Assessment of Dietary Habits in Patients With Chronic Heart Failure

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ABSTRACT

Background: Nutritional deficiency is a critical factor in the development and prognosis of heart failure. An optimal diet should be ensured and maintained to manage the symptoms of heart failure.

Purpose: This study assessed the dietary habits of patients with chronic heart failure using diet quality indices with the goal of determining their nutritional status.

Methods: Forty-four female patients and 56 male patients (mean age: 66 ± 11.38 years) who had been admitted to the cardiology clinics of a university hospital in Istanbul between March 2012 and August 2014 were included in this study.

Results: In terms of body mass index, 34% of the participants were normal weight, 37% were overweight, and 21% were obese. Furthermore, this study found the mean daily total energy intake to be inadequate and the total mean score of the Healthy Eating Index to be 74.6 ± 9.32. The diet quality of most participants fell into the “needs improvement” category.

Conclusions: This study used the Healthy Eating Index, a measure developed to assess diet quality, to assess the food consumption patterns of patients with chronic heart failure. The findings support using this index before providing diet recommendations to patients.

Key Words: heart failure, food preference form, food variety, Healthy Eating Index.

Introduction

Chronic heart failure (CHF) is characterized by high mortality, multiple comorbidities, a complex therapeutic regimen, frequent hospitalization, and reduced quality of life. Known predictors of mortality in patients with CHF are older-age diabetes, lower left ventricular ejection fraction, a higher New York Heart Association classification (NYHA class), elevated N-terminal pro-B-type natriuretic peptide, frailty, and cardiac cachexia. In addition, poor nutritional conditions have been strongly associated in several studies with mortality in hospitalized patients with CHF (Tevik, Thürmer, Husby, de Soysa, & Helvik, 2016).

Heart failure (HF) causes low nutritional intake because of various factors, including intestinal edema, anorexia, absorption disorder, increasing resting metabolic rate, and increased energy and nutrient demands of the heart, which lead to malnutrition (Yoshihisa et al., 2018). In patients with HF, increased risk of poor dietary intake is associated with lower quality of life, which predicts cardiovascular events (Sciatti et al., 2016). Nutritional status is a critical risk factor for the development and prognosis of HF. Nutritional deficiency is often observed in patients with HF, particularly at the advanced stages of the disease, as indicated by an NYHA class of III or IV (Pinho & da Silveira, 2014). Maintaining optimal nutritional status is important for effectively managing HF symptoms. The most effective guidelines-based practices, which should be performed by patients to reduce their HF symptoms, include adhering to the daily intake recommendations for fluids (1.4–1.9 L) and salt (≤ 2 g/day), self-weighing daily, losing weight (5%–10% of body weight) if overweight, reducing consumption of fats, consuming fiber-rich foods, being active, and not using alcohol or cigarettes (Alberta Health Services, 2016).

Appropriate nutritional assessment is important, and several nutritional indices have been published for assessing patients with chronic diseases and the general population (Yoshihisa et al., 2018).

Diet quality plays an important role in preventing and delaying the development of chronic diseases. Consuming a variety of foods and food groups helps ensure that macronutrients and micronutrients, which are necessary for health, are consumed at adequate levels and that nutritional patterns improve (Barut Uyar & Yücecan, 2012; Guenther et al., 2013). Therefore, the aim of this study was to determine the nutritional conditions of patients with CHF by assessing their dietary habits using diet quality indices.

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Methods

Study Design and Study Population
This study was planned as a descriptive study. One hundred patients with chronic HF who had been admitted to the cardiology clinics of a university hospital in Istanbul, Turkey, between March 2012 and August 2014 and who had been diagnosed with chronic HF in the previous 6-month period were recruited, and their dietary habits were assessed using the diet quality index. Patients who had been diagnosed with diabetes were excluded from this study, as diabetes requires a specific nutritional program. Patients with communication, mental, or memory problems were also excluded from participating.

Data Collection
Data were collected using a questionnaire that included a basic information form, the Healthy Eating Index (HEI), a food preference form, and a food variety form. All questionnaires were completed by the researcher during a face-to-face interview with each participant.

