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Case Report

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Nutrition Intervention Process for Heart Failure Patients according to Their Nutritional Problems

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ABSTRACT

Patients with heart failure (HF) need nutritional management such as sodium restriction and healthy eating habits to relieve symptoms and to manage chronic disease. This case study examined 3 patients who had different nutritional problems and responded positively to the nutrition management program. Patient 1 and 2 had high levels of energy intake and were obese. Patient 1 had a habit of irregular binge eating and frequently consumed sweetened snacks and fast foods. He was advised to eat regular 3 meals per day with balanced food choices. He decreased his energy consumption to the recommenced intake and his body mass index had dropped to 22.9 kg/m^2 by his second follow-up visit. Patients 2 ate 3 meals regularly but ate a large amount of food. Although he decreased his energy intake to 97% of the recommended intake, he should be advised to increase his protein intake at the 1st follow-up session because he decreased his protein intake less than 90% of the recommended amount. Patient 3 reduced food intake by half due to dyspnea caused by HF before hospitalization, but symptoms improved after discharge and his energy as well as sodium intake increased. In the second follow-up, his nutritional diagnosis was excessive sodium intake and nutritional intervention was performed to reduce sodium intake. This study showed that additional nutritional problems might arise throughout the nutritional intervention process. Therefore, follow-up nutritional counseling should be held to evaluate the compliance with the nutrition management guidelines and to decide whether additional nutrition problems are suggested.

Keywords: Heart failure; Nutrition management; Medical nutrition therapy

INTRODUCTION

Heart failure (HF) is characterized by a decrease in cardiac output, which results in decreased blood flow throughout the entire body. It presents through symptoms including shortness of breath, fatigue, and swelling. Making lifestyle changes, such as healthier eating habits, and medication can relieve symptoms [1]. Patients with HF often suffer from other chronic diseases, such as obesity, diabetes, and chronic kidney disease. They might often experience a lack of micronutrients, such as minerals and vitamins, due to sodium and water intake restrictions [2]. Malnutrition and cardiac cachexia may also appear in patients with severe

HF [3]. HF can cause various nutritional problems over time, so each patient should be individually assessed for potential issues and receive suitable nutritional management.

Oftentimes patients with HF have maintained the same eating habits for decades, so it is often difficult to achieve compliance with dietary guidelines with a single round of nutrition education and counseling. Therefore, according to the evidence-based guidelines for adult HF patients produced by the Academy of Nutrition and Dietetics (AND) [4], patients should receive at least 2 rounds of nutritional consulting, the first of which involves 30–60 minutes of nutritional assessments, identification of nutritional problems, nutritional education, and recommendations according to patient needs. A second consultation session should then be held 4 to 6 weeks later, during which the compliance with the nutrition management guidelines is evaluated and it is decided whether additional consultation sessions are recommended. Patients with New York Heart Association class 4 HF are recommended to receive nutritional counseling every 2 weeks. However, in the South Korea, although there have been reports on the nutritional status and nutrient intake of HF patients [5,6], few studies have examined the impact of nutritional education on HF patients' health outcomes.

In January 2020, Severance Cardiovascular Hospital began administering a nutrition management program for patients who received treatment for HF symptoms and participated in a group education program for HF patients. This study examined 3 patients who had different nutritional problems and had responded positively to the nutrition management-counseling program. This study was a retrospective case analysis study that examined data from patients' medical records. It was approved by the Research Ethics Committee of Severance Hospital under a consent exemption (4-2020-1466).

CASE

Individualized nutrition education

The HF patients were referred to receive multidisciplinary group education before being discharged. A clinical dietitian reviewed their medical records to collect their medical history, treatment history, and the results of biochemical and cardiac tests, such as echocardiography. All referred patients received identical HF group dietary education. After the group session, a clinical dietitian interviewed patients about their usual dietary intake using 24-hour recall and a semi-quantitative food frequency questionnaire which is a modified form of the Korean National Health and Nutrition Survey. Their dietary habits were evaluated using the Nutritional Quotient (NQ) Inventory for Korean Adults, which was developed to assess adults' overall dietary quality and food-related behaviors. This inventory contained 7 items about nutritional balance, 3 items about food diversity, 6 items about the amount of food intake, and 5 items about dietary behaviors. The NQ and individual category scores were calculated according to the obtained weights of the questionnaire items. The score for each category could be 0–100 and be evaluated as high, medium, or low [7]. Bioelectrical impedance analysis was conducted if the patient agreed. Nutritional diagnoses were made based on the analytical results of usual food intake, NQ score, and anthropometric measurements made using the International Dietetics and Nutrition Terminology developed by the AND [8]. Each patient was instructed to keep a food diary.

