. Waist and hip circumferences were measured by trained personnel using a tape measure. Skinfold thicknesses (biceps, triceps, subscapular and supra-iliac) were measured three times on the right side of the body using a Harpenden calliper (Holtain, Crymych, UK).

1.6. Statistical analyses

The descriptive statistics of continuous variables was expressed as mean \pm standard deviation (SD). The differences between groups mean values was determined by parametric (Independent Sample t-Test) and non-parametric (Kruskal-Wallis) tests. All data analysis was performed by using SPSS statistical package (version 11.0) and the level of statistical significance for analysis was set at $p < 0.05$.

2. Results

The average HEI score of the participants have found to be 66.8 ± 11.26 . The HEI scores have been found to be good only in the %11.7. When the subgroups of the HEI have been examined, the diet sodium (9.5 ± 1.52) and cholesterol (9.3 ± 1.94) scores have been high whereas total fat (3.1 ± 3.24) and food variety (3.1 ± 3.20) have been found low (Table 2).

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Table 2. Health status, BMI classification and HEI score groups of participants (n=566)

	Frequency	%
Health status		
Excellent/very good/good	364	64.3
Fair/poor*	202	35.7
Anemia	111	19.6
Gastro-intestinal disease	94	16.6
Neurological diseases	18	3.2
Cardiovascular diseases	5	0.9
Diabetes	1	0.2
Body Mass Index classification		
Underweight (<18.5)	74	13.2
Normal (18.5-24.9)	452	79.8
Overweight (≥ 25)	40	7.0
HEI score groups		
<51 (poor diet)	46	8.1
51-80 (needs improvement)	454	80.2
>80 (good diet)	66	11.7

*More than one selection has been made. Percentages (%) have been taken on frequency.

As shown in Table 2, it has been determined according to the statements of the participants that %64.3 don't have health problems and that from those who do have health problems mainly have anemia (%19.6) and gastrointestinal disorders (%16.6). It has been determined that the BMI's of %79.8 of the participants are at normal limits and the HEI scores of %80.2 are at medium levels. The average points of the subcomponents which make up the HEI scores and the HEI scores of the participants who have health problems and those who don't have health problems have been illustrated in Table 3.

Table 3. Mean Healthy Eating Index and component scores by self-rated health status among female students (n=566) ($X \pm SD$)

	Health Status		t-test	p
	Excellent/Very Good/Good (n=364)	Fair/poor (n=202)		
HEI score	67.1 \pm 11.30	66.3 \pm 11.13	0.849	0.396
Component scores				
Meat	7.9 \pm 2.58	7.7 \pm 2.73	0.853	0.394
Fruit	7.7 \pm 2.70	7.4 \pm 2.95	1.548	0.122
Milk	7.1 \pm 2.50	6.9 \pm 2.98	0.804	0.422
Grain	6.8 \pm 3.00	6.7 \pm 2.87	0.154	0.878
Vegetable	6.2 \pm 2.84	6.1 \pm 2.77	0.284	0.777

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Total fat	3.0±3.20	3.3±3.32	-1.034	0.301
Saturated fat	6.6±3.44	6.3±3.28	0.938	0.349
Cholesterol	9.2±2.13	9.6±1.51	2.230	0.026*
Sodium	9.5±1.60	9.7±1.36	-1.211	0.226
Food variety	3.2±3.20	2.7±3.17	1.779	0.076

* $p < 0.05$

According to this, the HEI scores, meat, fruit, milk, cereal, vegetable, saturated fat and food variety scores of those who don't have health problems have been found to be high compared to those who do have health problems. However, the difference between the groups have been found to be significant only in the cholesterol scores ($p < 0.05$). When the cholesterol intake through diets of the unhealthy individuals has been compared with those who are healthy, it has been found to be higher.

