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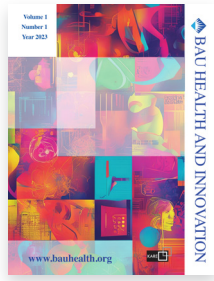

Original Article

Adherence to the Mediterranean Diet and Dietary Supplement Use in Heart Failure Patients

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Abstract

Objectives: This study aims to investigate the use of dietary supplements (DS) among heart failure (HF) patients and evaluate adherence to the Mediterranean diet (MD) among DS users.

Methods: This cross-sectional study was conducted between May and July 2023, involving 65 patients admitted to cardiology inpatient wards. Data collection included a structured questionnaire on sociodemographic characteristics, health status, and DS use; a 3-day food consumption record to assess dietary intake; and the Mediterranean Diet Adherence Scale (MEDAS) to evaluate adherence to the MD. All data were collected through face-to-face interviews. Nutritional analyses were performed using BeBiS software, and adherence levels were categorized based on MEDAS scores.

Results: Of the HF patients, 66.2% were male, with a mean age of 62.6 years. Vitamins and minerals were the most commonly used supplements (20%), while herbal products were less frequently used (9.2%). Among herbal supplement users, garlic was the most commonly reported product. The primary motivations for DS use were treating the disease and managing symptoms such as shortness of breath, nausea, and edema. The MEDAS score was moderate, with an average of 6.71±1.44, and no significant difference was observed between DS users and non-users ($p>0.05$). Micronutrient deficiencies, including vitamin C, iron, magnesium, and potassium, were identified in the dietary intake of patients. While physician recommendations were the primary source for vitamin and mineral supplement use, herbal supplements were more influenced by self-research and internet recommendations. No significant association was found between adherence to the MD and DS use ($p>0.05$).

Conclusion: The use of vitamins, minerals, and herbal products was low among HF patients. Adherence to the MD was moderate and showed no significant association with DS use.

Keywords: Dietary supplements, heart failure, MEDAS, mediterranean diet.

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Heart failure (HF) is defined as insufficient cardiac output resulting from a structural or functional abnormality, characterized by a reduced ability of the heart to pump and fill with blood, compensatory neurohormonal activation, and increased left ventricular filling pressure.[1] The prevalence of HF is anticipated to increase globally in the coming decades, driven by an aging population and improved survival rates among individuals with heart disease.[2] According to the 2012 data published by the Turkish Society of Cardiology, the prevalence of HF in the total population aged 35 years and above was found to be 2.9%.[2] By the end of 2022, there were 1,803,637 individuals living with HF in Türkiye, with a total population of 85,279,553. This corresponds to

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an overall HF prevalence of 2.1%. When stratified by sex, the prevalence was 2.2% in females and 1.9% in males. Notably, in Türkiye, HF tends to develop at a younger age compared to Western populations; however, survival rates among patients are comparable to those reported in these regions. Hypertension was the most common comorbidity, followed by atherosclerotic cardiovascular disease, dyslipidemia, diabetes mellitus, and anxiety disorders. The prevalence of comorbidities varied by sex and age. Females exhibited higher rates of conditions such as atrial fibrillation, anemia, severe obesity, diabetes mellitus, hypertension, hypothyroidism, pulmonary embolism, and anxiety disorders compared to males. Conversely, males had a greater prevalence of atherosclerotic cardiovascular disease, acute myocardial infarction, chronic obstructive pulmonary disease, dyslipidemia, and chronic kidney disease than females. Congenital heart disease was predominant in individuals under 20, whereas atherosclerotic cardiovascular disease, hypertension, and diabetes mellitus were more common in adults.[3]

Dietary supplement (DS) use is becoming increasingly common, with a prevalence of 57.6% in the United States, and has grown significantly compared to the past. Its prevalence is closely tied to individual characteristics such as age, gender, and education level. Women, older adults, and individuals with higher education are particularly likely to use DS. For example, DS use reaches 80.2% among women aged 60 and over,[4] while a national study in Australia reported a 43% overall DS usage rate among adults. Key predictors of DS use include female gender, advancing age, higher education, a healthy body mass index (BMI), physical activity, and being a non-smoker. [5] Certain groups, such as cancer survivors, pregnant or breastfeeding women, and individuals with higher incomes or greater food security, also exhibit notably high rates of DS use.[6] The use of DS is also becoming more common in Türkiye. According to the 2019 "Türkiye Nutrition and Health Survey," 9.9% of individuals aged 15 and older use DS, with this rate rising to 14.3% among those aged 65 and above.[7] These patterns underscore the variations in DS usage across different demographic and socioeconomic groups worldwide. However, it is worth noting that no consistent generalizations can be made about DS use among individuals with chronic illnesses. Moreover, DS users make healthier food choices than non-users, and they are often individuals focused on maintaining or improving their health. In this context, it is plausible that awareness of metabolic disorders, such as cardiovascular disease, diabetes, or hypertension, increases receptiveness to using supplements.[8]

