

Short Communication

Evaluating dietary quality in diabetes by the Healthy Eating Index

Şevket Direktör MS, Emel Özer PhD

Department of Nutrition and Dietetics, Faculty of Health Sciences, Near East University, Nicosia, Northern Cyprus

Diabetes and diabetes-induced complications is a rising health concern in Northern Cyprus. Of the adult population in Northern Cyprus, 12.2% has diabetes and 90% of all individuals suffering from cardiovascular disease are people with diabetes. The aim of this study was to evaluate nutritional habits of people with diabetes in Northern Cyprus in order to make the necessary recommendations to improve their eating habits to prevent diabetes-induced complications. We used the Healthy Eating Index (HEI) to evaluate dietary quality of people with diabetes in Northern Cyprus based on their 24-hour food intake. A total of 200 participants with diabetes were selected randomly from the out-patient clinic of Dr. Burhan Nalbantoğlu central hospital in Nicosia. Individuals were asked to complete a questionnaire to determine their 24-hour food intake and frequency of intake of various food substances. The mean HEI score for the subjects with diabetes was 58.8. The HEI component scores for saturated fat, vegetables, dairy products and meat consumption were less than 5, whereas average scores for fat, cholesterol, fruits, grains, and sodium consumption were more than 5. The meat component of the HEI had the lowest mean score (3.3). There was statistical significance between male and female subjects regarding the HEI scores for meat and nutrient variety intake. In conclusion, the results of the present study suggest that subjects with diabetes in Northern Cyprus should improve their diet by decreasing their intake of saturated fat and by increasing their intake of vegetables, meat and milk.

Key Words: diabetes Mellitus, dietary quality, BMI, nutritional status, nutrient

INTRODUCTION

Diabetes mellitus (DM), a chronic disease which includes a group of metabolic disorders, is characterized by chronic hyperglycemia. It is caused by disorders of either insulin secretion or insulin action or both.¹ Blood glucose levels are not under control of the diseases associated with vascular and nervous system develops multi-organ damage.^{2,3} Today, there are 366.2 million people with diabetes all over the world. After 20 years, it is expected to reach 551.8 million.⁴ In Northern Cyprus, there are 18,500 people with diabetes (11% of the population) and 30,000 people are considered to be at the prediabetes state (18% of the population). Of the adult population, 12.2% has diabetes and 90% of all individuals suffering from cardiovascular disease are people with diabetes in Northern Cyprus.⁵ Due to the increased incidence of diabetes, the United Nations announced that the diabetes is a disease that must be fought against.

Unless the blood glucose level is not taken under control, it causes microvascular complications (diabetic nephropathy, neuropathy and retinopathy) and macrovascular complications (coronary artery disease, peripheral artery disease and stroke) which may negatively affect the life span and quality of life.⁶⁻⁸ Therefore diabetes imposes a large economic burden on the individual, national healthcare systems, and countries. Healthcare expenditures due to diabetes account for 11% of the total healthcare expenditures in the world in 2011. About 80%

of the countries were estimated to spend between 5% and 18% of their total healthcare expenditures on diabetes. Healthcare expenditures include expenditures on diabetes by the health systems as well as by people living with diabetes.⁹ Monthly expenditure for an individual with non-complicated diabetes is 80-110 US dollars in Turkey,¹⁰ there is not any study for the cost of diabetes in Northern Cyprus.

Medical Nutrition Therapy (MNT) for DM, with food intake (focusing on carbohydrate), medication, metabolic control (glycemia, lipids, and blood pressure) anthropometric measurements and physical activity serves as the basis for implementation of the nutritional prescription, goals and intervention. The effects of MNT on the treatment of DM have been shown with many studies. Taking or not taking the suggestions of MNT affects diabetic complications. According to the MNT studies, it has been reported that for those who perform MNT at least 3-6 months, there have been reductions in their levels of A1c ranging from 0.25-2.9%, 2-3% in total cholesterol and 7%

Corresponding Author: Şevket Direktör, Department of Nutrition and Dietetics, Faculty of Health Sciences, Near East University, Nicosia, Northern Cyprus.