The patients were provided 2 additional individualized nutrition counseling sessions. The first session was provided when the patient first visited the outpatient clinic 2–3 weeks after

Table 1. Nutrition education and counseling program for heart failure patients

Session	Time between sessions	Nutrition program
Baseline	After group session	- Evaluate anthropometric measurement and BIA - Obtain patient's comprehensive diet history including usual dietary intake - Assess food behavior using NQ score - Identify nutrition diagnosis
First follow-up session	2–3 weeks	- Individualize nutrition prescription - Provide nutrition education and counseling based on nutrition diagnoses - Provide feedback for 3-day food diary
Second follow-up session	3–6 months	- Re-evaluate anthropometric measurement and BIA - Feedback for 3-day food diary - Re-evaluate food behavior using NQ score - Reinforce or modify nutrition prescription and assist patient in setting behavioral goals

BIA, bioelectrical impedance analysis; NQ, Nutritional Quotient.

initially being discharge. During the counseling session, a clinical dietitian assessed and provided feedback on the patients' food diaries. Specific nutrition education was provided to each patient in accordance with his or her nutritional diagnoses and each patient received training on how to improve their nutrition using additional materials, such as recipes. The second counseling session was conducted 3–6 months after the first session to evaluate compliance with the dietary recommendations, review the patients' food diaries, and re-take their anthropometric measurements. Patients were encouraged to maintain desirable changes in the future (**Table 1**).

Case 1

A 36-year-old male patient was referred to the cardiology department and hospitalized with complaints of dyspnea during exercise and pitting edema on both legs. His suggested diagnoses were myocarditis, dilated cardiomyopathy, or both and an echocardiogram conducted by a previous hospital showed that he had a 14% left ventricle (LV) ejection fraction (EF). He had previously been prescribed aldactone. He had no previous medical diagnoses. He weighed 77 kg at admission while his healthy body weight was 66 kg. An echocardiogram revealed that his left antrum (LA) and LV were enlarged, he had a decreased global LV systolic function with a 12% EF, and may have had a thrombus at the LV apex. Heparinization was started for his LV thrombus and conbloc and diuretics were prescribed to promote urination. Coronary angiography revealed minimal coronary artery disease. On the 9th day of hospitalization, warfarin was prescribed. On the 14th day, he was discharged from the hospital after his chief complaint had improved. Before discharge, he attended the group education.

He had a habit of binge-eating 1 or 2 meals per day. He would usually eat Korean soups in restaurants. He ate fast food every day and 1–1.5 servings of ramen 1–3 times/week. He frequently consumed bread, cake, chips, and sweetened beverages. He preferred red meat, such as ribs and pork belly, and fried chicken to vegetables. Three nutritional diagnoses were made. First, he consumed excessive calories as a result of a food- and nutrition-related knowledge deficit as evidenced by the fact that he consumed 133% of his recommended daily calorie intake (**Table 2**) and his body mass index (BMI) was 25.5 kg/m^2 (**Table 3**). Second, he consumed excessive sodium as a result of a food- and nutrition-related knowledge deficit about sources of sodium as evidenced by the fact that he consumed 160% of the daily recommended amount of sodium for cardiac disease patients and frequently consumed high-sodium foods, such as ramen, fast food, and Korean soups. His sodium intake checklist score was 4, which meant that he was at high risk of consuming high amounts of sodium. Third, his poor food choices were a product of his lack of exposure to accurate nutrition-

Table 2. Changes of daily nutrients intake

Cases	Energy (kcal)	Protein (g)	CHO (g)	Fat (g)	CPF ratio	Na (mg)
Case 1						
Recommended intake	1,600	75	-	-	-	2,000
Baseline	2,135*	73	225	65	16:51:33	3,190
1st follow-up	1,950	70	285	59	59:14:27	3,560
2nd follow-up	1,595	70	185	64	46:18:36	2,975
Case 2						
Recommended intake	1,700	75	-	-	-	2,000
Baseline	2,175	85	300	70	55:16:29	4,570
1st follow-up	1,650	65	245	45	59:16:25	2,500
2nd follow-up	1,725	72	260	44	60:17:23	3,100
Case 3						
Recommended intake	2,000	85	-	-	-	2,000
Baseline	1,015	38	178	17	70:15:15	1,965
1st follow-up	1,840	87	295	36	64:19:17	4,210
2nd follow-up	1,740	61	255	53	59:14:27	3,885

CHO, carbohydrate; CPF ratio, ratio of calorie intake from carbohydrate, protein and fat.
*Including energy from alcohol consumption.