Adherence to the Mediterranean diet (MD) has been linked to a reduced risk of chronic non-communicable diseases, including cardiovascular diseases, neurodegenerative disorders, and cancer.[9] The American Heart Association emphasizes the critical role of a healthy diet in preventing cardiovascular disease and stroke.[10] MD represents the typical dietary patterns of populations around the Mediterranean region, characterized by high consumption of fruits, vegetables, monounsaturated fatty acids (MUFA), fish, whole grains, legumes, and nuts, along with low consumption of red meat. This dietary pattern is inversely associated with carotid artery disease and atherosclerosis risk factors, including markers of inflammation and endothelial function.[11] For HF patients, where oxidative processes and inflammatory markers play a critical role, MD is particularly significant.[12]

Considering the similar factors affecting DS use in HF patients, such as comorbidities, sex distribution, and age, the context between MD adherence and DS use will provide an in-depth approach to the subject. While there is limited data on the use of DS in cardiovascular diseases in Türkiye, there is no data on the correlation between adherence to MD and the use of DS. This study aims to determine the prevalence and characteristics of DS use among HF patients hospitalized in cardiology wards, evaluate adherence to MD, and examine the correlation between MD adherence and DS use.

Materials and Methods

Definition of "Dietary Supplement"

In this study, the definition of DS was given to the patients verbally and was explained in writing in the form based on the Dietary Supplement Health and Education Act of 1994 and the Food and Drug Administration definition. DS was defined as products, other than tobacco, taken orally to supplement the diet, containing one or more vitamins, minerals, herbal substances, or amino acids.[13]

Participants

This cross-sectional study was conducted between May 16, 2023, and July 16, 2023, with a total of 65 participants, including 22 women and 43 men, who were treated in the cardiology inpatient wards of a specialized training and research hospital. The participants were aged between 18 and 80 years, were literate, had a diagnosis of HF, did not have any visual or hearing impairments, and consented to participate in the research. This study is derived from a master's thesis.

The study was conducted in accordance with the Declaration of Helsinki, and ethical approval for the study was obtained from the Kartal Koşuyolu High Specialization Training and

Research Hospital Ethics Committee on May 16, 2023, with decision number 2023/08/692. Verbal notification was made to the patients and written consent was obtained.

Data Collection

The data form used in the study was prepared by the researchers in line with the relevant literature and consists of two sections. The first section includes questions aimed at identifying the sociodemographic and general characteristics of the patients (age, sex, marital status, education level, smoking habits, alcohol consumption, income level) as well as details related to their illnesses (time of diagnosis for the current condition, other chronic diseases). The second section comprises questions regarding the patients' use of DS. Patients were evaluated separately regarding their use of vitamin and mineral DS (vitamin-mineral combinations, single-source vitamins, etc.), fish oil, and herbal DS (garlic, echinacea, ginseng, flaxseed, canola oil, carnitine, ginger, turmeric, ginkgo biloba, and other products). The study explored how HF influences patients' perspectives on DS use, the specific products they utilize, their primary motivations, whether these products are used to address HF symptoms or related conditions, and the sources of recommendations for these supplements.

Body Mass Index

Participants self-reported their body weight (kg) and height (cm). Accordingly, the Body Mass Index (BMI) value was calculated using the formula: body weight (kg) / height (m^2). BMI classification was performed based on the World Health Organization (WHO) classification.[14]

Mediterranean Diet Adherence Screener

To assess participants' adherence to MD, a 14-item Mediterranean Diet Adherence Screener for adults was used. MEDAS was developed to efficiently evaluate adherence to the dietary intervention used in the Prevención con Dieta Mediterránea (PREDIMED) study. This multicenter clinical trial focused on investigating the impact of the traditional Mediterranean diet on the primary prevention of cardiovascular diseases. MEDAS includes 14 simple questions covering key components of the Mediterranean diet, such as the consumption of olive oil, fruits, vegetables, legumes, nuts, fish, and wine, as well as the intake of foods like red or processed meats and sweets. Each positive response contributes one point, allowing for a quick and practical assessment of overall adherence to this dietary pattern. In the scale, responses to the questions were scored as +1 for "yes" and 0 for "no." The total score from the responses was categorized into three levels of adherence: low (≤5), medium (6–9), and high (≥10) adherence to MD.[15] It has been shown to be an appropriate scale through the Turkish validity and reliability study.[16]