Tel : +90 (392) 223 64 64; Fax: +90 (392) 223 64 61

Email: shdirektor@yahoo.com

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in LDL cholesterol are observed.¹¹

Epidemiologic studies have shown positive relationship between diet and risks of chronic diseases.^{12,13} For measuring the overall nutritional status and chronic disease risk, the Healthy Eating Index (HEI) have been developed. The HEI, is a summary measure of diet quality. It is a simple facility for monitoring the changes in eating habits and decision-making in order to improve nutrition.¹³⁻¹⁵

MATERIAL AND METHOD

A total of 200 adult men and women were selected randomly between the ages of 19-65 years that were followed with diabetes as outpatients for more than one year at Nicosia Dr Burhan Nalbantoğlu Central Hospital. The food consumption in 24 hours dietary recall and the frequency of food consumption were examined by face to face method and HEI was calculated.

The HEI is nutritional quality measurement tool according to the RDA. It has 10 dietary components. The first five components (grains, vegetables, fruits, milk and meat) of HEI include proposals to the amount of daily change. The other four components are based on the food item. Each of the 10 dietary components had a scoring range of 0 to 10. Individuals with an intake at the recommended level received a maximum score of 10 points. A score of 0 was assigned when no food in a particular group was eaten. Intermediate scores were calculated proportionately. Calculation of HEI was based on 100 points. The highest score was 100, and the lowest score was 0. An HEI score over 80 implies a 'good' diet, an HEI score between 51 and 80 implies a diet that 'needs improvement' and an HEI score less than 51 implies a 'poor' diet.¹⁴

In this study, the portion size of food was based on the Nutrition Guide for Turkey.¹⁶ For the HEI criteria, the article published in 2008 was taken into consideration.¹⁴ The amount of food and nutrients used for scoring HEI was shown in Annex 1.

A variety of foods at HEI refers to the sum of the different varieties of food a person consumes in a day. At least half serving of any food must be taken in order to consider that food as dietary variety taken. For example, boiled potatoes or chips, fried foods such as potatoes are basically prepared with different cooking methods, but it is also counted as a single food, even fish types are considered separately.

If a person, consumed eight or more types of foods in a day will be given 10 points, if the consumption is ≤ 3 and >8 types then 5 points, and consumption of less than 3 types will be considered as 0 points.¹⁷ Annex 1 includes more details on the coding structure used to compute the variety component of the HEI. All statistical analyses were performed using standard statistical software (SPSS version 16.0). This study has approval from Near East University institutional ethics committee.

RESULTS

A total of 200 subjects with diabetes (65 men and 135 women) participated in this study. The average age of participants was 52.4 ± 9.8 years. Of the subjects, 66% were in the 51-65 age groups. The general characteristics of participants by gender were shown in Table 1. Of the

participants, 66.0% (67.7% men, 65.2% women) were in the >50 years age group, and 31.0% (29.2% men, 31.9% women) were in ≤ 50 years age group. Of the participants, 85.5% (89.2% men, 83.7% women) were married, and 75.5% (52.3% men, 86.7% women) was at minimum income level. With regard to the nationality of the participants, 63.5% (60.0% men, 65.2% women) were Cypriot, 35.5% (38.5% men, 34.1% women) were Turkish. Of Turkish participants, 60.5% (53.8% men, 63.7% women) graduated from primary school. Of female participants, 68.1% were housewives; and 60.0% (55.4% men, 62.2% women) lived together with 2-3 people.

BMI values of subjects with diabetes are shown in Table 1. According to this table, 9% (13.8% men, 6.7% women) of subjects were of normal weight, 27.5% (35.4% men, 23.7% women) of them were overweight, and 63.5% (50.8 men, 49.8 women) were obese.