Instrument

Information form
The information form gathered participant-related sociodemographic, daily fluid and salt consumption, body mass index (BMI), waist circumference, waist–hip ratio, NYHA functional classification assessment, and laboratory test result data in the clinic on the day of hospital admission. The reference range of anthropometric measurements and laboratory test results was assessed in accordance with related guidelines and literature recommendations (Jensen et al., 2014; Montalescot et al., 2013; Ponikowski et al., 2016).

Food preference form
The food preference form was used to assess how often the participants consumed foods high in fats or cholesterol, fruit, vegetables, milk and dairy products, meat, fish, salty and convenience foods, and sugary foods (Enc, Yiğit, & Alnök, 2007, 2010; Ponikowski et al., 2016). The participants were asked to describe how often they consumed foods in these categories using the statements “never,” “sometimes,” and “always.” No scoring was done, and only the frequency distribution of each participant’s food consumption preferences was examined.

Healthy eating index
The HEI, developed by Kennedy, Ohls, Carlson, and Fleming (1995), uses a “24-hour food consumption record” to assess the adherence of respondents to the Dietary Guidelines for Americans. The index consists of 10 dietary components, including the total consumption of fat and saturated fat (to measure total energy intake), cholesterol and salt (in milligrams), vegetables, fruit, grains, milk, and meat and food variety. The maximum total score is 100. An HEI score greater than 80 indicates a “good” diet, between 51 and 80 indicates “improvement needed,” and below 51 indicates “poor” diet. The Dietary Guidelines for Turkey (Besler et al., 2015) and the diet and portion sizes included in the International Heart Failure Guidelines (Yancy et al., 2013) were used in this study to calculate the HEI (Barut Uyar & Yücecan, 2012; Guenther et al., 2013; U.S. Department of Agriculture [USDA], Center for Nutrition Policy and Promotion [CNPP], 1995).

24-Hour individual food consumption record form
The 24-hour individual food consumption record form is designed to determine the types and amount of nutrients an individual receives daily and to calculate the energy and nutrient items, which allows calculations of average daily food consumption and portion sizes. This form was used to assess the food consumption status, diet quality, and food variety of the participants. The average energy of foods consumed and the sufficiency of nutritional elements were assessed using the Turkish Food Composition Database (TürKomp; TürKomp, T. R. Ministry of Food, Agriculture and Livestock, 2014) and the recommendations of related guidelines (Besler et al., 2015; Yancy et al., 2013), whereas the HEI of participants were assessed using the 24-hour individual food consumption record form (Barut Uyar & Yücecan, 2012).

Food variety form
Using the data obtained using the 24-hour individual food consumption record form, the variety of foods consumed by the participants was determined by considering 19 different food groups (red meat, offal, fish and marine products, poultry, eggs, cheese, milk and yogurt, tomatoes, green leafy vegetables, other vegetables, citrus fruit, other fruits, white bread, whole-grain and whole-wheat breads, other grain products, potato and starchy foods, legumes and oil seeds, butter, and sugar and sugary foods). Consuming six or fewer types of food earned a score of 0, consuming 7–16 types earned a score of 5, and consuming more than 16 types earned a score of 10. This form was one of the 10 dietary components considered in calculating the HEI total score (Barut Uyar & Yücecan, 2012; Guenther et al., 2013; USDA, CNPP, 1995).

Data Analysis
Frequency, arithmetic mean, and standard deviation tests were assessed for the qualitative and numeric variables. The data were analyzed using Istanbul University SPSS Version 21 software program (IBM, Armonk, NY, USA). Significance was regarded as p < .05.

Ethical Issues
After approval was obtained from the department where the study was conducted and the ethics committee (Istanbul
University Cardiology Institute, No. 09), the patients who were invited to participate in the study were informed about the study aim and expectations in accordance with the Helsinki Declaration. Patients were enrolled as participants after obtaining their verbal and written approval.

Results

Participant Characteristics
In terms of characteristics, 44% of the participants were female and 56% were male; the mean age was 66.00 ± 11.38 years; and 5% were underweight, 34% were normal weight, 37% were overweight, 21% were obese, and 3% were morbid obese (Table 1).

