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INCIDENCE OF CACHEXIA AND ITS ASSOCIATION WITH FUNCTIONAL CAPACITY IN CHRONIC HEART FAILURE PATIENTS

Anam Tariq[1], Muhammad Muneeb[2], Atta Ullah Khan Niazi[2], Faheem Mustafa[1], Naveed Munir[3]*, Zahra Khan[4], Tayyaba Arshad[2], Muhammad Riaz[5], Zanib Javed Chatha[2]

[1]**Department of Nutrition and Dietetics,** School of Health Sciences, University of Management and Technology, Lahore, 54000, Pakistan
[2]**Department of Cardiology, Shalamar Medical and Dental College**, Lahore, 54000, Pakistan
[3]**Department of Biomedical Lab Sciences,** School of Health Sciences, University of Management and Technology, Lahore, 54000, Pakistan
[4]**Department of Nutrition and Health Science,** Faculty of Engineering and Science, University of Greenwich Medway Campus ME4 4TB, UK
[5]**Department of Allied Health Sciences,** Sargodha Medical College, University of Sargodha, Sargodha, Pakistan

***Corresponding Author:** Dr. Naveed Munir. E. mail: naveed.munir@umt.edu.pk

Abstract

Heart failure (HF) is a progressive clinical syndrome with a high morbidity and mortality rate. In such patients Cachexia also known as wasting syndrome or anorexia cachexia syndrome and is very complicated problem which is far dangerous than a loss of appetite. This study was planned to investigate the incidence of cachexia in chronic heart failure (CHF) patients and further elucidate its association with functional capacity and outcomes in affected patients. We assessed cachexia status among 55 patients with CHF (25 females, 30 males, over 35 years old) using a convenient sampling method. Patients were included in this study due to their diagnosis from the outpatient Heart Failure Department of Shalamar Hospital (Trust) in Lahore. Reduction of the body weight was noted upto 6 months. Functional capacity was assessed by the handgrip dynamometer and the short physical performance battery test (SPPB). Results explored 64% of females became cachectic with a mean age of (58.43± 7.25), and 52.7% of males became cachectic with a mean age of (64.15 ±11.02). In this study, the mean value of SPPB was reported lower in the cachectic group than the non-cachectic group (5.0± 2.1 vs. 7.4±0.94) with a mean age of 61.0 ± 9.4. These results reflect that the physical activity level of heart failure (CHF) patients was reduced due to cachexia development and anorexia. Patients with cachexia are more likely to show weakened functional capacity and may lead to higher mortality rate in CHF cachexia patients as compared to non-cachectic patients Additionally, patients who developed cachexia also showed reduced muscular strength and exercise ability. It could be concluded that CHF patients affected by cachexia with the passage of time which might affect adversely the health status of cardiac patients both in male and female.

Keywords: *Cachexia, Cardiovascular diseases, Chronic heart failure, Malnutrition*

INTRODUCTION

Heart failure (HF) is a progressive clinical syndrome with a high morbidity and mortality rate. The coronary artery disease is the major cause of HF and HF divided into three main subtypes as HF with reduced ejection fraction (HFrEF), HF with midrange ejection fraction (HFmrEF) and HF with preserved ejection fraction (HFpEF). In the afore mentioned classification the level of natriuretic peptide and structural heart disease' presence and diastolic dysfunction are also considered (1). Risk factors associated with CHF are hypertension, smoking, obesity, hyperlipidemia, alcohol use, stress, physical inactivity, and uncontrolled diabetes (2). It has been reported that more than 20 million people are affected by Chronic heart failure (CHF), having high ratio of hospitalization with average cost of 8000 US dollars and high mortality worldwide (3, 4). Although a wide range of therapeutic agents are available to manage the CHF but still with poor long-term prognosis (5, 6, 7) so globally CHF is become the major challenge both socioeconomically and for healthcare systems (2). Moreover, metabolic changes like anorexia, frailty, metabolic syndrome, sarcopenia and cachexia besides various cardiovascular and non-cardiovascular

comorbidities, also affects adversely the physical activities, survival and the quality of life of CHF patients (8, 9, 10). Change in the catabolic and anabolic pathways are among the major characteristics of Cachexia (11) and in CHF this imbalance in metabolic pathways is most common (12).