Dietary Records

A 3-day food consumption record, covering three consecutive days, was collected from each participant. The process of recording their 3-day food consumption was explained to the patients through face-to-face interviews with the researcher. To provide an example, the researcher completed a one-day food consumption record during the interview with the patient, after which the form was handed over to the patient. The consumption records kept by the patients were reviewed by the researcher and analyzed using the Computer-Aided Nutrition Information Systems Package Program 9 (BeBiS) software (Stuttgart, Germany, Turkish Version). This analysis determined the patients' average daily energy, macro, and micronutrient intake (BeBiS, 2021).[17] These values were then compared to Dietary Reference Intakes (DRI).[18] To contribute to the literature, the dietary habits of HF patients were examined; however, this section will not be linked to DS use. The relationship between DS use and diet was assessed using the MEDAS.

Statistical Analysis

The data were analyzed using SPSS 21.0 software (Armonk, NY: IBM Corp).[19] The Mann-Whitney U and Chi-square tests were used for comparisons based on demographic variables and DS usage. For comparisons involving variables with more than two groups, the Kruskal-Wallis H test was employed. When a significant difference was observed in the Kruskal-Wallis H test, the Mann-Whitney U test with Bonferroni correction (since the significance level was determined as $p<0.05$, the "0.05 / number of comparisons" method was used in the correction) was used to determine which groups the difference was between. A significance level of $p<0.05$ was considered for all statistical analyses.

Results

The general characteristics of patients are summarized in Table 1. The majority of patients, with an average age of 62.6 years, are male, married, low-educated, overweight, and obese. There is no difference between sexes in terms of HF diagnosis time, presence of comorbid diseases, and BMI distribution. However, education, income, and smoking differed by sex.

Perspectives and practices on DS use among patients according to sex are seen in Table 2. The findings highlight notable patterns in DS use and attitudes

Table 1. General characteristics of patients

General characteristics	Total		Female		Male		X^2	SD	p
	n	%	n	%	n	%			
Sex							–	–	–
Female	22	33.8							
Male	43	66.2							
Marital status									
Married	48	73.8	14	63.6	34	79.1	1.79	1	0.180
Single	17	26.2	8	36.4	9	20.9			
Educational status									
Primary	50	76.9	21	95.5	29	67.4	6.43	1	**0.011**
Secondary	15	23.1	1	4.5	14	32.6			
High school/Undergraduate and postgraduate	–	–	–	–	–	–			
Smoking status									
Yes	10	15.4	0	0.0	10	23.3	6.05	1	**0.014**
No	55	84.6	22	100	33	76.7			
Alcohol use status									
Yes	5	7.7	0	0.0	5	11.6	2.77	1	0.096
No	60	92.3	22	100	38	88.4			
Income-expenditure status									
Income < Expense	25	38.5	4	18.2	21	48.8	5.78	1	**0.016**
Income = Expense	40	61.5	18	81.8	22	51.2			
Other chronic disease									
Exist	20	30.8	7	31.8	13	30.2	0.02	1	0.896
None	45	69.2	15	68.2	30	69.8			
Number of other chronic diseases (n=20)									
Only one	11	55.0	2	28.6	9	69.2	3.04	1	0.081
More than one	9	45.0	5	71.4	4	30.8			
Body mass index (kg/m^2)									
Normal (18.5–24.9)	17	26.2	6	27.3	11	25.6	0.06	2	0.969
Overweight (25.0–29.9)	22	33.8	7	31.8	15	34.9			
Obese (30.0 and over)	26	40.0	9	40.9	17	39.5			

Other characteristics	Mean±SD	Mean±SD	Mean±SD	t	p
Age (years)	62.6±13.5	64.3±14.5	61.8±13.0	0.70	0.485
Body height (cm)	166.4±9.3	157.7±7.2	170.9±6.8	-7.20	**0.000**
Body weight (kg)	80.0±17.6	72.0±16.0	84.1±17.1	-2.75	**0.008**
Time to diagnosis of the disease (months)	33.4±42.8	32.4±42.1	34.0±43.6	-0.04	0.886

SD: The degrees of freedom, X^2: Chi-square statistic, p: Significance level, p<0.05.

among individuals with HF, with some sex-based differences. While a minority expressed positive views on the impact of DS for heart disease, the majority reported no perceived impact. Men were slightly more likely to view DS positively than women, but this difference was not statistically significant (p>0.05). Twenty percent of patients (n=13) reported using vitamin or mineral supplements for heart disease management, with similar rates observed between sexes. Herbal supplement use was less common (n=6) but appeared to be slightly more frequent among women compared to men. However, this difference did not reach statistical significance (p>0.05). Among those who reported their motivations, managing or preventing disease symptoms was the most frequently cited reason, particularly among women. Conversely, men were more likely to use DS with the intent of treating the disease. These differences were also not statistically significant (p>0.05).