Assessment of Food Consumption Preferences
In terms of food consumption preferences, 61% of the participants stated that they never consumed two or more eggs, a recommended food, per week, whereas 31% stated that they consumed eggs occasionally; 55% stated that they always consumed the unsaturated fats, a food recommended to be eaten in moderation, whereas 38% stated that they never consumed unsaturated fats (Table 2).

Assessment of Macronutrient and Micronutrient Consumption
The daily total energy intake of the female participants (1,659.96 ± 717.19) was lower, but not significantly lower, than that of the male participants (1,766.04 ± 696.35; p > .05; Table 3). This study found the daily consumption of carbohydrates and omega-6 to be inadequate and the daily consumption of omega-3 to be excessively high. Furthermore, sodium consumption was excessively high (69.6% in female participants and 79.6% in male participants), potassium consumption was inadequate (93.2% in female participants and 92.9% in male participants), and iron consumption fell within the “normal” range (54.5% in female participants and 89.3% in male participants).

Assessment of Healthy Eating Index Scores
The HEI total mean score for participants was 74.6 ± 9.32. The diet of most of the participants (77.5% in female participants [n = 34] and 82.4% in male participants [n = 46]) was in the “needs improvement” category. The HEI scores for female participants (77.50 ± 8.98) were significantly higher than that of male participants (72.4 ± 9.04; p < .05). In addition, a preponderance of the participants fell into the “needs improvement” category (p > .05) for BMI, NYHA class, and laboratory test results in relation to HEI total score. This study found that the HEI total mean score (78.00 ± 4.47) of the participants who were underweight based on their BMI score was higher than their score in the other categories (p > .05; Table 4).

Discussion

The causes of nutritional and metabolic deficiencies in patients with HF have been reported to result from either inflammation or direct food intake deficiencies (Irish Heart Foundation, 2007). The nutritional status of patients with HF in this study was assessed using the diet quality index recommended by relevant guidelines.

Assessment of Individual Characteristics and Health Status
The relevant studies in the literature indicate that patients with congestive HF have the strongest indication for hospital admission among adults older than 65 years (Eloranta et al., 2016). In line with the literature, the age mean score of participants in this study was 66.00 ± 11.38 (Table 1).

The Framingham Heart Study found a positive relationship between BMI and HF incidence and found that each unit increase in normal BMI increased the risk of disease development by 5% in men and 7% in women (Kenchaiah et al., 2002). Another study showed the risk of cardiac compensation to be two times higher in obese individuals than normal-weight individuals (Campillo et al., 2004). The examination of BMI values in this study found that “overweight” defined the largest number of participants (Table 1).

Similar to the results of Montalescot et al. (2013), this study identified that waist circumference and waist–hip ratios were high in proportion to the reference values indicated in the guidelines (Jensen et al., 2014) and that women had higher waist circumference and waist–hip ratios than men (Table 1).

Assessment of Healthy Eating Index Scores
This study was one of the few studies to use HEI to assess the diet quality of patients with HF in terms of their nutritional component consumption patterns. This study found that the HEI mean score for female patients (77.50 ± 8.98) was higher than that for male patients (72.4 ± 9.04) and that most of the participants (80%) scored in the “needs improvement” category.

In addition, similar to other studies (Drewnowski, Fiddler, Dauchet, Galan, & Hercberg, 2009; USDA, CNPP, 1995), this study found that most participants (80%) scored in the “needs improvement” diet category, with 19% in the “good diet” category and only 1% in the “poor diet” category (p < .05).

A previous study that was similar to this study in terms of mean age reported a significant relationship between triglyceride level and HEI score in female participants (p < .05; Barut Uyar & Yücecan, 2012). Moreover, this study found that the participants fell into the “needs improvement” category in terms of total cholesterol, triglyceride, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol, respectively, although none of these values attained significance (Table 4). In addition, the HEI total mean scores of the participants showed a borderline-high total cholesterol value, a normal triglyceride value, a high low-density lipoprotein cholesterol value, and a normal or high (required) high-density lipoprotein cholesterol value. These results may be related to the fact that the
participants were currently receiving lipid-management-related drug therapy and complying with nutrition-related diet recommendations (Table 4).