Cardiac cachexia is a clinical indication and a dangerous complication of CHF that predicts mortality in patients. Weight loss is a significant feature of cachexia in adults. However, in severe CHF conditions, water accumulation occurs in the body due to hypoalbuminemia, leading to an increase in body weight despite body wasting. Body muscle wasting is an important feature of cachexia (13). Cachexia is defined as a complicated metabolic syndrome that is linked with chronic conditions and is characterized by a decrease in muscle mass, with or without a decrease in fat mass. Cachexia is defined as non-edematous weight loss of at least 5% during a period of 6 months (14) with BMI (body mass index) of <20 kg/m2 and diagnosed with more than three out of following clinical features: fatigue, decreased muscle strength, anorexia, abnormal blood chemistry, increased inflammatory marker (C-reactive protein and IL-6), low fat-free mass index, low serum albumin level (<3.2 g/dL), and hemoglobin (<12g/dL) (1). Cachexia is linked to different pathophysiological processes, including triggering the inflammatory systems, neuroendocrine abnormalities, wasting of muscles, and increased lipolysis, which affect 10-15% of CHF patients. Its appearance is an important predictor of poor anticipation in them (14). In patients diagnosed with cardiac cachexia, the incidence of mortality rate is as high as 50% in 18 months, which is higher than most types of cancer (15). Approximately 15% of advanced CHF patients will proceed to cardiac cachexia (16).

Nutritional status and CHF have a strong association with each other. Malnutrition is more profound in CHF patients, and with time, it leads to cardiac cachexia, which is defined as protein-calorie deficit with the presence of peripheral edema. The mechanisms by which CHF leads to cardiac cachexia are malabsorption of nutrients due to gut edema, eating and food preparation limitations due to fatigue, anorexia due to cytokine production, and increased work of breathing. Other comorbidities due to CHF, such as renal insufficiency and frailty, also take part in cardiac cachexia, which leads to further muscle wasting. The cardiac cachexia condition further reduces the macro and micro-nutrient delivery to the heart, leading to further reduction in cardiac function, and further muscle wasting leads to impaired functional capacity (17). In Pakistan, there is no data regarding the incidence of cachexia in CHF patients and its association with reduced functional capacity. We propose to determine the prevalence of cachexia by observing patients for 6 months to record weight changes and measuring the body composition of CHF patients. Furthermore, we analyzed the association of cardiac cachexia with functional capacity.

MATERIALS AND METHODS

PLACE OF WORK

The study was conducted at Shalamar Hospital (Trust), Lahore from November 2019 to April 2022. The sample size was 55, using the convenient sampling method based on patients visiting hospital during the COVID-19 pandemic which limited the number of patients due to strict policies and due to risk of COVID-19 infection. Patients were included in this study based on their diagnosis from the Cardiology outpatients Department of Shalamar Hospital, Lahore. All patients were over the age of 35 years. The proposed study aimed to determine the incidence of cachexia in CHF patients and its association with their functional capacity. For this purpose, written consent was obtained from the patients, and ethical approval was obtained from the ethical committee of Shalamar Hospital, Lahore (Ref: SHL-102519/noc/203/DOC).

INCLUSION AND EXCLUSION CRITERIA

Patients with CHF were included in the study. The following criteria were used: (1) Both males and females over the age of 35 years, (2) Preserved Left ventricular ejection fraction (LVEF) ≤ 40%. Patients with a history of previous heart transplantation, renal disease, hepatic diseases, pregnancy, hypothyroidism and hyperthyroidism, and coronary revascularization were excluded from the study.

MEASUREMENT TOOLS AND QUESTIONERS

Anorexia in CHF patients was assessed using the Likert scale. Patients were asked a single question: "Do you have an appetite loss?" This question was rated on a six-point scale: 1) Not at all, 2) very rarely, 3) rarely, 4) frequently, 5) very frequently. A higher score indicates an increase in the frequency of anorexia in patients. A cut-off value of >1, which is very rarely, indicates that the patient experiences a loss of appetite different from their usual appetite. Based on this criterion, the patient was considered anorexic, as described by Blauwhoff-Buskemolen (18). The patient's weight change history was followed up for 6 months. The first weight was taken at the start for the evaluation of weight loss, and then the weight was taken each month up to 6 months. Any loss in weight was recorded to determine the percentage weight loss. Cachexia was defined according to current diagnostic criteria as the presence of unintended non-edematous weight loss of ≥ 5% over the period of 6 months. During the weight follow-up, patients who developed edema were excluded from the study (19).

ANTHROPOMETRIC MEASUREMENTS AND BODY COMPOSITION

Anthropometric measurements included height and weight. Height was measured using a stadiometer. Weight was taken with light clothes and barefooted using a digital weighing machine. According to the World Health Organization, BMI was calculated by following standard protocol. Patients with a BMI <18.5 kg/m2 were considered underweight. Patients with a BMI of 18.5-24.5 kg/m2 were considered normal. Patients with a BMI of 25-29.9 kg/m2 were classified as overweight, while those with a BMI >30 kg/m2 were considered obese.