Table 2. Perspectives and practices on dietary supplement use according to sex

	Total		Female		Male		X^2	SD	p
	n	%	n	%	n	%			
Impact of heart disease on perspectives regarding dietary supplement use									
Positive	16	24.6	4	18.2	12	27.9	0.41	1	0.522
Negative	2	3.1	1	4.5	1	2.3			
No impact	47	72.3	17	77.3	30	69.8			
Use of vitamin/mineral supplements for heart disease									
Yes	13	20.0	5	22.7	8	18.6	0.15	1	0.694
No	52	80.0	17	77.3	35	81.4			
Use of herbal dietary supplement for heart disease									
Yes	6	9.2	3	13.6	3	7.0	0.77	1	0.380
No	59	90.8	19	86.4	40	9.3			
The primary motivation for using dietary supplements									
Supporting nutrition	3	4.6	1	16.7	2	22.2	3.33	3	0.343
Maintaining and improving health	1	1.5	0	0.0	1	11.1			
Treating the disease	5	7.7	1	16.7	4	44.4			
Managing or preventing disease symptoms	6	9.2	4	66.7	2	22.2			
No answer	50	76.9	–	–					

SD: Degree of freedom, X^2: Chi-square statistic, p: Significance, p<0.05.

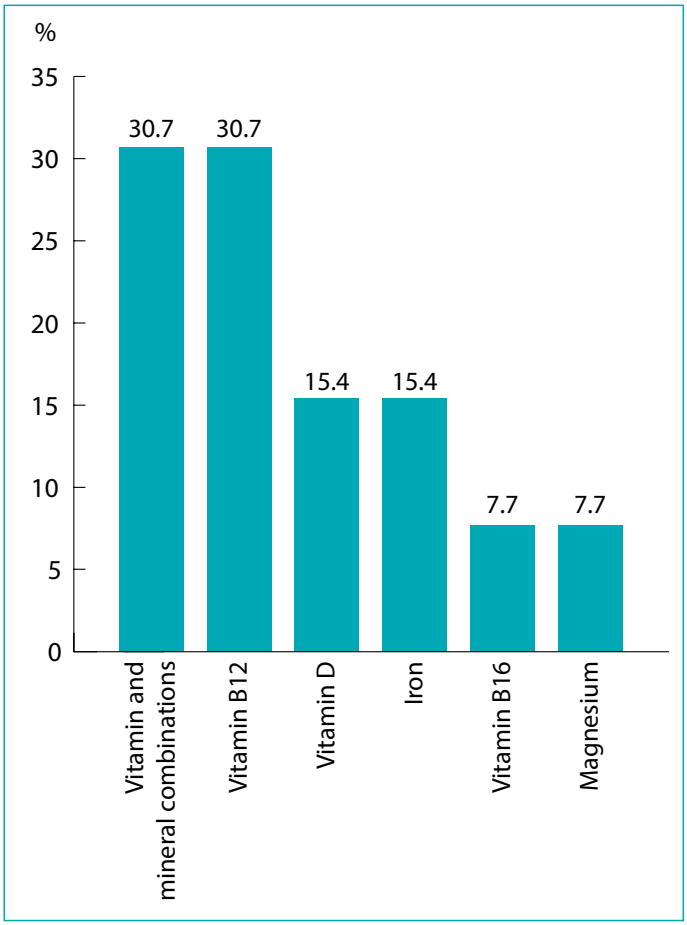

Figure 1. Patients' use of vitamin and mineral supplements (n=13).