Table 3. Changes of anthropometric measurement

Variables	Case 1		Case 2		Case 3	
	Before discharge	2nd follow-up	Before discharge	2nd follow-up	Before discharge	2nd follow-up
Weight (kg)	67.0	60.2	78.0	68.0	67.1	70.0
BMI (kg/m²)	25.5	22.9	26.8	24.5	20.8	21.9
WHR	0.94	0.87	-	-	0.84	0.88
SMM (kg)	24.0	26.6	-	-	29.1	30.0
FM (kg)	21.6	12.7	-	-	14.2	16.1
PFM (%)	32.4	21.1	-	-	21.2	22.9

BMI, body mass index; WHR, waist-to-hip ratio; SMM, skeletal muscle mass; FM, fat mass; PFM, percentage of fat mass.

related information as evidenced by his low overall NQ score, his low diversity score of 19.6 in particular, and his frequent consumption of foods high in saturated fat, such as fried chicken and fast food.

After 1 month, the patient visited the outpatient clinic where the clinical dietitian conducted individualized nutrition education and counseling, advising him to eat 3 meals regularly throughout the day, make balanced food choices, and reduce his sodium intake. The clinical dietitian provided him with a recommended meal plan to achieve his recommended calorie and protein intake goals and recipes for low-salt kimchi. He had 3 meals/day, which contained a more balanced range of foods and he had stopped drinking alcohol. His calorie intake decreased to 1,950 kcal/day, which was 121% of the recommended energy intake for weight reduction, 1,600 kcal/day. However, he still frequently consumed pork cutlets and pork ribs throughout the week and sweetened bread and chips between meals. The dietitian counseled him to make healthy food choices and moderate the amount of food he consumed.

At his second follow-up visit that occurred 5 months after his first follow-up visit, his dietary intake and anthropometric measurements were measured again. According to his 3-day food diary, he had 3 meals/day and ate animal foods other than red meat, such as fish, soy, soy products, and vegetables every day. His estimated calorie and protein consumptions were 1,595 kcal/day and 70 g of protein/day, respectively, both of which were within the recommended range (**Table 2**). While his initial NQ was 41, his NQ at the second follow-up visit was 68.8 and all of his balance, diversity, moderation, and dietary behavior category scores had risen to the medium or high level. His BMI had dropped to 22.9 kg/m² by his second follow-up visit (**Table 3**).

Case 2

A 62-year-old male patient was admitted to the hospital with complaints of aggravated dyspnea during exercise and dizziness. Three years before his admission, he received an artificial pacemaker because he was suffering from sick sinus syndrome. A physical exam noted pitting edema on both of his legs. He weighed 80.45 kg at admission while his healthy body weight was 74.5 kg. Echocardiographic assessment revealed regional wall motion abnormality (RWMA) and an enlarged LA and LV and decreased LV systolic function with an EF of 47%. He was diagnosed with dilated cardiomyopathy. A cardiac positron emission tomography-computed tomography scan confirmed that he had cardiac sarcoidosis, so he was prescribed steroids. He was discharged from the hospital on day (HOD) #10 with plans to titrate steroid doses in an outpatient clinic.

He attended the group session for HF patients before being discharged and revisited the clinical dietitian twice after being discharged. His usual nutritional intake and anthropometric measurements are presented in **Tables 2** and **3**. He usually ate 3 meals regularly throughout the day but ate a large amount of food. His NQ score was 61.1, which was in the good range and his diversity score was 88.4, which was in the high range. He said that as much as he wanted of a variety of foods and did not consider his health when making eating choices. He usually ate 2,175 kcal/day and 85 g of protein/day, which were 128% and 113% of the recommended amounts, respectively. He selected 8 out of 10 in the checklist to assess his sodium intake patterns, which showed that he was at high risk of consuming a high amount of sodium. He was obese with a BMI of 26.8 kg/m^2 based on his healthy body weight. His nutritional diagnoses were excessive food and beverage intake and excessive sodium intake.