Furthermore, this study reported that 58% of the participants consumed 6–16 types of foods and that 42% consumed 16 or more types of foods. In this study, the diet indexes of the participants were higher and their food variety was lower than those in similar studies (Table 5). The high HEI score obtained in this study may result from low fat consumption, high omega-3 and omega-6 fat consumption, high fiber consumption, and high food variety (Table 3).

A noteworthy finding in this study was the high level of sodium consumption (Table 5). One of four food groups that should be consumed at each meal is milk and dairy products, with two portions recommended per day (Barut Uyar & Yücecan, 2012; Besler et al., 2015). This study found that the dairy subscores of individuals were at good levels for both genders (Table 5). Moreover, the meat subscores were also at good levels, with male participants higher than female participants, which is similar to Drewnowski et al. (2009). The recommended daily consumption of legumes and grain is three to five portions. Legumes should be consumed at least twice a week to increase the intake of complex carbohydrates and fiber. The recommended daily vegetable and fruit consumption amounts are three to five portions and two to four portions.

TABLE 1. Baseline Characteristics (N = 100)

| Characteristic                      | n  | %  |
|-------------------------------------|----|----|
| Gender                              |    |    |
| Female                              | 44 | 44.0|
| Male                                | 56 | 56.0|
| Age (M and SD)                      | 66.0 | 11.38|
| Education                           |    |    |
| Illiterate                          | 16 | 16.0|
| Primary school                      | 50 | 50.0|
| Secondary school/high school        | 29 | 29.0|
| University/postgraduate              | 5  | 5.0 |
| NYHA class                          |    |    |
| I                                   | 10 | 10.0|
| II                                  | 36 | 36.0|
| III                                 | 34 | 34.0|
| IV                                  | 20 | 20.0|
| Waist circumference (cm; M and SD)a |    |    |
| Female                              | 100.02 | 16.74|
| Male                                | 98.17 | 14.95|
| Waist/hip (cm; M and SD)b           |    |    |
| Female                              | 0.95 | 0.13|
| Male                                | 0.98 | 0.11|
| BMI (kg/m²)                         |    |    |
| Underweight (< 18.5)                | 5  | 5.0 |
| Normal (18.5–24.9)                  | 34 | 34.0|
| Overweight (25–29.9)                | 37 | 37.0|
| Obese (30–39.9)                     | 21 | 21.0|
| Morbid obese (≥ 40)                 | 3  | 3.0 |
| Did the participant gain or lose weight in the last 1 month? |    |    |
| Yes                                 | 72 | 72.0|
| No                                  | 28 | 28.0|
| Did the participant receive a recommendation about daily fluid consumption? |    |    |
| Yes                                 | 74 | 74.0|
| No                                  | 26 | 26.0|
| Daily amount of fluid recommended   |    |    |
| 1–1.5 L                             | 36 | 36.0|
| 2 L                                 | 39 | 39.0|
| No restriction                      | 25 | 25.0|
| Adaptation to the recommended fluid amount |    |    |
| Yes                                 | 63 | 63.0|
| No                                  | 16 | 16.0|
| Did not answer                      | 21 | 21.0|
| Did the participant receive a recommendation about daily salt consumption? |    |    |
| Yes                                 | 84 | 84.0|
| No                                  | 16 | 16.0|
| Daily amount of salt recommended    |    |    |
| Normal                              | 20 | 20.0|
| Low salt                            | 42 | 42.0|
| Salt-free                           | 38 | 38.0|

Note. NYHA = New York Heart Association; BMI = body mass index; LDL = low-density lipoprotein; HDL = high-density lipoprotein.

aNormal waist circumference: female, < 80 cm; male, < 94 cm. bNormal waist–hip ratio: female, < 0.8 cm; male, < 0.95 cm.

(continues)
respectively, for a healthy diet (Barut Uyar & Yücecan, 2012; Besler et al., 2015). The grain subscores of both female and male participants in this study were similar and indicative of a good diet quality (Table 5). The HEI subscore results in this study were similar to the results of Drewnowski et al. (Table 5).