The mean HEI score for the participants with DM was 58.8. About 5.5% of the participants with DM had a good diet and 33% had a poor diet. The diets of most subjects with diabetes (61.5%) needed improvement.

The HEI component scores for saturated fat, vegetables, dairy products and meat consumption were <5 whereas average scores for fat, cholesterol, fruits, grains, and sodium consumption were >5 (Table 2). With an average score of 9.5, cholesterol accounted for the highest component score. With an average score of 7.9, sodium accounted for the second highest component score. The milk and meat components of the HEI had the two lowest mean scores (3.7 and 3.3 respectively). Average scores for the other HEI components were between 4 and 6. There was a statistically significant difference between HEI score of meat component and variety of foods according to the individual gender ($p < 0.05$) (Table 2).

DISCUSSION

Our study indicated that HEI score was 58.8 for people with DM living in North Cyprus. Lin *et al* found that the average score of HEI was 66.0 in Macau.¹⁸ The average score of HEI was 67.8 in another study which was conducted in Brazil.¹⁹

The nutritional status should be developed according to the results of the HEI obtained from the studies performed on the patients with diabetes. This may indicate a widespread lack of education or the need for re-evaluation of TBT.

The HEI component scores from highest to lowest at Santos's study were meat (8.9), sodium (8.5), fat (8.1), cholesterol (8.1), saturated fat (7.0), variety (6.7), grain (4.7), fruit (4.9) and milk (4.6).¹⁹ At Ağören's study, the HEI component scores from highest to lowest were cholesterol (8.2), variety (7.2), saturated fat (6.1), sodium (6.0), fat (5.7), meat (4.9), milk (4.8), fruit (4.8), cereals (4.5) and vegetables (4.0).²⁰

According the results of our study, the HEI component scores from highest to lowest were cholesterol (9.5), sodium (7.9), variety (6.5), fat (6.3), cereals (6.2), fruit (6.1), saturated fat (4.6), vegetables (4.6), milk (3.7) and meat (3.3).

Ağören's study was on the general population of Cyprus, the present and Santos' study were on the people with DM.^{19,20} According to these three studies, milk con-

Table 1. General characteristics of individuals by gender

| General characteristics | Men | Women | All |
|--|------------|------------|-------------|
| n (%) | 65 (32.5) | 135 (67.5) | 200 (100.0) |
| Age, y * | 53.7 ±10.5 | 52.7 ±9.5 | 52.9 ±9.8 |
| ≤50, n (%) | 19 (29.2) | 43 (31.9) | 62 (31) |
| >50, n (%) | 44 (67.7) | 88 (65.2) | 132 (66) |
| Marital status, n (%) | | | |
| Married | 58 (89.2) | 113 (83.7) | 171 (85.5) |
| Single | 6 (9.2) | 7 (5.2) | 13 (6.5) |
| Widow | 1 (1.5) | 15 (11.1) | 16 (8.0) |
| Education status, n (%) | | | |
| Illiterate | - | 9 (6.7) | 9 (4.5) |
| Primary school | 35 (53.8) | 86 (63.7) | 121 (60.5) |
| Secondary school | 9 (13.8) | 19 (14.1) | 28 (14) |
| High school | 13 (20.0) | 19 (14.1) | 32 (16) |
| University | 8 (12.3) | 2 (1.5) | 10 (5) |
| Income level, n (%) | | | |
| Low-income | 34 (52.3) | 117 (86.7) | 151 (75.5) |
| Middle income | 29 (44.6) | 18 (13.3) | 47 (23.5) |
| High income | 2 (3.1) | - | 2 (1) |
| Ethnic group, n (%) | | | |
| Cyprus | 39 (60.0) | 88 (65.2) | 127 (63.5) |
| Turkey | 25 (38.5) | 46 (34.1) | 71 (35.5) |
| Bulgaria | 1 (1.5) | - | 1 (0.5) |
| Azerbaijan | - | 1 (0.7) | 1 (0.5) |
| Occupation, n (%) | | | |
| Unemployed | 7 (10.8) | 3 (2.2) | 10 (5.0) |
| Housewife | - | 92 (68.1) | 92 (46.0) |
| Officer | 17 (26.2) | 8 (5.9) | 25 (12.5) |
| Worker | 7 (10.8) | 10 (7.4) | 17 (8.5) |
| Teacher | 2 (3.1) | 1 (0.7) | 3 (1.5) |
| Retired | 32 (49.2) | 21 (15.6) | 53 (26.5) |
| Number of people living at home, n (%) | | | |
| <2 | 2 (3.1) | 7 (5.2) | 9 (4.5) |
| 2-3 | 36 (55.4) | 84 (62.2) | 120 (60) |
| 4-5 | 22 (33.8) | 34 (25.2) | 56 (28) |
| >5 | 5 (7.7) | 10 (7.4) | 15 (7.5) |
| Body mass index (kg/m ²) | | | |
| 18.5-24.9 (Normal) | 9 (13.8) | 9 (6.7) | 18 (9.0) |
| 25.0-29.9 (Overweight) | 23 (35.4) | 32 (23.7) | 55 (27.5) |
| 30.0-34.9 (Obese class I) | 23 (35.4) | 43 (31.9) | 66 (33.0) |
| 35.0-39.9 (Obese class II) | 7 (10.8) | 32 (23.7) | 39 (19.5) |
| >40 (Obese class III) | 3 (4.6) | 19 (14.1) | 22 (11.0) |