Bioelectric Impedance Analysis (BIA) (Maltron Bioscan 920-2S international Ltd) was used to evaluate the body composition, such as fat mass and fat-free mass in kilograms and percentage. All measurements were taken using the tetra-polar method. Patients were lying in the supine position with four surface electrodes placed on their right ankle and wrist. Measurements were taken before 30 minutes of urination and at least 3 hours of fasting determine on describing the routine of patients during participation (20). The fat-free mass index was calculated using the formula that divides the lean body mass by the height in meters squared. Patients were classified as having low fat-free mass if the value in males was <16 kg/m2 and in females <15 kg/m2. Fat free mass index was calculated by using the formula. Dividing the lean body mass by height in meter square. Patients were classified as having low fat free mass if value was ≤ 19.1 kg/m2 Fat mass index was calculated by using the formula. Dividing the lean body mass by height in meter square. Patients were classified as having low fat mass index if value was ≤ 8.2kg/m2 (21). Blood samples were obtained and immediately sent to the laboratory to perform the following tests for routine assessment according to the hospital's laboratory criteria: hemoglobin, plasma creatinine, sodium, albumin, and potassium.

PERIPHERAL MUSCLE STRENGTH AND FUNCTIONAL CAPACITY ASSESSMENT OF CHF

The peripheral muscle strength was assessed by the electronic handgrip dynamometer model EH101. Low muscle strength was classified according to age. For males with age 35-44 years, low strength was classified as <35 kg; for age 45-54 years, low strength was classified as <34.7 kg; for age 50-54 years, low strength was considered <32.9 kg; for age 55-64 years, low strength was classified as <30.2 kg, and for age 65-99 years, low strength was <21 kg. For women with age 35-44 years, <18.9 kg was considered as low muscle strength; for age 45-54 years, <18.1 kg was classified as low muscle strength; for age 55-64 years, <17.2 kg was considered as low muscle strength, and for women who were older than 64 years, <14.7 kg was classified as low muscle strength (22).

Functional capacity was also evaluated by the short physical performance battery score (SPPBS). This test consists of gait speed, endurance, and balance. Through this, we evaluated the patients' ability to stand side by side, tandem position, and semi-tandem position, and ability to walk about 4 minutes and the

time to rise from a chair and return to a seated position in five times. All points were scored within 10 seconds. SPPBS ranges from 0 to 12 points. Patients with low SPPBS scores show impaired functional capacity (23).

STATISTICAL ANALYSIS

Statistical analysis was carried out using SPSS software (version 20.0; SPSS, Chicago, IL, USA). Continuous variables were stated as mean ± standard deviation (SD), and categorical variables were computed as frequencies and percentages. The continuous variables were compared using the independent t-test, while categorical variables were compared using the chi-square test or Fisher's exact test (when necessary) to assess the associations among categorical variables. Statistical significance was defined as a two-tailed p-value < 0.05.

RESULTS

BASELINE CHARACTERISTICS OF CHRONIC HEART FAILURE PATIENT (WHOLE SAMPLE)

Table I represents the baseline characteristics of patients with CHF. The data in this table is presented as mean, standard deviation, and percentage. We enrolled 55 stable patients with CHF in this study, of whom 25 were female and 30 were male. The mean age of patients in the cachexia group was (61.0 ± 9.4), while in the non-cachectic group, it was (58.46 ± 11.67). Anorexia was reported by 79.3% of cachectic patients, while in the non-cachectic group, it was 20.7%. The percentages of patients according to NYHA classification and comorbidities are given in Table I.

Table I. Baseline Characteristics of chronic heart failure patient (Whole sample)

Parameters	Cachexia (n=29)	Non-cachexia (n=26)	p-value
Age (mean ±SD *)	61.0 ± 9.4	58.46 ± 11.67	0.377
Duration of disease (X±SD)	5.8 ± 4.4	5.5 ± 4.7	0.787
Anorexia (%)	79.3	20.7	0.0083
NYHA* -1(%)	4.0 (1)	10 (3)	
NYHA-2 (%)	20 (5)	23 (7)	0.080
NYHA-3 (%)	64 (16)	56 (17)	
NYHA-4 (%)	12 (3)	10 (3)	
Co- morbidities			
Ischemic heart failure (%)	82.2	17.2	0.0385
Hypertension (%)	89.7	11	0.0398
Hyperlipidemia (%)	48.3	51.7	0.324
Diabetes (%)	72.4	27.6	0.008
Anemia (%)	48.3	51.7	0.104

NYHA= New York heart association, SD *= standard deviation

BODY COMPOSITION PARAMETERS OF CHRONIC HEART FAILURE PATIENTS (WHOLE SAMPLE)

Table II shows the mean values of body composition parameters. The mean percentage of weight loss in the cachectic group was (8.46 ± 4.76), while in the non-cachectic group it was (2.84 ± 1.863). A significant difference in weight loss was reported with p<0.001.