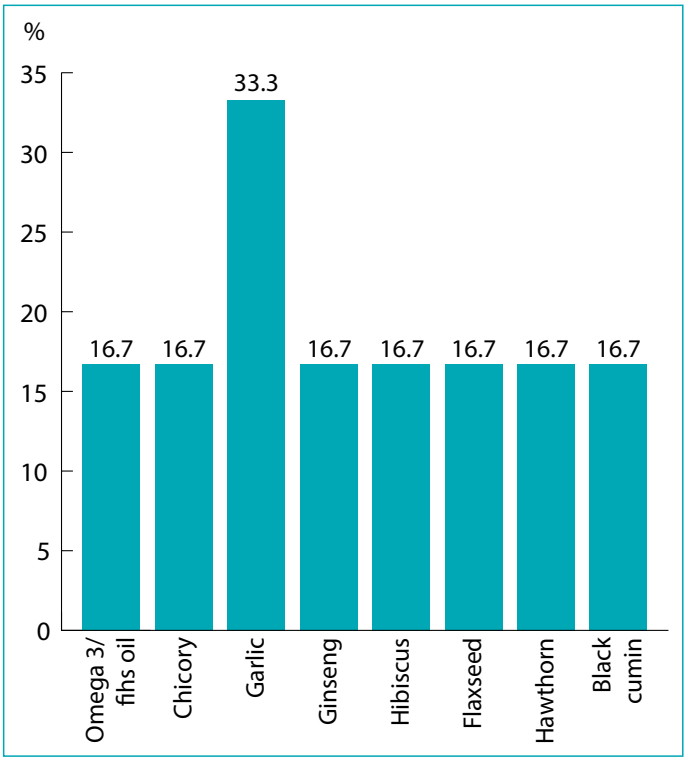

Figure 2. Patients' use of herbal dietary supplements (n=6).

Types of vitamins, minerals, and herbal products used by patients are seen in Figure 1 and Figure 2. Patients using vitamin-mineral supplements (n=13) reported that they mostly used vitamin and mineral combinations (n=4), B12

Table 3. Characteristics of usage based on dietary supplement type

Dietary supplement use	Dietary supplements*			
	Vitamins and mineral (n=13)		Herbal (n=6)	
	n	%	n	%
Key reasons				
Treating the disease	5	38.5	3	50.0
Preventing a symptom of the disease	4	30.7	3	50.0
Supporting nutrition	3	23.1	–	–
Maintaining and improving health, strengthening immunity, feeling fit	1	7.7	–	–
Health reason or symptom related to use				
Shortness of breath	3	23.1	1	16.7
Edema	3	23.1	1	16.7
Getting tired easily	1	7.7	1	16.7
Indigestion	1	7.7	1	16.7
Lack of appetite	3	23.1	2	33.3
Weakness	2	15.4	1	16.7
Heartburn	2	15.4	1	16.7
Nausea	–	–	2	33.3
Indigestion	–	–	1	16.7
Constipation	1	7.7	–	–
Low blood count	4	30.7	–	–
Improve the general condition	1	7.7	–	–
Chest pain	1	7.7	–	–
Cough	1	7.7	–	–
Hypertension	1	7.7	–	–
Feeling better	1	7.7	–	–
Frequent urination at night	–	–	1	16.7
The thought of it being useful	–	–	1	16.7
Thought to increase kidney function	–	–	1	16.7
Product recommended by				
Doctor	11	84.6	2	33.3
Self-research	1	7.7	1	16.7
Internet	1	7.7	2	33.3
Pharmacist	1	7.7	–	–
User experience	–	–	2	33.3

*: Multiple answers were given.

(n=4), vitamin D (n=2), and iron (n=2), respectively. Patients using herbal supplements (n=6) reported that they mostly used garlic (n=2), followed by other supplements (n=1).

Table 3 highlights key motivations and health-related reasons for using DS, including vitamins, minerals, and herbal products. The primary reasons for DS use are disease treatment and symptom prevention. Health-related motivations for DS use included managing symptoms like shortness of breath, nausea, edema, lack of appetite, and low blood count. Vitamins and minerals were predominantly recommended by doctors, whereas herbal products had a broader range of influence, including self-research and internet sources.

The patients' adherence to MD was found to be at a moderate level, with a MEDAS score of 6.71±1.44, showing no significant difference between sexes ($p>0.05$) (Table 4). Additionally, the MEDAS score did not vary significantly with changes in sex, BMI, perspectives, and motivations on DS use, or the use of vitamin/mineral and herbal supplements ($p>0.05$).

Table 4. Patients' adherence with the mediterranean diet according to sex, body mass ındex, perspectives and practices on dietary supplement use