At his first follow-up session, his food diary showed that he had reduced his food intake after discharge, but he still frequently ate kimchi stew and soybean paste stew, which are high-sodium foods. He ate more vegetables and nuts and less fruit; protein-dense foods, such as meat, eggs, and beans; and ramen and other instant foods. Analysis of his 3-day food diary revealed that he consumed 97% of the recommended amount of calories and 87% of the recommended amount of protein. The clinical dietitian instructed him to consume an adequate amount of lean meat and meat substitutes because the patient's protein intake decreased to less than 90% of the recommended amount as a result of the fact that he avoided most protein-dense foods. A clinical dietitian gave him individualized nutrition education and counseling to teach him how to choose foods and plan meals to reduce his sodium intake. The second follow-up session took place 4 months after the first follow-up session. He selected 4 out of 10 in the checklist to assess his sodium intake patterns, which showed that he was at moderate risk of consuming a high amount of sodium. He said that he was not adding table salt or extra sauces to foods and reduced his consumption of delivery food. His overall NQ score and each of his category scores had increased, but his food intake moderation score had increased the most. He consumed 103% of the recommended amount of calories and 96% of the recommended amount of protein. His BMI had decreased to 24.5 kg/m^2, which was lower than the cutoff for obesity diagnosis as defined by the Korean Society for the Study of Obesity.

Case 3

A 64-year-old male visited the emergency room because he was experiencing aggravated dyspnea during exercise and edema on his right leg over the preceding 3 days. Although he had undergone percutaneous coronary intervention for his 2-vessel coronary artery disease

3 months before his visit, he was still experiencing chest discomfort. He weighed 77 kg when he was admitted to the hospital while his healthy weight was 72 kg. He had diabetes. An echocardiogram revealed that he had RWMA in the area supplied by his right coronary artery and left circumflex coronary artery, his LA and LV were enlarged, and his LV had a reduced systolic function with an EF of 12%. Diuretics were prescribed to promote urination. On the 9th day of hospitalization, a stent was inserted in his left circumflex coronary artery under coronary angiography and a previously inserted stent at his right coronary artery was confirmed to be intact. He was discharged from the hospital on HOD#10. He weighed 65 kg when he was discharged.

At the end of the group session on HOD#6, a clinical dietitian evaluated his nutritional status. Over 3 months before hospitalization, the dyspnea he experienced during exercise caused him to decrease his food consumption by half. He would eat 3 meals/day of rice and kimchi and ate some fruit between meals. He did not consume meat, other vegetables, milk, or sweetened or high-fat bread or chips. He reported that he would frequently eat out or order delivery foods, including Korean soups and stews. His initial overall NQ was 49.2, which was low and his diversity and dietary behavior category scores were particularly low. His diagnosis was inadequate food and beverage intake as a result of his dyspnea as evidenced by the fact that his estimated calorie consumption was 50.7% of the recommended amount and his estimated protein consumption was 45.1% of the recommended amount. The clinical dietitian encouraged him to eat more by consuming small, frequent meals and taking an oral nutritional supplement. First follow-up session was 2 weeks after his group session. His estimated calorie and protein consumption increased to 1,840 kcal/day and 87 g/day, which were 92% and 102% of the recommended amounts, respectively. However, his increased food consumption resulted in his estimated sodium consumption increasing to more than twice the recommended amount. He ate out for 2 meals/day. He would eat noodles or Korean soup for lunch and grilled beef or bulgogi for dinner. A clinical dietitian taught him how to choose foods that would lower his sodium intake and how to analyze nutrition information and provided him with low-salt kimchi recipes. His second follow-up session was held 4 months after his first follow-up session. During his second session, he said that he was eating more balanced foods, such as bibimbap, kimbap, and grilled pork with vegetables. An analysis of his 3-day food diary showed that his estimated calorie and protein consumption had decreased slightly to 1,740 kcal/day and 61 g of protein/day, respectively. His BMI was 21.9 kg/m^2, which was within the normal range. He said that he was not experiencing any more respiratory symptoms, including dyspnea, and an echocardiogram showed that there were no interval changes in his pre-existing RWMA, enlarged LA and LV, and his reduced LV systolic function with an EF of 28%.

DISCUSSION

The 3 patients examined in this case study were hospitalized for HF, participated in a group education program for HF patients, and were then given follow-up nutrition education and counseling. HF treatments include both medical treatment and nutritional management. Worsening symptoms due to a lack of compliance with treatment guidelines are the most common cause of readmission. HF patients are provided with clinical nutrition therapy to help improve their symptoms, such as edema and dyspnea, and to effectively manage comorbid diseases, such as hypertension, dyslipidemia, diabetes, and obesity, in a timely manner.