Table II. Body composition parameters of chronic heart failure patients (whole sample)

Parameters	Cachexia (n=29)	Non-cachexia (n=26)	p-value
BMI (kg/m2) *	26.51 ± 4.97	27.25 ± 4.87	0.581
Percentage weight loss	8.46 ± 4.76	2.84 ± 1.863	0.0001
Waist circumference (inches)	34.0± 2.8	36.7± 2.5	0.010
Fat mass index	8.08 ± 4.93	12.49 ± 12.4	0.0361
Fat free mass index	17.5 ± 4.07	23.72 ± 3.79	0.0001

kg*= kilogram, m*=meter

The mean value of waist circumference in the cachectic group was (34.0 ± 2.8), while in the non-cachectic group it was (36.7 ± 2.5). The fat-free mass index, which indicates sarcopenia or loss of muscle mass, showed a significant association with the development of cachexia. The mean value of the fat-free mass index in the cachectic group was (17.5 ± 4.07), while in the non-cachectic group it was (23.72 ± 3.79). The fat mass index was low in the cachectic group but did not show any significant association with the development of cachexia.

LABORATORY PARAMETERS OF CHRONIC HEART FAILURE PATIENTS (WHOLE SAMPLE)

Table III shows the laboratory parameters in the form of mean and standard deviation. In this table, the laboratory parameter C-reactive protein did not show any significant association between cachexia and non-cachexia. The mean value of C-reactive protein in the cachectic group was (6.0 ± 3.7), while in the non-cachectic group it was (4.8 ± 4.2). The mean value of albumin (g/dL) in the cachectic group was (3.36 ± 0.7), while in the non-cachectic group it was (3.80 ± 0.57). Serum albumin showed a significant association with the development of cachexia. There was no significant association found in the laboratory parameters of sodium, potassium, creatinine, and hemoglobin between the cachectic and non-cachectic groups.

Table III. Laboratory parameters of chronic heart failure patients (whole sample)

Parameters	Cachexia (n=29)	Non- cachexia (n=26)	p-value
C-reactive protein (mg/ L)	6.0 ± 3.7	4.8 ± 4.2	0.26
Creatinine (mg/dl)	0.95 ± .43	1.06 ± .37	0.30
Hemoglobin (g/dl)	11.78± 1.8	12.31± 1.6	0.26
Albumin (g/dl)	3.36± 0.7	3.80 ± 0. 57	0.010
Sodium (mmol/L)	139.4 ± 7.7	140.8 ± 4.81	0.410
Potassium (mmol/L)	7.04 ± 10.57	4.21 ± 1.0	0.018

FUNCTIONAL CAPACITY IN CHRONIC HEART FAILURE (WHOLE SAMPLE)

Table IV shows the mean values and standard deviation of functional capacity in CHF patients. The data showed that the short physical performance battery score (SPPBS) had a stronger association with the development of cachexia. The mean value of SPPBS in the cachectic group was (5.0±2.1), while in the non-cachectic group, it was (7.4±0.94). The handgrip dynamometer showed marginal association with cachexia.

Table IV. Functional capacity in chronic heart failure (Whole sample)

Parameters	Cachexia (n=29)	Non- cachexia (n=26)	p-value
Handgrip dynamometer (kg)*	18.6±7.2	24.4±8.2	0.007
SPPBS *	5.0±2.1	7.4±0.94	0.0001

Kg= kilogram, SPPBS= short physical performance battery score

MULTIVARIATE LOGISTIC REGRESSION MODEL (WHOLE SAMPLE)

In the multivariable logistic regression model, two variables were identified as significant independent risk factors for cachexia: percentage weight loss (adjusted odds ratio [AOR] 3.31; 95% confidence interval [CI] 1.179-9.299), p-value (0.02), fat-free mass index (AOR 0.68; 95% CI 0.399-1.03, 0.02). Furthermore, SPPBS (AOR 0.12; 95% CI 0.01-1.29, 0.08) and albumin (AOR 0.30; 95% CI 0.10-1.13) showed a marginally significant response. Although, hemoglobin level in cachectic patients is lower than 12g/dL as per cachexia diagnostic criteria (Table 3) but according to multivariable logistic regression model for whole sample size it showed non-significance result as shown in Table V.

THE PERCENTAGES OF CACHEXIA AND NON-CACHEXIA (WHOLE SAMPLE)

Fig. 1 shows the percentage of the development of cachexia at in the whole sample both male and female CHF patients. A noticeable ratio of CHF developed cachexia during the 6 months of observation period (weight loss >5%).