	Mediterranean diet adherence screener		
	Total Mean+SD	**Female Mean+SD**	**Male Mean+SD**
Mediterranean diet adherence screener score	6.71±1.44	6.77±1.19	6.67±1.57
Z	-0.75		
p	0.456		
Body mass index (kg/m^2)			
Normal (18.5–24.9)	6.88±1.22	6.67±1.51	7.00±1.10
Overweight (25.0–29.9)	6.41±1.30	6.14±0.90	6.53±1.46
Obese (30.0 and over)	6.85±1.69	7.33±1.00	6.59±1.94
X^2	3.07	3.56	0.78
p	0.381	0.312	0.855
Use of dietary supplements			
Impact of heart disease on perspectives regarding dietary supplement use			
Yes	6.78±1.44	7.00 ± 1.00	6.69±1.60
No	6.68±1.46	6.71±1.26	6.67±1.58
Z	-0.35	-0.45	-0.18
p	0.727	0.654	0.859
Use of vitamin/mineral supplements for heart disease			
Yes	7.00±1.22	7.40±0.89	6.75±1.39
No	6.63±1.50	6.59±1.23	6.66±1.63
Z	-1.20	-1.43	-0.42
p	0.232	0.153	0.675
Use of herbal dietary supplement for heart disease			
Yes	6.83±0.75	6.33±0.58	7.33±0.58
No	6.69±1.50	6.84±1.26	6.63±1.61
Z	-0.59	-0.85	-1.35
p	0.558	0.397	0.175
The primary motivation for using dietary supplements			
Supporting nutrition	7.00±2.00	7.00±/2.30	7.00±2.83
Maintaining and improving health	7.00±1.20	6.00±1.33	7.00±1,60
Treating the disease	6.60±0.55	7.25±0.96	6.75±0.50
Managing or preventing disease symptoms	7.00±1.26	7.00±0.89	6.50±2.12
X^2	0.72	1.56	0.08
p	0.869	0.458	0.994

Z: Mann Whitney U test, X^2: Kruskal-Wallis H test, p<0.05. SD: Standard deviation.

Patients demonstrated insufficient daily energy and nutrient intakes compared to DRI (Table 5). In particular, iron, iodine, potassium, magnesium, and vitamins C, B1, folate, B5, A, and D intake levels were notably inadequate. While deficiencies were observed in other macro and micronutrients, no statistically significant differences were detected. There were no significant differences in nutrient intake between male and female patients overall; however, zinc intake was significantly lower in males (p=0.001). Similarly, vitamin C intake was higher in females than males, but the overall intake remained inadequate (p=0.036).

Discussion

This cross-sectional study examines the patterns of dietary supplement (DS) use and adherence to the Mediterranean diet (MD) among heart failure (HF) patients (n=65), emphasizing the interplay between these factors. The prevalence of herbal DS use, excluding vitamins and minerals, was 9.2% among HF patients treated in cardiology inpatient units. The primary motivation for DS use was to treat the disease or prevent its symptoms. Among individuals with chronic diseases, the therapeutic use of

Table 5. Daily energy, micro and macro nutrient daily reference intakes meeting percentages of patients

Energy and nutrients	Total Mean±SD	Female Mean±SD	Male Mean±SD	Z	p
Energy (kcal)	51.4±15.3	49.3±12.8	52.4±16.5	-0.60	0.551
Protein (g)	87.9±30.3	89.8±36.3	86.9±27.1	-0.22	0.824
Fat (g)	55.3±23.5	51.9±17.8	57.1±26.0	-0.51	0.613
Carbohydrate (g)	40.8±13.9	38.7±10.5	41.9±15.4	-0.71	0.475
Fiber (g)	44.0±20.1	41.7±22.9	45.1±18.7	-0.93	0.353
Polyunsaturated Fatty Acids (mg)	96.6±66.1	84.6±45.3	102.8±74.2	-0.51	0.613
Vitamin A (µg)	57.4±42.2	52.8±33.2	59.7±46.3	-0.15	0.879
Vitamin E (eq.) (mg)	82.8±50.0	77.2±44.4	85.7±52.9	-0.39	0.698
B1/ Thiamine (mg)	56.6±24.2	59.1±29.7	55.4±21.2	-0.07	0.945
B2/Riboflavin (mg)	91.7±35.6	95.2±40.18	89.9±33.4	-0.26	0.792
B6/ Pyridoxine (mg)	68.3±32.9	77.2±44.58	63.7±24.3	-1.30	0.195
Folate (µg)	54.8±21.1	52.6±23.96	56.0±19.7	-0.80	0.421
Vitamin C (mg)	56.8±44.8	69.8±50.07	50.3±40.9	-2.09	**0.036**
Sodium (mg)	195.2±529.9	297.4±741.2	142.9±380.7	-0.63	0.528
Vitamin B12 (µg)	102.6±52.5	106.4±63.2	100.7±46.8	-0.24	0.814
Biotin (µg)	73.5±34.2	70.6±36.2	74.9±33.5	-0.75	0.454
Copper (mg)	72.6±35.4	71.8±39.1	73.0±33.8	-0.37	0.708
Vitamin D (mg)	18.9±31.8	25.8±46.4	15.5±20.7	-0.83	0.408
Niacin (mg)	125.3±49.4	140.5±57.3	117.6±43.5	-1.87	0.061
Iodine (µg)	28.2±15.5	26.3±12.3	29.3±16.9	-0.52	0.603
Vitamin B5 (mg)	60.6±19.9	60.7±21.5	60.6±19.3	-0.30	0.766
Potassium (mg)	49.1±18.8	48.6±23.2	49.3±16.4	-0.52	0.603
Calcium (mg)	66.9±28.7	65.1±34.6	67.8±25.7	-0.51	0.608
Magnesium (mg)	54.9±25.2	57.6±28.1	53.6±23.8	-0.55	0.584
Vitamin K (µg)	161.5±222.0	153.1±227.8	165.9±221.6	-0.13	0.895
Phosphorus (mg)	137.1±87.6	159.2±138.0	125.7±42.3	-0.03	0.978
Iron (mg)	63.7±26.8	60.8±27.7	65.3±26.6	-0.58	0.565
Zinc (mg)	79.6±32.1	99.7±37.3	69.3±23.5	-3.43	0.001

