Annals of Clinical and Analytical Medicine
Original Research

Nutritional status of patients with heart failure

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Abstract

Aim: This study aims to evaluate and compare the nutritional status of patients with heart failure (HF) and coronary artery disease without HF.

Material and Methods: The study included 33 HF patients and 33 patients without HF coronary artery disease . The nutritional status of participants was evaluated with anthropometric measurements and Nutritional Status Control (CONUT). The obtained data were analyzed with the SPSS program.

Results: It was determined that most of the individuals participating in the study were overweight or obese (HF=66.7%, without HF=75.8%), and when the body fat percentage was classified, the majority of them were in the unhealthy class (HF=81.8%, without HF=63.6%). In addition, individuals in both groups were considered at high risk of chronic disease according to their waist circumference, waist-hip ratio, and waist-to-height ratio. Although the handgrip strength of individuals with heart failure was not statistically significant, it was lower than in the other group ($p>0.05$). It was determined that the mean CONUT score of individuals with HF was significantly higher ($p<0.05$), and the score increased with the increase in New York Heart Association (NYHA) class.

Discussion: In this study, it was determined that the risk of malnutrition in individuals with HF is higher than in the other group. It is known that the symptoms that occur with the progression of heart failure negatively affect the nutrition of patients. For this reason, it is essential to follow up on the nutritional status of HF patients by evaluating their nutritional status from the time of diagnosis.

Keywords

Heart Failure, Nutrition Status, CONUT

DOI: 10.4328/ACAM.21327 Received: 2022-07-20 Accepted: 2022-08-22 Published Online: 2022-08-29
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Introduction

Heart failure is defined as a structural or functional cardiac disorder in which the heart does not deliver enough oxygen to meet the metabolic needs of the tissues, despite normal or only increased filling pressures. The functional classification prepared by the NYHA is used to classify the disease according to symptoms and severity [1].

Nutritional deficiencies and weight loss are prevalent in individuals diagnosed with HF disease, and involuntary weight loss develops in most patients [2]. The European Society of Cardiology (ESC) defines cachexia as the involuntary loss of ≥6% of total body weight in the last 6–15 months, not related to edema [1]. It is known that cardiac cachexia that develops in patients affects the course of the disease and accelerates cardiac death [3]. Therefore, nutritional intervention has an important place in the treatment of HF patients. One of the most important causes of weight loss and cachexia observed in patients is insufficient intake of various nutrients and dietary energy [2,4]. This situation shows the necessity of evaluating and following the nutritional status of the patients.

Body mass index (BMI) is frequently used in assessing body weight because it is a practical and straightforward method. However, studies showed that BMI alone is insufficient in evaluating nutritional status in HF patients [5,6]. In a study, it was found that even in individuals who were considered normal or overweight according to BMI, there was nutritional deficiency according to arm muscle area, skinfold thickness, and albumin level [6]. Therefore, the nutritional status of patients with heart failure should be evaluated with other anthropometric measurements, such as skinfold thickness or waist circumferences [6-7].

Various screening and evaluation tools and risk indices can be used to evaluate the nutritional status of these patients [8]. CONUT (Controlling Nutritional Status), calculated by albumin, lymphocyte, and cholesterol values, is one of the screening tools which is suitable for use in HF patients [9].

In this study, it was aimed to evaluate and compare the nutritional status of patients with HF and coronary artery disease without HF.

Material and Methods

This study was conducted with 33 patients (M=21, F=12) diagnosed with heart failure by the physician and 33 coronary artery patients (M=28, F=5) in a similar age group without HF diagnosis. The heart failure group included 12 systolic heart failure patients with ejection fraction (EF) ≤35% and class I according to NYHA functional classification, 13 in class II, and eight patients in class III. Patients admitted to the hospital due to Acute Coronary Syndrome in the last three months, hospitalized with decompensated HF, or diagnosed with HF with preserved ejection fraction were not included in this group. Individuals who were not diagnosed with chronic heart failure had normal left ventricular ejection fraction (LVEF), but were diagnosed with coronary artery disease, were included in the study as the control group.

In individuals included in both the case and control groups,

1. Glomerular Filtration Rate was >30,
2. There was no diagnosis of Type 1 or Type 2 Diabetes Mellitus,
3. The condition of not having a by-pass in the last three months was sought.

