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Association of body composition with quality of life, cardiovascular risk factors, and physical activity in patients with chronic heart failure

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Abstract

Introduction: Chronic heart failure (CHF) is a common cardiovascular disease, especially with ischemic etiology that has shown an increasing trend. It is assumed that physical activity level (PAL), body composition and quality of life may interact with each other and also with conventional cardiovascular risk factors.
Objectives: In this study the association of body composition [according to DXA (dual-energy x-ray absorptiometry) method] with quality of life and physical activity and also some cardiovascular risk factors were determined in patients with CHF.
Patients and Methods: In this cross-sectional comparative study, 52 consecutive CHF patients attending to a referral training heart center in Tehran, Iran were enrolled. The body composition was determined by DXA method and the PAL was assessed by IPAQ (international physical activity questionnaire) questionnaire. Also the quality of life was assessed with IHF-QoL questionnaire and dynamometer was used to determine the muscle strength. Finally, the association between these factors and cardiovascular risk factors was determined.
Results: Self-efficacy was the most related subscale of quality of life with fat mass and fat percent in males ($P < 0.05$). The quality of life, PAL, and cardiovascular risk factors were generally not significantly related to the abnormal skeletal muscle mass index and grip strength ($P > 0.05$), except for significant correlation of grip strength with lower PAL ($P=0.046$). Patients with muscle wasting had significantly lower body mass index (BMI) and lower fat percent ($P<0.001$ and $P=0.008$, respectively).
Conclusion: Overall, this study showed that body composition in patients with CHF is not related to quality of life, conventional cardiovascular risk factors, and physical activity. However, grip strength is related to physical activity.

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Introduction

Chronic heart failure (CHF) is a common cardiovascular disease especially with ischemic etiology that has shown an increasing trend with 3% to 6% increased incidence rate (1). Nearly 16% of CHF patients die during hospital stay while in 33% of the cases hospital readmission is needed that results in high economic burden for health sector (2, 3). These patients have decreased quality of life in comparison with the general population (4). Further clinical symptoms in these patients are accompanied with further decreased quality of life (5). Hospital mortality rate of approximately 5% may be attenuated if clinical factors are recognized and controlled (6). Two proposed factors affecting the quality of life in CHF patients are physical activity level (PAL) and body composition (7, 8). Further, improved PAL especially as resistance exercise is associated with appropriate body composition and muscular strength, which could subsequently affect the quality of life per se (9-12). This matter has been assessed by clinical trials and longitudinal studies. The role of baseline body composition before enforcement by physical activity is not so considered. On the other words, when it is assumed that PAL may affect the body composition as the third part of this equilibrium i.e., quality of life would also

Core tip
In a cross-sectional comparative study on 52 consecutive chronic heart failure patients, we found that body composition, in general, is not related to quality of life, conventional cardiovascular risk factors, and physical activity in patients with chronic heart failure.

be important (13,14). Regarding this subject, the role of cardiovascular risk factors as initiating factors with probable aggravating effect should also be remembered. This matter is similar to a baseline cycle including body composition, physical activity, and quality of life with a mediator effect by cardiovascular risk factors. Intervention in each part of this circle may improve the final situation for patients and their prognosis.

Objectives

In this study the association of body composition [according to DXA (dual-energy x-ray absorptiometry) method] with quality of life and physical activity and also some cardiovascular risk factors were determined in patients with CHF.

Patients and Methods

Study design

In this cross-sectional comparative study, 52 consecutive CHF patients attending to a referral training heart center in Tehran, Iran were enrolled.

Inclusion criteria

The inclusion criteria were established CHF and age range from 18 to 65 years, ejection fraction of 35 percent or less, at least three months of treatment with ACCF/AHA protocol, and ability to walk unaided. The exclusion criteria were any type of trauma or limb injury resulting in inability to do diagnostic tests, history of heart transplantation, thromboembolic events in the past 6 weeks, hemodialysis, pregnancy, artificial limbs/prosthesis, and having neurological, orthopaedic, and other types of diseases accompanied with decreased physical activity.