Mann Whitney U test, $p<0.05$. SD: Standard deviation.

DS varies by condition. In line with global trends, DS use among HF patients in this study was limited but reflected common motivations such as disease management and symptom prevention. Vitamin and mineral use, primarily recommended by physicians, was more prevalent than herbal supplement use, which was influenced by self-research and internet recommendations. This finding aligns with existing literature indicating that DS use among cardiac patients is largely influenced by healthcare professionals, particularly in Türkiye, where physician recommendations play a significant role.[20–22]

The therapeutic use of DS also varies among individuals with chronic diseases. The prevalence of herbal product and DS use among patients with chronic kidney disease ranges from 25.2% to 57% globally and from 4% to 37% in Türkiye. Other population studies in Türkiye have reported that herbal product use ranges from 22.0% to 57.6% in individuals with diabetes and from 40% to 60% in patients with cancer. Additionally, individuals with hypertension most commonly use lemon and garlic; those with diabetes prefer cinnamon; and those with hyperlipidemia favor walnuts.[23] In our study, HF patients most frequently reported using garlic. A study of 199 patients over the age of 18 in the cardiology department of a private hospital found that 28.6% (n=57) of patients used herbal products. However, only 14.03% (n = 8) of these individuals consulted their physician before using herbal medicine. In the same study, 35.7% of participants with hypertension reported using herbal medicine, with 22.5% consuming lemon, 17.5% pomegranate syrup, and 17.5% green tea. Among participants with cardiovascular disease, 23.5% reported using herbal products, with 25% consuming green tea, 25% ginger, and 18.8% sage.[20] In our study, patients reported using hibiscus, garlic, flaxseed, hawthorn, black cumin, ginseng, and chicory.

In this study, 20% of patients reported using vitamin and mineral supplements, with the most common being multivitamin and mineral combinations, followed by vitamin B12, vitamin D, and iron. Similar findings were reported in a study conducted among coronary heart disease patients undergoing angiography in Diyarbakır, where vitamins and minerals were the most commonly used DS. This could be attributed to the fact that most patients in both studies used these products upon physician recommendation.[21] However, DS use was generally low in this study and in other studies conducted among coronary heart disease patients in Türkiye.[20–22] Conversely, studies on hypertension patients have reported higher herbal product use, which may be due to differences in educational levels between study populations. Higher educational attainment among hypertension patients may indicate a greater tendency to use non-pharmacological alternative products to support health.[24]

Most patients in this study began using supplements to address symptoms such as shortness of breath, lack of appetite, nausea, edema, and low blood count. Similar studies have found that patients frequently use supplements to manage hypertension or diabetes.[20–24] The primary reason for this difference may be the pathophysiology of HF, in which reduced cardiac output leads to symptoms such as shortness of breath and nausea.

A meta-analysis evaluating overall cardiovascular health reported that a two-point increase in an 18-point MD scale was associated with a 10% reduction in cardiovascular disease risk.[25] Patients with chronic HF and high adherence to MD tend to have improved cardiac profiles.[26] Beyond its disease-related benefits, MD adherence has also been linked to improved cardiorespiratory fitness and lower body fat, further supporting its role in cardiovascular health among HF patients.[27] The first study to evaluate the relationship between MD adherence and HF severity, conducted in Italy between 2008 and 2014, reported a MEDAS score of 6–7 among HF patients.[28] Similarly, in our study, MD adherence was at the lower end of moderate levels (6.7), supporting the notion that individuals diagnosed with or at high risk for HF may have poor adherence to healthy dietary patterns, potentially contributing to disease progression. The beneficial effects of MD have often been attributed to its high MUFA content from sources such as fish and olive oil, as well as its role in mitigating key metabolic changes observed in HF. Since HF is characterized by a shift in cardiac energy metabolism from fatty acid oxidation to glucose utilization, a diet rich in MUFAs may help prevent this metabolic alteration.[29]