* Data are given as mean (SD)

Table 2. Healthy Eating Index (HEI) score components and total scores by gender†

| | HEI scores | | |
|---------------|---------------|------------------|------------------|
| | Men (n=65) | Women (n=135) | Total (n=200) |
| Overall | 59.2±16.7 | 58.3±16.7 | 58.8±16.7 |
| Components | | | |
| Total fat | 6.5±3.3 | 6.1±3.4 | 6.3±3.4 |
| Saturated fat | 4.8±4.0 | 4.4±3.8 | 4.6±3.9 |
| Cholesterol | 9.7±1.2 | 9.4±2.1 | 9.5±1.8 |
| Fruits | 5.7±4.2 | 6.3±4.1 | 6.1±4.1 |
| Vegetables | 4.8±3.8 | 4.5±3.6 | 4.6±3.6 |
| Grains | 5.6±4.3 | 6.5±3.9 | 6.2±4.1 |
| Milk | 3.2±3.4 | 3.9±3.6 | 3.7±3.6 |
| Meat | 4.1±4.0* | 2.9±3.3 | 3.3±3.6 |
| Sodium | 7.7±2.7 | 7.9±3.0 | 7.9±2.9 |
| Variety | 7.2±2.5* | 6.1±2.4 | 6.5±2.5 |

†Data are given as mean (SD) unless otherwise noted.

* $p < 0.05$

sumption was insufficient. According to Ağören's study and the present study, meat and vegetable consumption were seen as inadequate.²⁰ Saturated fat score was higher in the study, this might be due to the high frequency of fast food and hellumi (a traditional cheese having high saturated fat) consumption. Individuals participating in our study generally go to hospital on an empty stomach for fasting blood analysis and waiting for the doctor examination. According to the doctor request, subjects with DM may come to hospital at the next day for blood test, eye and foot examination. After giving the blood at the hospital, they get their food at hospital's cafeteria. Unfortunately, hospital does not provide proper food service to individuals who come from outside the city and this must be corrected in order to prevent people from eating unhealthy foods. There are no hospital facilities to provide their food. This situation might have increased fast food

consumption of the subjects with DM.

There was a statistically significant difference between meat and variety component scores according to gender. This was due to the fact that men required more energy intake than women gender. Thus, men consumed more meat and food varieties.