Assessment of Fluid and Electrolyte Changes

The typical symptoms of HF are dyspnea, weakness, fatigue, and edema. The participants, particularly those in NYHA functional classes II, III, and IV, experienced these symptoms (McMurray et al., 2012). Moreover, this study found that, although the NYHA class II, III, and IV participants complied with the fluid restriction recommendations, they gained or lost weight often ($p > .05$).

Colín Ramirez et al. (2004) reported that a daily fluid consumption of less than 1.5 L caused extracellular fluid levels to decrease. This study found that most of the participants categorized in NYHA classes II (36%), III (34%), and IV (20%; Table 1) and that 1–2 L/day of fluid restriction was generally recommended by the doctors to those in NYHA classes II, III, and IV ($\chi^2 = 12.68, p = .04$). The participants were found to have mostly adapted to these fluid restriction recommendations (Table 1).

Colín Ramirez et al. (2004) further found that a daily sodium intake of less than 2,400 mg/day caused extracellular fluid levels to decrease. In this study, salt restrictions, including salt-free consumption (38%) and low salt consumption (42%), were recommended by doctors to 84% of the participants, with 62% complying with these recommendations (Table 1). Similar to previous studies (Okoshi, Romeiro, Paiva, & Okoshi, 2013; Yancy et al., 2013), compliance

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**TABLE 2.**

**Food Consumption Patterns of the Participants (N = 100)**

| Food Group                                   | Consumption Frequency |
|----------------------------------------------|-----------------------|
|                                              | Never | Sometimes | Always |
| I. Recommended foods                         |       |           |        |
| Cholesterol: two eggs in a week              | 61    | 31        | 8      |
| Fruit: all fruits                            | 67    | 30        | 3      |
| Vegetable: all fresh vegetables (consumption except for frying) | 71    | 25        | 4      |
| Grains: whole wheat, rye bread, fat- and salt-free crackers, oatmeal, cornflakes, pasta, rice, and cracked wheat grains | 32    | 58        | 10     |
| Milk and dairy products: fat-free and/or low-fat milk and dairy products, and soy milk and cheese | 33    | 30        | 37     |
| Meat: skinless and fat-free chicken, turkey, and beef | 29    | 55        | 16     |
| Fish: all of the white meat and oily fishes | 29    | 55        | 16     |
| Dried nuts: walnut, almond, and chestnut     | 19    | 58        | 23     |
| Sugar: desserts made with fat-free milk, fruit salad, wheat pudding with dried nuts and fruits, fruit leather, and carrot and nut dessert | 15    | 60        | 25     |
| II. Foods recommended to be eaten less       |       |           |        |
| Unsaturated fats: sunflower seed oil, corn oil, soy, hazelnut oil, etc. | 38    | 7         | 55     |
| Milk and dairy products: semi-skimmed milk and yogurt, and string cheese | 56    | 26        | 18     |
| Meat: lean beef, veal, ham, lamb (one to two portions in a week), veal and chicken sausage, and liver (once in a month) | 46    | 44        | 10     |
| Dried nuts: peanut and pistachio             | 55    | 36        | 9      |
| Sugar: cakes made using polyunsaturated fats and margarine, almond dessert, and halvah | 38    | 54        | 8      |
| III. Foods not recommended                   |       |           |        |
| Saturated fats: butter, suet, tail fat, margarines, coconut oil, and cocoa butter | 31    | 49        | 20     |
| Vegetable: fried vegetables, potato chips, and salty canned foods | 50    | 42        | 8      |
| Grains: pastry with meat/cheese filling, etc. | 42    | 53        | 5      |
| Milk and diary products: whole-fat milk and dairy products, whipped cream, and clotted cream of milk | 40    | 32        | 28     |
| Meat: duck, goose, all of meats seemingly fatty, sausage, salami, salt cured, air-dried beef (pastirma), Turkish style fermented sausage, poultry (with skin), and offal | 58    | 33        | 16     |
| Fish: roe, caviar, and fried fish            | 57    | 36        | 7      |
| Salt: convenience salty salad dressings, mayonnaise, ketchup, salty appetizers, canned convenience and salty foods | 70    | 22        | 8      |
| Sugar: ice cream, dessert with syrup and chocolate, convenience cake with cream, pudding, biscuits, candies, and beverages | 39    | 52        | 9      |
was found to be higher in the NYHA functional class II, III, and IV subgroups \( p > .05 \). As shown in Table 1, although the participants stated that they complied with the salt consumption recommendations, most participants were shown to still consume overly high levels of sodium (Table 3). This suggests that the participants consumed foods without checking or paying attention to the amount of contained sodium. One prior study found a daily average intake of 4,700-mg potassium to be adequate for stable patients with HF (Arcand et al., 2009). This study found that the