Another potential benefit of MD in HF is its association with lower sodium intake due to reduced consumption of processed foods and an overall healthier dietary pattern, which can positively impact blood pressure—one of the key modifiable risk factors for HF.[30] Additionally, MD is rich in antioxidants, which may contribute to cardiovascular protection by reducing oxidative stress-induced inflammation, a key driver in HF pathophysiology.[31] However, findings on MD's impact on cardiovascular mortality remain inconsistent. While some studies confirm lower cardiovascular mortality with high MD adherence in HF,[32,33] others, such as those conducted in Taiwan[34] and different regions in Spain,[27] reported no significant associations. Notably, the study in Taiwan even suggested that lower red and processed meat intake was paradoxically linked to higher all-cause mortality.[34]

Few studies have explored the relationship between DS use and overall diet quality. Since individuals consume meals containing complex nutrient combinations rather than isolated nutrients, overall diet quality has been identified as a stronger predictor of disease risk.[35] A study of 6,352 men and women aged 35–80 found that 9.3% of participants used DS. Positive predictors of DS use included being female, having a higher education level, and having greater adherence to MD, while higher body mass index and hypertension awareness were negatively associated with DS use. This suggests that individuals adhering to a healthy diet are more likely to use DS.[36] Similarly, a study among university students found that higher MD adherence was positively associated with DS use, with a one-point increase in MD adherence linked to a 10% higher probability of DS use.[37] However, a study conducted in Türkiye found no significant association between MD adherence and awareness of herbal products and DS use.[38] In contrast, our study, which examined MD adherence (measured via MEDAS) and DS use as a potential indicator of health awareness, did not identify a significant association. The relationship between MD adherence and DS use varies by population, highlighting the need for further research.

The macronutrient distribution in HF patients should not differ from that of the general population; energy intake should range from 28 to 32 kcal/kg, with 50%–55% of total calories from carbohydrates, 30%–35% from lipids, and 15%–20% from proteins.[39] A study evaluating the dietary habits of HF patients found that daily energy and carbohydrate intake was low, similar to our findings.[40] Micronutrient intakes of patients were also found to be low, similar to the studies in the literature.[41–44] Notable deficiencies in essential nutrients such as vitamin C, iron, magnesium, and potassium among HF patients were found. These deficiencies are particularly concerning, given their role in managing oxidative stress and inflammation, key processes in HF pathophysiology. While DS use has the potential to address these gaps, the lowmissed

opportunities for optimizing patient outcomes. Cardiac insufficiency were related to a reduced risk of low food intake.[45] In addition, the patients' refusal to eat hospital food due to their dissatisfaction with the food served in the hospital, nausea and loss of appetite, which are symptoms of HF, may have affected the food intake of the patients. Malnutrition is a significant risk factor for both short- and long-term mortality, as well as other clinical outcomes, among hospitalized patients with chronic HF. Providing individualized nutritional support, as opposed to standard hospital meals, effectively reduces these risks, particularly in patients identified as being at high nutritional risk. To optimize outcomes in this vulnerable population, malnutrition screening at hospital admission followed by a tailored nutritional support strategy is strongly recommended.[46]

This study is one of the few in the literature evaluating the relationship between MD adherence and DS use and the first to do so in the Turkish population. Unlike previous studies that examined these factors separately in HF patients, this study uniquely explores their interaction. Additionally, patients' overall dietary habits were assessed to account for potential influences on MD adherence. However, some limitations exist. Due to participants' poor prognosis and age-related recall difficulties, a one-day dietary recall was used instead of a three-day dietary record, which may have introduced inaccuracies. Additionally, since the participants were hospitalized, their dietary intake remained stable, suggesting that dietary assessment methods for inpatients may need adjustment. The sample size was also small, and psychological factors, which could influence dietary intake, were not assessed. Future studies should address these limitations for a more comprehensive understanding.

Conclusion

This study highlights the limited use of dietary supplements (DS) among heart failure (HF) patients, with vitamins and minerals being the most commonly used, primarily based on physician recommendations. Herbal supplement use was less frequent and often driven by self-research or internet sources. DS use was motivated by symptom management and disease treatment, reflecting the specific challenges of HF pathophysiology, such as shortness of breath and edema. Adherence to the Mediterranean diet (MD) was moderate and showed no significant association with DS use. Notable nutrient deficiencies emphasize the need for tailored nutritional interventions. Malnutrition screening and individualized nutritional support should be prioritized for HF patients to improve clinical outcomes. Further research is necessary to better understand the relationship between MD adherence and DS use in this population.

Disclosures

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