Table V. Multivariate logistic regression model (Whole sample)

Multivariable logistic regression model				
Variables	**Odds ratio**	**95% Confidence interval**		**p-value**
		Lower	**Upper**	
Fat free mass index	0.71	0.399	1.03	0.02
SPPBS*	0.19	0.011	1.294	0.05
Albumin	0.34	0.10	1.13	0.04
Hemoglobin	1.27	0.56	3.313	0.52

SPBBS*= short physical performance battery score

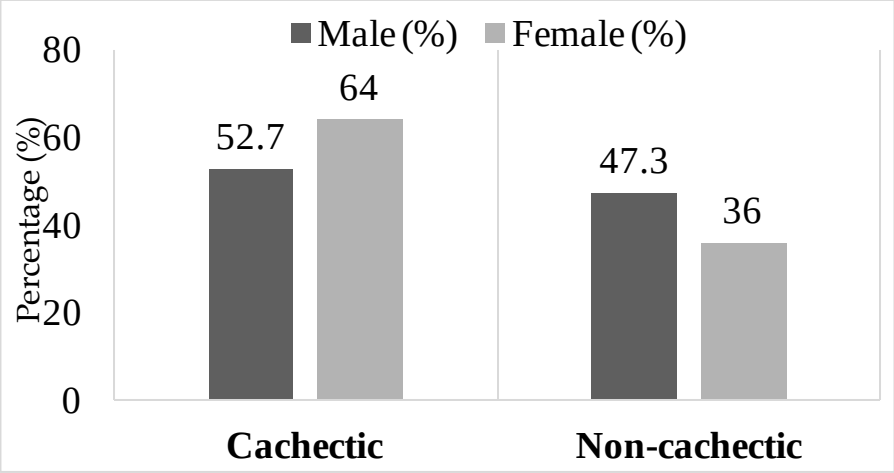

Fig. 1. Percentage of cachexia in both selected genders (whole sample)

PREVALENCE OF ANOREXIA

The percentage prevalence of anorexia was investigated using a Likert scale. The data showed that 69.1% of CHF patients reported anorexia, while 30.9% did not report anorexia.

DISCUSSION

The present study included both male (n=30) and female (n=25) patients with stable CHF. In this study, 64% of females were reported as cachectic with a mean age of 58.43 ± 7.25, and males were reported as 52.7% cachectic with a mean age of 64.15 ± 11.02 (Fig. 1). The results of this study were found to be consistent with two different studies that reported the prevalence of cachexia in male and female CHF patients separately. The first study, conducted at the Heart Failure Clinic of General Hospital in Boston, reported that 37.8% of male patients were cachectic with a mean age of 62.5 years. The other study, held in Germany, reported that 36.8% of female patients were cachectic with a mean age of 68.9 years (24).

In the present study, 79.3% of cachectic CHF patients reported having anorexia (Table I), which is a major contributing factor to cachexia in CHF patients. Nutritional status and CHF have a strong association with each other (25). Malnutrition is more profound in CHF patients, and over time, it leads to cardiac cachexia, which is defined as a protein-caloric deficit with the presence of peripheral edema. The mechanisms by which CHF leads to cardiac cachexia are malabsorption of nutrients due to gut edema, eating and food preparation limitations due to fatigue, anorexia due to cytokine production, and increased work of breathing. The result was found to be consistent with another study conducted in Germany, which showed that more than 33% of clinically stable mobile patients with CHF had revealed symptoms of anorexia. Findings of this study suggest that patients with anorexia are at an increased risk of compromised functional capacity which may also explore the linkage between higher mortality and anorexia in CHF patients. Various studies have found that anorexia is commonly prevalent among different chronic diseases due to various associated mechanisms (26).

Compromised physical activity greatly influences the quality of life of a patient. The results of the current study showed that 78% of CHF patients had progressed disease and were classified according to the NYHA classification in classes 3 and 4 (21). Body mass index is not a sensitive parameter to predict the development of cachexia. A higher body mass index is considered a risk factor for cardiovascular diseases.

As BMI is calculated by weight (kg) / height (m)² (27), it does not predict the loss of muscle mass in CHF patients in cachectic condition. The results of this study showed that patients who developed cachexia had a lower BMI with a mean of 26.51 ± 4.97 compared to those who did not develop cachexia with a mean of 27.25 ± 4.87. Similarly, a study conducted at the Ahmanson University of California, Los Angeles, at the cardiomyopathy center reported a lower level of BMI in CHF patients with a mean of 24.9 ± 4 (21). However, waist circumference is considered a more sensitive parameter for the development of cachexia. Waist circumference is used to assess central obesity (28). The mean waist circumference of the cachectic group was 86.36 ± 7.34 cm, which might reflect abdominal lipolysis. Similarly, José Paulo and his colleagues conducted a study on chronic stable CHF patients at the CHF clinic (Hospital S. João, Porto, Portugal), which reported a mean waist circumference of 82.8 ± 6.2 cm (16).