### TABLE 3.
**Total Energy, Protein, Carbohydrate, Fats, Fiber, Vitamin, and Mineral Consumption According to Gender (N = 100)**

| Macronutrient and Micronutrient Consumption | Female \((n = 44)\) | Male \((n = 56)\) |
|--------------------------------------------|---------------------|------------------|
| **Total energy (cal/day)**                  |                     |                  |
| Inadequate \((0–1,999)\)                    | 29 \(69.0\)         | 38 \(67.8\)      |
| Adequate \((2,000–2,999)\)                  | 13 \(31.0\)         | 17 \(30.4\)      |
| Excessive \((≥3,000)\)                      | – –                 | 1 \(1.8\)        |
| **Fiber (g/day)**                           | 45.79 \(23.08\)    | 39.23 \(26.75\)  |
| Inadequate \((F = 0–24, M = 0–37)\)        | 6 \(13.6\)          | 35 \(62.5\)      |
| Adequate \((F > 25, M > 38)\)               | 38 \(86.4\)         | 21 \(37.5\)      |
| **Protein (g/kg/day)**                      | 113.69 \(144.72\)  | 114.39 \(99.81\) |
| Inadequate \((≤0.8)\)                      | 8 \(18.2\)          | 12 \(21.4\)      |
| Adequate \((≥0.8)\)                        | 36 \(81.8\)         | 44 \(78.6\)      |
| **Carbohydrate (% of total calories)**      | 278.34 \(303.86\)  | 237.37 \(133.89\) |
| Inadequate \(<55\)                         | 44 \(100.0\)        | 56 \(100.0\)     |
| Normal \((55)\)                            | – –                 | – –              |
| Excessive \(>55\)                          | – –                 | – –              |
| **Omega 3 (g/day)**                         | 6.39 \(11.80\)     | 4.79 \(9.08\)    |
| Inadequate \(<1.1\)                        | 9 \(20.5\)          | 17 \(30.3\)      |
| Normal \((1.1–1.6)\)                       | 12 \(27.3\)         | 9 \(16.1\)       |
| Excessive \(>1.6\)                         | 23 \(52.3\)         | 30 \(53.6\)      |
| **Omega 6 (g/day)**                         | 14.04 \(16.18\)    | 11.25 \(12.05\)  |
| Inadequate \(<12\)                         | 27 \(61.4\)         | 37 \(66.1\)      |
| Normal \((12–17)\)                         | 7 \(15.9\)          | 10 \(17.9\)      |
| Excessive \(>17\)                          | – –                 | – –              |
| **Sodium (mg/day)**                         | 2620.23 \(1094.12\) | 3362.04 \(2824.81\) |
| Inadequate \(<1,500\)                      | 6 \(13.0\)          | 5 \(9.3\)        |
| Normal \((1,500–2,000)\)                   | 8 \(17.4\)          | 6 \(11.1\)       |
| Excessive \(>2,000\)                       | 32 \(69.6\)         | 43 \(79.6\)      |
| **Potassium (mg/day)**                      | 3243.64 \(1326.42\) | 2974.00 \(1063.13\) |
| Inadequate \(<4,700\)                      | 41 \(93.2\)         | 52 \(92.9\)      |
| Normal \((≥4,700)\)                        | 3 \(6.8\)           | 4 \(7.1\)        |
| **Calcium (mg/day)**                        | 1224.84 \(817.93\) | 1164.39 \(681.08\) |
| Inadequate \(<1,000\)                      | 19 \(43.2\)         | 37 \(66.1\)      |
| Normal \((≥1,000)\)                        | 25 \(56.8\)         | 19 \(33.9\)      |
| **Iron (mg/day)**                           | 268.32 \(1164.95\) | 55.50 \(264.25\) |
| Inadequate \((F < 15, M < 10)\)            | 20 \(45.5\)         | 6 \(10.7\)       |
| Normal \((F ≥ 15, M ≥ 10)\)                | 24 \(54.5\)         | 50 \(89.3\)      |
| **Vitamin A (mg/day)**                      | 1675.61 \(1064.10\) | 1367.55 \(1297.50\) |
| Inadequate \((F < 700, M < 900)\)          | 5 \(11.4\)          | 23 \(41.1\)      |
| Normal \((F ≥ 700, M ≥ 900)\)              | 39 \(88.6\)         | 33 \(58.9\)      |
| **Vitamin C (mg/day)**                      | 274.20 \(172.22\)  | 178.35 \(113.06\) |
| Inadequate \(<45\)                         | 5 \(11.4\)          | 8 \(14.3\)       |
| Normal \((≥75)\)                           | 39 \(88.6\)         | 48 \(85.7\)      |