Individuals who applied to Hacettepe University Medical Faculty Hospital Cardiology Department polyclinic between March 2014-May 2015 and agreed to participate in the study were included. The EF of the coronary artery patients included in the study was re-checked by the physician before the study, and the presence of HF was eliminated.

Before the study, ethics committee approval was obtained from Hacettepe University Ethics Committee (10.01.2014-16969557-25). The "Informed Consent Form", that explained the purpose and practices of the research, was read to the individuals who agreed to participate in the study. General information of the participants was recorded using the questionnaire form prepared by the researchers.

Anthropometric Measurements

Using this technique, height, body weight, handgrip strength, waist and hip circumference, triceps, biceps, subscapular, and suprailiac skinfold thicknesses of the participants were measured. BMI was calculated and classified as <18.5 underweight, 18.5-24.99 normal weight, 25.0-29.99 overweight, and ≥30.0 obese (available at: https://apps.who.int/iris/handle/10665/63854).

Waist circumferences were classified as ≥94 cm and ≥80 cm at risk in men and women, respectively, and ≥102 cm and ≥88 cm as high risk. The waist-hip ratio was interpreted as 0.90 in men and above 0.85 in women (available at: https://www.who.int/publications/i/item/9789241501491).

The ratio between measured waist circumference and height was evaluated according to the classification developed by Ashwell et al. [10]. Accordingly, it was classified as <0.4 attention, 0.4-0.5 appropriate, 0.5-0.6 consider action, and >0.6 take action. The body composition of the patients was determined by the "Durnin and Womersley" body fat and lean tissue mass equation and the Siri equation. The body fat percentage of male participants ≤5 was considered unhealthy (very low), 6-15 (low), and 16-24 (high) were considered acceptable, and ≥25 was considered unhealthy (very high). The reference values used for women in the body fat percentage classification are ≤8, 9-23, 24-31, and ≥32, respectively [11].

Evaluation of Nutritional Status

The Nutritional Status Control-CONUT, which was developed to evaluate the nutritional status of HF patients in the clinic, was calculated from albumin, lymphocyte, and cholesterol values [9]. The first validity study of this scoring method was carried out in 2005, and it was shown that it gave results compatible with proven techniques. The obtained CONUT score is classified as 0-1 normal nutritional level, 2-4 mild, 5-8 moderate, and 9-12 severe nutritional deficiency [12].

Statistical analysis

SPSS 21.0 package program was used in the analysis of the data. From the answers given by the subjects to the questionnaire, mean ± standard deviation was given for the continuous variables. The Chi-square test was used to investigate the relationships between qualitative variables. Differences between group values of continuous variables were analyzed with the t-test and statistical significance level was accepted as $p<0.05$.

Results

Thirty-three patients with a diagnosis of HF with a mean age of 62.7±9.7 years and 33 patients diagnosed with any other coronary artery disease (CAD) other than HF with a mean age of 62.9±6.3 years participated in the study. It was found that 90.9% of individuals with heart failure were married, 39.4% were university,18.1% were high school graduates, and only 18.2% were working. All participants in the other group were married, 57.5% of them were university and 15.2% were high school graduates. The number of employed participants was significantly higher in the non-HF group (63.6%, p<0.05).

In Table 1, the mean values of the anthropometric measurements of the individuals are given. The mean triceps skinfold thickness (SFT) of men with HF was significantly higher, and the hip circumference of women was lower (p<0.05).

It was determined that 28.8% of the participants in the study had normal body weight, and there were no underweight individuals. 66.7% of individuals with heart failure and 75.8% of the other group were overweight or obese (Table 2). When the body fat percentage was classified, it was seen that the majority of them were in the class considered unhealthy (HF=81.8%, without HF=63.6%). In addition, it was found that the risk of chronic disease was higher in both groups according to waist circumference, waist-hip ratio, and waist-height ratio.

In Table 3, the average CONUT score and the nutritional status classifications were given. The mean CONUT score of patients with HF was significantly higher than in those without HF (p<0.05). It was determined that 39.4% of patients with HF and 21.2% without HF who participated had a mild nutritional deficiency.

In Figure 1, the nutritional status of patients with HF was given according to the NYHA class. With the increase in the NYHA class, the proportion of patients with mild nutrition deficiency also increased (p<0.05). It was determined that 62.5% of the patients in class 3 had nutritional deficiencies.