Fat-free mass can influence resting energy expenditure and is also used for the determination of sarcopenia. Body composition measurement was done by bioelectric impedance analysis to get fat-free mass in kilograms. Fat-free mass (kg) was used for the estimation of fat-free mass index, which indicates the body muscle mass according to height. The results of the current study revealed that a lower level of fat-free mass index was associated with the development of cachexia. The mean value of the fat-free mass index in the cachectic group was 17.5 ± 4.07. Similarly, a low level of fat-free mass index with a mean of 17.3 kg/m² was reported in a study conducted in Japan at Yamagata University Hospital on heart failure patients (29). Fat mass (kg) was also measured by bioelectric impedance analysis in this study. For the estimation of the fat mass index, fat mass (kg) was used. Fat mass did not show any association with the development of cachexia in this study, although a lower level of fat mass was shown in cachectic patients, with a mean value of 8.08 ± 4.93. A study reported increased concentration of adiponectin in cachectic CHF patients (30). This may contribute to the conservation of the physiological reaction to maintain fat mass; however, it is also proposed that adiponectin may play a role in the pathogenesis of cachexia (31). In the current study, laboratory values were recorded for the assessment of cachexia. Albumin is considered a good biochemical marker for the indication of malnutrition, and its lower level is seen in cachectic patients. The current study showed that albumin had an association with the development of cachexia, with a mean value of 3.36 ± 0.7 g/dL in the cachectic group. Castillo-Mart and his colleagues (20) also reported that serum albumin levels were associated with cachexia. Similarly, another study reported the same results, which was conducted on stable CHF patients in Japan at Fukushima Medical University Hospital. The study showed the mean value of albumin in cachectic patients as 3.4g/dL (32).

Due to changes in intestinal mucosal integrity, malabsorption mostly occurs in cachectic conditions. Generally, low hemoglobin levels (<12 g/dL) are reported in cachectic patients based on diagnostic criteria. The current study reported a low level of hemoglobin in the cachectic group compared to the non-cachectic group (11.78 ± 1.8 vs. 12.31 ± 1.6) but did not show a significant association. Similarly, another study conducted at the Heart Failure Clinic Hospital S. Joao, Porto, Portugal, reported a hemoglobin level of 12.0 g/dL in CHF patients (16). C-reactive protein is used as an indicator of an inflammatory marker. A high level of C-reactive protein indicates the severity of heart disease. The findings of this study showed that the mean value of C-reactive protein in cachectic patients was higher than non-cachectic patients (Table 3). Yu Sato and his colleagues (32) conducted a study at Fukushima Medical University Hospital in Japan that reported a higher level of C-reactive protein in cardiac cachectic patients, with a mean value of 6.7 mg/L (33). Another study conducted in Portugal also reported a higher level of CRP in cachectic patients, with a mean value of 5.4 mg/L (16).

Functional capacity in CHF patients was assessed using a handgrip dynamometer and SPPBS. The handgrip dynamometer was used to assess peripheral muscular strength, which is assumed to be low in patients who develop cachexia due to the loss of muscle mass. The results of this study showed a marginal association between muscle strength and the development of cachexia because the overall cohort had compromised muscular strength. The mean peripheral muscular strength was reported as 18 kg in the cachectic group, while 24 kg was reported in the non-cachectic group. Another study conducted at the OSCAL clinic in Bucaramanga, Santander, Colombia, reported a lower level of handgrip dynamometer with

a mean value of 22 kg (34). Short Physical Performance Battery (SPPB), a concise presentation battery dependent on a coordinated short-distance walk, recurring seat stands, and a balance test, is an approved evaluation apparatus for estimating lower limit work that is generally utilized in both clinical and examination settings. For the assessment of functional capacity, SPPBS was used. In this study, the mean value of SPPBS was reported to be lower in the cachectic group than the non-cachectic group (5.0 ± 2.1 vs. 7.4 ± 0.94) with a mean age of 61.0 ± 9.4 years. These results reflect that the physical activity level of CHF patients was reduced due to cachexia development. Another study conducted in Japan on male heart disease patients to see the relationship between SPPBS and laboratory values reported a mean value of SPPBS of 8.2 ± 2.1 with a mean age of 77.2 ± 6.5 years (25).

CONCLUSION

The present study showed that a large proportion of CHF patients developed cachexia during the observation period among recruited patients. Bioelectric impedance analysis is a valuable tool for assessing changes in body cell mass in CHF patients, and it provides additional information to weight loss. Additionally, patients who developed cachexia also showed reduced muscular strength and exercise ability. Although small number of CHF patients had participated but our findings are promising, and they should serve as a basis for future exploration of this vulnerable group of patients especially in developing countries like Pakistan. Moreover, research particularly on considering the factors to investigate how enhanced nutritional support can be provided to improve the quality of life of suspected cardiovascular cachexia patients.

Limitations:

The current study has a few limitations, e.g., during data collection, the COVID-19 pandemic also influenced the recruitment of patients as well as limited number of patients. It is suggested that a large-scale prospective study should be conducted to determine the significant contributors to cachexia in CHF patients. Despite these special circumstances, our findings are promising, and they should serve as a basis for future exploration of this vulnerable group of patients. We should investigate how enhanced nutritional support can be provided to improve the quality of life of suspected cardiovascular cachexia patients.