Note.  \(F = \) female; \(M = \) male.
TABLE 4.
Comparison of NYHA Class, BMI, and Laboratory Test Results to HEI Total Score (N = 100)

| Category          | Healthy Eating Index | M   | SD  | F    | p   |
|-------------------|----------------------|-----|-----|------|-----|
| NYHA class        |                       |     |     |      |     |
| I                 | 76.00                 | 4.59| 0.135 | 939 |
| II                | 75.00                 | 8.28| 0.791 | 534 |
| III               | 76.26                 | 10.23| 1.058 | 307 |
| IV                | 74.00                 | 11.53| 0.234 | 792 |
| Total cholesterol |                       |     |     |      |     |
| Normal            | 74.58                 | 8.98| 1.205 | 305 |
| Borderline high   | 77.77                 | 6.66|       |     |
| High              | –                    | –   |       |     |
| Triglyceride      |                       |     |     |      |     |
| Normal            | 75.00                 | 9.36| 0.234 | 792 |
| Borderline high   | 72.50                 | 9.35| 1.469 | 236 |
| High              | 73.33                 | 11.54|       |     |
| Very high         | –                    | –   |       |     |
| LDL cholesterol   |                       |     |     |      |     |
| Normal            | 74.54                 | 9.32| 1.205 | 305 |
| Borderline high   | 78.50                 | 7.83|       |     |
| High              | 80.00                 | 15.00|       |     |
| HDL cholesterol   |                       |     |     |      |     |
| Low/risky         | 73.83                 | 10.30| 1.469 | 236 |
| Normal/required   | 77.38                 | 5.61|       |     |
| High/required     | 77.00                 | 5.86|       |     |

Note. NYHA = New York Heart Association; BMI = body mass index; HEI = Healthy Eating Index; LDL = low-density lipoprotein; HDL = high-density lipoprotein.

sodium intake of most participants was high (> 2,000 mg/day) but their potassium consumption was inadequate (< 4,700 1mg/day; Table 3).

Assessment of Macronutrient and Micronutrient Consumption

The distribution of macronutrients in the diet of individuals with HF does not differ significantly from that of the general population. Suggestions are that energy intake should be between 28 and 32 kcal/kg, with 50%–55% carbohydrate consumption, 30%–35% lipids, and 15%–20% protein by total calories. However, in relation to protein intake, patients with HF have higher requirements than the general population, ranging from 1.1 g/kg of dry weight per day for normal patients to 1.5–2.0 g/kg of dry weight per day for malnourished patients with cardiac cachexia or who show losses because of nephropathy and/or intestinal malabsorption. Thus, the authors recommend limiting the intake of saturated fats, trans fats, dietary cholesterol (< 200 mg/day), and simple sugars (Eckel et al., 2014; Pinho & da Silveira, 2014).