Table 1. Anthropometric measurements of participants

Male	Male		Female	
	HF X̄ ± SS	Without HF X̄ ± SS	HF X̄ ± SS	Without HF X̄ ± SS
BMI (kg/m²)	27.3±3.5	27.1±3.3	28.1±6.8	27.8±0.2
Waist circum (cm)	101.3±11.3	101.6±9.7	97.6±20.6	95.0±8.2
Hip circum. (cm)	103.8±9.9	101.7±9.4	102.2±19.6^	107.2±1.6^
Handgrip (kg)	30.2±6.8	33.7±6.4	17.7±4.7	20.6±2.1
Biceps SFT (mm)	10.7±4.9	9.6±4.8	16.0±6.7	11.8±8.4
Subscapular SFT (mm)	18.9±5.4	20.2±6.2	18.7±5.9	15.1±1.2
Triceps SFT (mm)	15.3±3.2*	11.3±4.9*	18.1±6.5	21.6±6.8
Suprailiac SFT (mm)	13.7±2.7	13.2±3.9	13.7±2.7	15.6±4.1

Circum.: circumference SFT: skinfold thickness, *, ^: p<0.05

Table 2. Evaluations of Anthropometric Measurements of patients

	HF n (%)	without HF n (%)	p
Body mass index			
Normal	11 (33.3)	8 (24.2)	
Overweight	17 (51.5)	18 (54.6)	0.09
Obese	5 (15.2)	7 (21.2)	
Body fat percentage *			
Acceptable (high)	6 (18.2)	12 (36.4)	0.11
Unhealthy (very high)	27 (81.8)	21 (63.6)	
Waist circumference			
Low risk	3 (9.1)	6 (18.2)	
Risk	11 (33.3)	9 (27.3)	0.54
High risk	19 (57.6)	18 (54.5)	
Waist-hip ratio			
Low risk	4 (12.1)	2 (6.1)	0.67
High risk	29 (87.9)	31 (93.9)	
Waist-height ratio			
Attention	2 (6.1)	-	
Appropriate	-	4 (12.1)	
Consider action	15 (45.4)	13 (39.4)	-
Take action	16 (48.5)	16 (48.5)	

* Results from "Durnin and Womersley" body fat and lean tissue mass equation and the Siri equation

Discussion

Nutritional deficiency and cachexia are frequently seen in patients with advanced HF. This situation causes the progression of the disease and increases mortality [3,8]. This study determined that 39.4% of HF patients had moderate nutritional deficiency according to the CONUT score (p>0.05), and the mean score was higher than in the other group (p<0.05) (Table 3). In the study of Nakagomi et al. [13], a CONUT score of 3 and above was associated with cardiac events. Therefore, although the results of the nutritional classifications between the two groups are not statistically significant, they are clinically meaningful. Nutritional deficiencies are more common as symptoms of the disease progression in heart failure patients [8]. Contrary to the literature [14], the number of patients with NYHA class I and II in whom HF symptoms did not develop much was high in this study. However, it was determined that the percentage of participants with mild nutrition deficiency

Table 3. Evaluation of Nutritional Status of the participants with CONUT scoring

	HF X̄ (SS)	Without HF X̄ (SS)	p
CONUT score	1.5 (1.4)	0.7 (0.6)	0.01
CONUT nutritional status	n (%)	n (%)	
Normal	20 (60.6)	26 (78.8)	0.11
Mild nutritional deficiency	13 (39.4)	7 (21.2)	

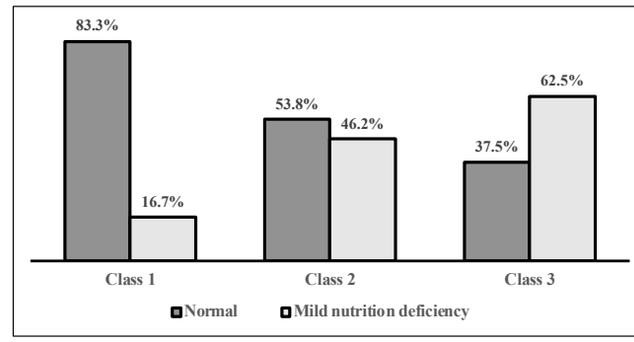


Figure 1. Nutritional status of patients with HF according to the NYHA class

also increased with increasing the NYHA class in patients with HF (Figure 1). Although the nutritional deficiency found in this study is lower than in the literature, the possibility of developing nutritional deficiency with the increase in the severity of the disease should not be ignored.