Table 4. Mean anthropometric measurements by HEI score groups (n=566) (X±SD)

Anthropometric measurements	HEI Score Groups			Kruskal-Wallis	p
	Poor (n=46)	Needs improvement (n=454)	Good (n=66)		
BMI (kg/m ²)	21.4±2.37	21.1±2.73	21.4±4.12	1.436	0.488
Body fat (%)	21.9±6.34	21.1±6.70	21.1±6.03	0.760	0.684
Waist circumference (cm)	74.0±7.46	73.7±7.21	73.0±7.66	2.269	0.322
TST(mm)*	70.3±16.53	71.4±17.08	70.2±16.05	0.294	0.863
Weight (Kg)	57.0±8.09	56.6±7.57	55.2±6.52	1.198	0.549
Hip circumference (cm)	97.4±7.51	96.5±5.89	96.8±6.87	0.694	0.707
Triceps (mm)	21.8±6.24	20.5±6.12	20.4±6.21	1.987	0.372
Biceps (mm)	11.9±4.76	12.9±5.45	12.4±5.34	1.703	0.427
Suprailiac (mm)	20.1±5.93	21.3±5.82	21.6±5.27	0.468	0.791
Subscapular (mm)	15.5±5.30	16.6±5.42	15.8±5.29	2.592	0.274

*Total Skinfold Thickness

When table 4 is examined, a significant difference has not been found ($p > 0.05$) between the anthropometric measurement averages according to the HEI score groups of the participants. It has been seen that, as the HEI score increases, body fat percentage, waist circumference, body weight, triceps skin fold thickness decreases and biceps, suprailiac skin fold thickness increases.

3. Discussion

In this study, “Good” HEI scores (>80) were found in 11.7%, “needs improvement” HEI scores (51-80) were found in 80.2% and “poor” HEI scores were found in (8.1%) of the total population (Table 2). Guo et al. (2004) found in a study conducted on 10,930 individuals aged between 20-75 that 17.8% of the participants had low HEI scores and 71.5% had moderate scores. Turconi et al. (2008) studied 532 Italian adolescents and observed 7.5% of them to display inadequate eating behaviors. Mirmirani et al. (2005) found in a study conducted on adolescents, aged 10-18, seventy-four, 23 and 3% of diets were categorized into “needs improvement”, “good” and “poor”, respectively. Beşikli et al. (2008) studied the eating habits of a total of 140 primary teachers (109 females and 31 males) aged between 23-58 and discovered that 21.4% had “poor” HEI scores, 33.4% had “needs improvement” scores and 42.9% had “very good” scores. Scott et al. (1996) studied 52 first year medical students and observed the mean HEI score 76.4. On the HEI subscores, the medical students scored lower on vegetables, milk and sodium, higher on fruits, meat, total fat, saturated fat, cholesterol and variety, and about the same for grains. In this study, we observed that, the participants scored lower on variety and total fat, higher on cholesterol and sodium. When the students who don't have health problems are compared to those who do have health problems, it has been found that HEI scores, and meat, fruit, milk, cereal, vegetable, saturated fat and food variety scores which make up the subgroups have been found to be higher whereas, total fat, cholesterol and sodium scores have been found to be lower (Table 3). In a study conducted by Weinstein et al. (2004), a positive relation has been found between HEI score and serum and folate in the red blood cells, serum vitamin C and E and the levels of all carotenides within the serum other than lycopene. In a research conducted by Goodwin and Knoll (2006) on adolescents, a difference has not been found between the HEI scores of adolescents according to their health. However, a positive relation has been found between health and vegetable scores and a negative relation with total fat score. While a significant relationship has not been found between HEI score and BMI in a similar study conducted by Hurley et al. (2008) on Afro-American adolescents, a significant negative relationship has been found between body fat and abdominal fat percentage in the same study. It has been determined in our study as well that the body fat percentage, waist

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circumference, body weight, triceps skin fold thickness decreases as HEI score increases and biceps and suprailiac skin fold thickness increases (Table 5).

Many methods have been developed to measure the eating habits of adolescents. Although these methods may yield accurate results, they are mostly difficult to implement and costly. However, the assessment of HEI score is relatively easier to use and less costly than all other methods aiming to measure eating habits. Taking the “Dietary Guidelines for Turkish” as a criterion, this study treats the HEI score as an accurate and practical index of healthy eating habits among Turkish adolescents.

The current study reveals three major findings. First, HEI score which is the indication of diet quality of participants has been found to be at a low level in the majority of the participants. Second, The HEI scores of the students who don't have health problems is found to be higher whereas total fat, cholesterol ($p<0.05$) and sodium scores, which are the subcomponents of the HEI score, is found to be lower. It has been determined that individuals who have health problems intake greater amounts of total fat, cholesterol and sodium through diets. Third, it is believed that HEI score can be a positive indication for high body fat percentage and waist circumference which are risk factors for chronic patients.

It has been highly emphasized that HEI is a method that can be used to evaluate the diet quality of adolescent females and to determine the risk factors of some illnesses, however, similar studies need to be conducted on males and other age groups.

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