Published studies have associated the DASH diet, which includes low saturated fat and increased consumption of low-fat milk, complex carbohydrates, fish, vegetables, and the Mediterranean diet (Butler, 2016), with low mortality in female patients with HF (Eloranta et al., 2016), and have further recommended this diet for patients with HF because of its beneficial effects (Butler, 2016).

Fatty foods are rich in calories and may cause weight gain. Thus, foods that are high in saturated fats such as full-cream milk and dairy products and red meat should be avoided. The GISSI-Heart Failure study showed that daily consumption of 1 g of eicosapentaenoic acid or docosahexaenoic acid omega-3 fatty acids had beneficial effects in patients with Stage 2–4 HF (Butler, 2016; GISSI-HF Investigators, 2008). Assessing in accordance with the guidelines, this study found that participants had inadequate total average energy intake, inadequate mean carbohydrate consumption, inadequate mean omega-6 consumption, high mean omega-3 consumption, adequate mean protein consumption, and adequate fiber consumption among female participants but inadequate fiber consumption among male participants (Table 3).

Patient energy needs vary by HF functional classification. The basal metabolism rate is 18% higher in patients in the NYHA functional classes III and IV than in healthy individuals (Pinho & da Silveira, 2014). On the basis of their nutritional status, the optimal energy needs of patients with HF are 25–30 kcal/kg a day (Aquilani et al., 2003). Given that most of the participants were in NYHA classes II and IV (Table 1), this study found that the total energy intake was inadequate (Table 3). In this study, the total daily energy intake levels of participants, based on the literature (Aquilani et al., 2003; Meseri, 2014; Yancy et al., 2013), revealed that total mean energy intake was 1,659.96 ± 717.19 for female participants and 1,766.04 ± 696.35 for male participants (Table 3).

Patients with HF have higher protein needs than healthy individuals. Approximately 30–40 kcal/kg a day of energy intake, including 1.5–2 g of protein per kilogram a day, has been recommended for HF patients with cardiac cachexia (Vieira, Caçapava, & Nakasato, 2004). A study found that changes in protein intake affect weight loss in obese patients (mean BMI = 37.3 kg/m²) and in patients with HF in NYHA classes II and III as well as significantly improve quality of life (Butler, 2016; Evangelista et al., 2009). The protein intake of the patients in this study was found to be adequate (Table 3).

Low serum potassium has been associated with HF-related mortality. Extremely low calcium levels are known to cause HF in rare instances (Levitan et al., 2013). This study found calcium consumption levels to be normal in most female participants and inadequate in male participants. The level of potassium consumption in this study was also found to be inadequate (Table 3).
Anemia, a frequent comorbidity of HF, is associated with poor health outcomes. Anemia in HF cases likely develops because of a complex interaction among iron deficiency, kidney disease, and cytokine production, although micronutrient insufficiency and blood loss may also be contributing factors (Shah & Agarwal, 2013). It is considered that iron deficiency in HF results partially from inadequate dietary iron intake (Drozd, Jankowska, Banasiak, & Ponikowski, 2017). This study was unable to obtain a result in this respect because participant blood values and serum iron levels were not routinely monitored in the hospital. However, in accordance with guidelines (GISSI-HF Investigators, 2008; Ponikowski et al., 2016), this study found dietary iron consumption to be within normal limits and dietary iron consumption to be inadequate in approximately half of the female participants (45.5%; Table 3).

Prior studies (Pinho & da Silveira, 2014; Vieira et al., 2004) have reported decreased Vitamin A and C levels in patients with HF. In contrast, this study found Vitamin A and C consumptions to be within normal limits (Besler et al., 2015; TüRKomp, T. R. Ministry of Food, Agriculture and Livestock, 2014) in most of the participants (Table 3).

### Conclusion and Recommendations

Evidence in the literature on the nutritional status, dietary practices, and dietary effects of patients with HF is limited. This study used HEI, a dietary quality assessment measure, to assess the food consumption patterns of patients with HF. The results of diet quality measurements may help set goals for developing nutrition education, for promoting health, and for monitoring changes in food consumption patterns. It is recommended that this measurement method be used before providing dietary recommendations.

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### Author Contributions

Study design: All authors; Data collection: HU; Data analysis: All authors; Manuscript writing: HU, HÖA, NE.

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