BMI is frequently used in the clinical assessment of body weight and monitoring of nutritional status. In this study, although the difference between the two groups was not statistically significant, the mean BMI value of individuals with HF was higher ($p>0.05$) (Table 1). However, as the edema that develops with the progression of the clinical-stage masks weight loss, the evaluation with BMI alone gives erroneous results, especially in patients with advanced HF [9].

In a study conducted by Gastelurrutia et al. [6], at the end of the anthropometric and biochemical evaluation of individuals with a ≥BMI 25, it was understood that nutritional deficiency was more common in this group. A recent study has shown that skinfold thickness or equations based on skinfold thickness are more effective than BMI in evaluating patients with HF [5]. Zuchinal et al. [15] found that triceps skinfold thickness was a strong independent predictor of all-cause mortality in HF. In this study, the rate of patients who were overweight or obese according to BMI, was lower in HF patients. However, when the body fat percentages of the participants were calculated using skinfold thickness measurements, it was found that the number of individuals with a very high body fat percentage, in contrast to BMI, was higher in the group with HF (HF=81.8%; without HF= 63.6%) (Table 2). The increase in adipose tissue in response to muscle loss in HF patients who reduce physical activity due to limited effort capacity is thought to be one of the reasons for this situation.

Obesity is one of the risk factors in the etiology of HF. However, in recent years, studies have shown that high BMI reduces the risk of mortality in patients with HF [16,17]. In a study that followed heart failure patients for ten years, it was determined that a BMI below 23.8 kg/m² increases the risk of mortality [17], and in another study, non-ischemic HF patients with a BMI of 30-34.9 have a longer life expectancy [16]. For this reason, the Heart Failure Society of America recommends 5-10% weight loss only in HF patients with a BMI of 35 and above [18]. This situation, which is called the obesity paradox, is supported by various studies. However, it should not be forgotten that in addition to the body weight and BMI classification of individuals, body composition is also crucial for the prognosis of the disease. Abdominal obesity has an important place in both coronary artery disease's etiology and life span. It was known that abdominal obesity is an independent risk factor for mortality in patients with HF [19]. In this study, it was found that the risk of chronic disease was relatively high in both groups according to the waist circumference, waist-hip ratio, and waist-to-height ratio (Table 2).

Handgrip strength is used practically in the clinic to evaluate the general condition of muscle mass. In recent years, it has been understood that there is a relationship between handgrip strength and, cardiovascular diseases [20]. In the PURE (Prospective Urban Rural Epidemiology) study, it was determined that the average handgrip strength value of the participants was 30.6kg and that the handgrip strength was inversely related to cardiovascular disease and cardiovascular deaths [20]. A study evaluating the risk of chronic HF (CHF) with handgrip strength showed that CHF is 1.35 times higher in individuals with low handgrip strength [21]. The relationship between handgrip strength and the risk of developing heart failure is very important [22]. In addition, low handgrip strength and high adipose tissue are also independent risk factors for mortality [23]. In this study, it was found that the handgrip strength was lower, and the body fat percentage was higher in patients with HF. In order to increase the quality and duration of life in patients, these two risk factors that increase the risk of both cardiovascular and all-cause mortality should be eliminated as soon as possible.

Limitation

Nutritional deficiencies are common in patients with advanced HF. However, in this study, both the small sample size and the high number of people with class 1 and 2 HF caused the general nutritional status of the patients to be better than expected. Therefore, the nutritional status of HF patients should be determined by prospective studies to be conducted with a larger sample. Comprehensive assessments will allow the creation of a tailored nutrition program for HF patients.

Conclusions

In this study, it was determined that individuals with HF have a higher risk of malnutrition than the other group. It is known that the symptoms that occur with the progression of heart failure adversely affect the patients' nutritional status. For this reason, the course of the disease must evaluate the nutritional status of HF patients from the time of diagnosis and follow up with the patient. Preventing involuntary weight loss in individuals with heart failure, creating an exercise and nutrition plan that will help reduce adipose tissue and increase muscle mass will help improve the patient's quality of life and duration.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: *None*

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:
Esma Asil, Emine Yıldız. *Nutritional status of patients with heart failure. Ann Clin Anal Med 2022; DOI: 10.4328/ACAM.21327*