Conflict of Interest:

Authors have no conflict of interest.

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References:

1. Evans WJ, Morley JE, Argilés J, Bales C, Baracos V, Guttridge D, Jatoi A, Kalantar-Zadeh K, Lochs H, Mantovani G, Marks D. Cachexia: a new definition. Clinical nutrition. 2008;27(6):793-9.
2. Roger VL, Go AS, Lloyd-Jones DM, Adams RJ, Berry JD, Brown TM, Carnethon MR, Dai S, De Simone G, Ford ES, Fox CS. Heart disease and stroke statistics—2011 update: a report from the American Heart Association. Circulation. 2011;123(4):e18-209.
3. Savarese G, Lund LH. Global public health burden of heart failure. Cardiac failure review. 2017;3(1):7.
4. Kleiner Shochat M, Fudim M, Shotan A, Blondheim DS, Kazatsker M, Dahan I, Asif A, Rozenman Y, Kleiner I, Weinstein JM, Panjrath G. Prediction of readmissions and mortality in patients with heart failure: lessons from the IMPEDANCE-HF extended trial. ESC heart failure. 2018;5(5):788-99.
5. Crespo-Leiro MG, Metra M, Lund LH, Milicic D, Costanzo MR, Filippatos G, Gustafsson F, Tsui S, Barge-Caballero E, De Jonge N, Frigerio M. Advanced heart failure: a position statement of the Heart

Failure Association of the European Society of Cardiology. European journal of heart failure. 2018;20(11):1505-35.
6. Rodil Fraile R, Malafarina V, Tiberio López G. Sacubitril–valsartan in heart failure and multimorbidity patients. ESC heart failure. 2018 Oct;5(5):956-9.
7. Rosano G. Medical Treatment of Heart Failure with Reduced Ejection Fraction–Prognostic Indication. InInternational Cardiovascular Forum Journal 2017 Jun 3 (Vol. 10).
8. Cogswell RJ, Norby FL, Gottesman RF, Chen LY, Solomon SD, Shah AM, Alonso A. High Prevalence of Sub-clinical Cerebral Infarctions in Patients with Heart Failure with Preserved Ejection Fraction. Journal of Cardiac Failure. 2015 Aug 1;21(8):S104-5.
9. Streng KW, Nauta JF, Hillege HL, Anker SD, Cleland JG, Dickstein K, Filippatos G, Lang CC, Metra M, Ng LL, Ponikowski P. Non-cardiac comorbidities in heart failure with reduced, mid-range and preserved ejection fraction. International Journal of Cardiology. 2018 Nov 15;271:132-9.
10. Lena A, Coats AJ, Anker MS. Metabolic disorders in heart failure and cancer. ESC heart failure. 2018 Dec;5(6):1092-8.
11. von Haehling S. Muscle wasting and sarcopenia in heart failure: a brief overview of the current literature. ESC heart failure. 2018 Dec;5(6):1074.
12. Scherbakov N, Doehner W. Cachexia as a common characteristic in multiple chronic disease. Journal of cachexia, sarcopenia and muscle. 2018 Dec;9(7):1189.
13. Muscaritoli M, Anker SD, Argilés J, Aversa Z, Bauer JM, Biolo GI, Boirie Y, Bosaeus I, Cederholm T, Costelli P, Fearon KC. Consensus definition of sarcopenia, cachexia and pre-cachexia: joint document elaborated by Special Interest Groups (SIG)"cachexia-anorexia in chronic wasting diseases" and "nutrition in geriatrics". Clinical nutrition. 2010 Apr 1;29(2):154-9.
14. Pocock SJ, McMurray JJ, Dobson J, Yusuf S, Granger CB, Michelson EL, Östergren J, Pfeffer MA, Solomon SD, Anker SD, Swedberg KB. Weight loss and mortality risk in patients with chronic heart failure in the candesartan in heart failure: assessment of reduction in mortality and morbidity (CHARM) programme. European heart journal. 2008 Nov 1;29(21):2641-50.
15. Anker SD, Negassa A, Coats AJ, Afzal R, Poole-Wilson PA, Cohn JN, Yusuf S. Prognostic importance of weight loss in chronic heart failure and the effect of treatment with angiotensin-converting-enzyme inhibitors: an observational study. The Lancet. 2003 Mar 29;361(9363):1077-83.
16. Araújo JP, Lourenço P, Rocha-Gonçalves F, Ferreira A, Bettencourt P. Nutritional markers and prognosis in cardiac cachexia. International Journal of Cardiology. 2011 Feb 3;146(3):359-63.
17. Grossniklaus DA, O'Brien MC, Clark PC, Dunbar SB. Nutrient intake in heart failure patients. The Journal of cardiovascular nursing. 2008 Jul;23(4):357.
18. Blauwhoff-Buskermolen S, Ruijgrok C, Ostelo RW, de Vet HC, Verheul HM, de van der Schueren MA, Langius JA. The assessment of anorexia in patients with cancer: cut-off values for the FAACT–A/CS and the VAS for appetite. Supportive Care in Cancer. 2016 Feb;24:661-6.
19. Drexler H, Riede U, Münzel T, König H, Funke E, Just H. Alterations of skeletal muscle in chronic heart failure. Circulation. 1992 May;85(5):1751-9.
20. Castillo-Martínez L, Colín-Ramírez E, Orea-Tejeda A, Islas DG, García WD, Díaz CS, Rodríguez AE, Durán MV, Davies CK. Cachexia assessed by bioimpedance vector analysis as a prognostic indicator in chronic stable heart failure patients. Nutrition. 2012 Sep 1;28(9):886-91.
21. Thomas E, Gupta PP, Fonarow GC, Horwich TB. Bioelectrical impedance analysis of body composition and survival in patients with heart failure. Clinical cardiology. 2019 Jan;42(1):129-35.
22. Rantanen T, Guralnik JM, Foley D, Masaki K, Leveille S, Curb JD, White L. Midlife hand grip strength as a predictor of old age disability. Jama. 1999 Feb 10;281(6):558-60.
23. Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, Scherr PA, Wallace RB. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. Journal of gerontology. 1994 Mar 1;49(2):M85-94.
24. Saitoh M, Dos Santos MR, Emami A, Ishida J, Ebner N, Valentova M, Bekfani T, Sandek A, Lainscak M, Doehner W, Anker SD. Anorexia, functional capacity, and clinical outcome in patients with chronic heart failure: results from the Studies Investigating Co-morbidities Aggravating Heart Failure (SICA-HF). ESC Heart Failure. 2017 Nov;4(4):448-57.
25. Yasuda T, Nakajima T, Sawaguchi T, Nozawa N, Arakawa T, Takahashi R, Mizushima Y, Katayanagi S, Matsumoto K, Toyoda S, Inoue T. Short Physical Performance Battery for cardiovascular disease inpatients: implications for critical factors and sarcopenia. Scientific reports. 2017 Dec 12;7(1):17425.