Obesity is a risk factor for HF and affects the prognosis of the disease. Obesity is reported in 38%–58% of patients with HF, a third of whom are severely obese [9]. Obesity has been reported to reduce the long-term mortality in patients with HF, but this conclusion should be verified through detailed analyses that control for confounding variables, such as degree of obesity, sex, and age. Rather than reducing the amount of food consumed by obese patients to promote weight loss, the AND's guidelines on nutritional management for HF patients focus on promoting weight loss through healthy eating habits and increased physical activity [4]. Weight loss is strongly promoted for patients who have comorbid diseases, such as diabetes, high blood pressure, and sleep apnea. In this study, Patient 1 was characterized by irregular eating times and poor meal choices, such as ramen, short ribs, pork belly, and fast food. Part of his nutritional intervention included a meal plan of 3-balanced meals/day of healthy foods. At the patient's follow-up session, both his overall NQ and category scores had improved. His caloric intake had decreased to the recommended level while he maintained his protein intake levels.

Data shows that 75%–90% of patients with severe HF are malnourished and more than 10%–15% of such patients experience cardiac cachexia [9]. Although Patient 3 decreased his food consumption by half due to dyspnea caused by HF, his weight increased by 5 kilograms. As such, it was difficult to diagnose malnutrition using only anthropometric measurements, including weight change and BMI, which made it difficult to conduct an appropriate nutritional intervention. A nutritional intake survey is needed to ensure that adequate nutritional intake is maintained. A dietary management plan that emphasizes reduced sodium and calorie consumption as well as symptoms of HF can cause malnutrition. One small study showed that energy, carbohydrate, calcium, thiamine, and folic acid intake decrease significantly when sodium intake was restricted to less than 2 g/day for 1 week [10]. However, HF patients who were advised to follow a Dietary Approaches to Stopping Hypertension diet regimen for 6 months successfully maintained low sodium consumption while also receiving adequate nutrition [11]. Many HF patients must also restrict their vitamin K intake by taking warfarin, limit their intake of saturated fatty acids in response to coronary artery disease, and receive dietary therapy for diabetes. Nutrition education and counseling that focuses on limiting nutrient consumption can cause macronutrient and micronutrient consumption deficits, which can lead to malnutrition and cachexia. By design, group nutrition education often emphasizes such restrictive models. Patients 1 and 2, who had high levels of caloric intake and were obese, decreased their energy consumption to the recommended levels by their first follow-up sessions, despite the fact that they occurred shortly after they were discharged. However, Patient 2's protein intake had decreased to 87% of the recommended amount, so at his first follow-up session, he was advised to consume an appropriate amount of protein-rich foods at each meal. By his second follow-up session, his protein intake was more than 90% of the recommended amount. His calorie consumption had decreased to 87% of the recommended amount and his BMI had decreased to 24.5 kg/m^2, which was below the standard for obesity. As such, his nutrition education and counseling were focused on the importance of maintaining adequate nutrition through a balanced diet.

Patient 3 consumed less than 2,000 mg of sodium/day before he was admitted, during which time he consumed less food. After being discharged, he did not experience any of his previous symptoms, so he increased the amount of food he was eating and, as a result, his sodium intake. Accordingly, he was diagnosed with excessive sodium consumption, so he received recommendations for low-sodium meal options and recipes.

Measurable indicators are required to evaluate the outcomes of nutritional interventions. In addition to analyzing the amount of nutrients consumed, either through an analysis of the patient's usual diet or a food diary, their NQ score, which evaluates the eating habits of adults, were evaluated both before the group education program and at the second follow-up session to evaluate whether their eating practices had improved. In clinical practice, it is difficult to analyze closely the food diaries of many patients. Although dietary assessment tools, such as Korean Health Eating Index, have been developed, they are limited in their ability to assess individual dietary habits [12]. We used the NQ index which consists of 4 categories: balance, diversity, moderation, and eating behaviors. As such, this index can quantify how much a person's overall eating habits have changed. Also the NQ index is useful in helping patients review their eating habits and consider potential areas for improvement during self-assessments. The development of such dietary evaluation tools is expected to be helpful in clinical practice.

This study was a case study on how nutrition education and counseling help HF patients manage their condition. It was conducted to show how patients might have different nutritional diagnoses and causes of their disease despite having the same diagnosis and so should receive different nutritional interventions. This study also showed that additional nutritional problems might arise throughout the nutritional intervention process. Given the purpose of this study, the impact of nutritional intervention results on long-term HF prognosis was not analyzed. Prospective studies should be conducted to analyze how different nutritional diagnoses caused by HF, how customized nutritional interventions should be developed based on these factors, the outcomes of such interventions, and the impact of such interventions on disease prognosis.

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