A weakness of this study is that we could not extend the study to more hospitals although our study was undertaken at the biggest hospital in North Cyprus and patients come to this particular hospital from many regions.

In summary, there is need for people with diabetes in North Cyprus to improve their dietary quality. Local government authorities and health officials need to develop programs including nutrition education to help with this urgent matter.

AUTHOR DISCLOSURES

All authors declared there is no conflict of interest.

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Appendix. Healthy Eating Index score criteria

| Healthy Eating Index | Recommended Daily Amount | Score Criteria |
|------------------------|--------------------------------------|---|
| 1-Total fat | 30% or less of total energy intake | ≤30%=10 >30%-≤45%=5 >45%=0 |
| 2- Saturated Fat | Less than 10% of total energy intake | ≤10%=10 >10%- ≤15%=5 >15%=0 |
| 3- Dietary Cholesterol | 300 mg/day or less | >450 mg/day = 0 >300 mg/day - ≤ 450 mg/day = 5 300 mg/day = 10 |
| 4- Fruit | 2-4 serving /day | <1 serving /day = 0 ≥1-2< serving /day =5 ≥2 serving /day = 10 |
| 5- Vegetables | 3-5 serving /day | <1.5 serving /day = 0 ≥1.5 serving /day - < 3 serving /day = 5 ≥3 serving /day = 10 |
| 6- Grain | 6-11 serving /day | <3 serving /day = 0 ≥3 serving /day - < 6 serving /day = 5 ≥6 serving /day = 10 |
| 7- Milk | 2-3 serving /day | <1 serving /day = 0 ≥1 serving /day - < 2 serving /day =5 ≥2 serving /day = 10 |
| 8- Meat | 2 serving /day | <1 serving /day = 0 ≥1 serving /day -<2 serving /day = 5 ≥2 serving /day = 10 |
| 9- Sodium | 2400 mg/day or less | >4800 mg/day =0 >2400 mg/day -≤ 4800 mg/day =5 ≤2400 mg/day =10 |
| 10- Food variety | 8 or more variety of food in a day | <3 variety = 0 ≥3-< 8 variety = 5 ≥8 variety = 10 |

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Department of Nutrition and Dietetics, Faculty of Health Sciences, Near East University, Nicosia, Northern Cyprus

以健康飲食指標評估糖尿病患者之飲食品質

在北塞普勒斯，糖尿病與糖尿病引發的併發症正逐漸成為重要健康議題。北塞普勒斯成人中，12.2%患有糖尿病；且所有心血管疾病的患者中，90%亦患有糖尿病。本篇研究主要目的是，評估北塞普勒斯糖尿病者的營養習慣，以提出建議來改善其飲食習慣，預防日後糖尿病所導致的併發症。利用健康飲食指標(HEI)，根據 24 小時食物攝取量，來評估北塞普勒斯糖尿病患者的飲食品質。從尼古西亞 Dr. Burhan Nalbantoğlu 中央醫院的門診病人中隨機挑選 200 位糖尿病患者為研究對象。參與者需完成 24 小時食物攝取量和多項食物攝取頻率之問卷。糖尿病參與者的 HEI 平均分數為 58.8 分。健康飲食指標分項分數，如飽和脂肪、蔬菜、乳製品和肉類攝取的分數皆低於 5 分；然而，脂肪、膽固醇、水果、穀類和鈉攝取的平均分數皆高於 5 分。健康飲食指標之分項中，以肉類的平均分數 3.3 分為最低。肉類與營養素多樣性攝取的分項分數，在男女性間有顯著差異。總之，本篇研究結果顯示，北塞普勒斯糖尿病患者，應藉由減少飽和脂肪攝取，並增加蔬菜、肉類和奶類攝取，以改善其飲食。

關鍵字：糖尿病、飲食品質、身體質量指數、營養狀況、營養素