26. Sandek A, Doehner W, Anker SD, Von Haehling S. Nutrition in heart failure: an update. Current Opinion in Clinical Nutrition & Metabolic Care. 2009 Jul 1;12(4):384-91.
27. Mustafa F, Munir F, Munir M, Riaz S, Bacha U, Tahir H, Baig AA. Association of Age and Gender with the BMI of Obese Subjects in Pakistan. BioScientific Review. 2022;4(3):29-39.
28. Hajhashemy Z, Foshati S, Saneei P. Relationship between abdominal obesity (based on waist circumference) and serum vitamin D levels: a systematic review and meta-analysis of epidemiologic studies. Nutrition reviews. 2022;80(5):1105-17.
29. Narumi T, Watanabe T, Kadowaki S, Takahashi T, Yokoyama M, Kinoshita D, Honda Y, Funayama A, Nishiyama S, Takahashi H, Arimoto T. Sarcopenia evaluated by fat-free mass index is an important prognostic factor in patients with chronic heart failure. European journal of internal medicine. 2015;26(2):118-22.
30. De Brandt J, Beijers RJ, Chiles J, Maddocks M, McDonald ML, Schols AM, Nyberg A. Update on the Etiology, Assessment, and Management of COPD Cachexia: Considerations for the Clinician. International journal of chronic obstructive pulmonary disease. 2022:2957-76.
31. McEntegart MB, Awede B, Petrie MC, Sattar N, Dunn FG, MacFarlane NG, McMurray JJ. Increase in serum adiponectin concentration in patients with heart failure and cachexia: relationship with leptin, other cytokines, and B-type natriuretic peptide. European heart journal. 2007;28(7):829-35.
32. Sato Y, Yoshihisa A, Kimishima Y, Yokokawa T, Abe S, Shimizu T, Misaka T, Yamada S, Sato T, Kaneshiro T, Oikawa M. Prognostic factors in heart failure patients with cardiac cachexia. Journal of Geriatric Cardiology: JGC. 2020;17(1):26.
33. Holder ER, Alibhai FJ, Caudle SL, McDermott JC, Tobin SW. The importance of biological sex in cardiac cachexia. American Journal of Physiology-Heart and Circulatory Physiology. 2022;323(4):H609-27.
34. Amare H, Hamza L, Asefa H. Malnutrition and associated factors among heart failure patients on follow up at Jimma University specialized hospital, Ethiopia. BMC cardiovascular disorders. 2015;15(1):1-6.