Data collection instruments and methods

The body composition was determined by DXA method (Hologic Discovery Wi DXA System, Hologic ULC, Canada) with patients lying supine. The data included both fat and muscle components in each limb and trunk. Also the body mass index (BMI) was calculated. Additionally, the skeletal muscle mass index (SMI) was developed by division of total lean mass of four limbs (as kg) to height square (as meter). It was considered as a categorical variable according to EWGSOP (European working group on sarcopenia in older people) (15) for diagnosing muscle wasting. Digital hand Dynamometer Seahan Corp (model SH5003)/Korea was used to measure the hand grip strength in sitting position with shoulder in adduction and neutral rotation when the elbow was bent 90 degrees and the elbow in neutral position with wrist in 0-30 degree of dorsiflexion (16). Dynamometer was taken in hand in a position that the base was put on the first metacarpal bone and the handle was put in middle part of other four fingers. Maximal pressure was exerted to dynamometer by dominant hand for five seconds. In this condition, all other body parts were immobile and this function was repeated three times with 60-second interval and the average of measurements was recorded. The PAL was assessed by IPAQ questionnaire (Long-Form) with Persian validated version (17) that determined objectively the type and amount of physical activity in the past week. Quality of life was assessed with the Iranian Heart Failure Quality of Life (IHF-QoL) questionnaire, a Persian questionnaire by Naderi et al (18) which is valid in heart failure patients.

Ethical issues

Human rights were respected in accordance with the Helsinki Declaration 1975, as revised in 1983. The ethical committee of Iran University of Medical Sciences (Ethical Code# IR.IUMS.FMD.REC1396.9411225002) approved the study. The informed consent was taken from the patients as well as from parents and first relatives.

Statistical analysis

After data collection was completed, among 52 patients, three subjects had missing data and were excluded and final statistical analysis was done by SPSS version 24.0 software among 49 patients. Kolmogorov-Smirnov, Pearson, chi-square, and Fisher's exact tests were utilized. *P* values less than 0.05 were considered significant.

Results

In this study, 31 subjects (59.6%) were male. The mean age and BMI were 50.1 ± 10.4 years and 27.3 ± 5.1 kg/m^2 respectively. The muscle measurements are shown in Table 1 separately. In addition, the mean fat measurements are shown in Table 2. The abnormal SMI (which denotes

Table 1. Muscle measurements among patients

Variable	Gender	Mean (SD)
Right upper extremity	Male	3.25 (0.67)
	Female	2.08 (0.44)
Left upper extremity	Male	3.04 (0.62)
	Female	1.89 (0.38)
Right lower extremity	Male	8.61 (1.39)
	Female	5.96 (1.29)
Left lower extremity	Male	8.89 (1.62)
	Female	6.15 (1.28)
Trunk	Male	27.73 (4.46)
	Female	20.71 (3.53)
Subtotal	Male	51.52 (8.28)
	Female	36.78 (6.48)
SMI	Male	7.88 (1.06)
	Female	6.43 (1.18)

Abbreviation: SMI, Skeletal muscle mass index.

muscle wasting) was seen in 14 cases (26.9%) and reduced grip strength was present in 13 patients (25.0%).

The overall quality of life status was poor, medium, and good in 7.7%, 40.4%, and 46.2%, among 49 patients who had filled out the QOL questionnaire, respectively. Also Table 3 shows the detailed scores for quality of life. The PAL was low, medium, and high in 34.6%, 59.6%, and 5.8%, respectively. Of body composition components, neither muscle mass nor fat mass had significant relationship with the level of physical activity or quality of life questionnaire or its subscales ($P > 0.05$). An exception was the positive correlation between self-efficacy subscale scores with fat mass and fat percent in male patients (Table 4). Such correlation was not found in female patients. Body composition was not related to the presence of cardiovascular risk factors or their number, except being overweight/obese for which a significant relationship was seen with higher muscle mass, fat mass and fat percent ($P<0.05$). Additionally, in females, sedentary life style (as a cardiovascular risk factor) was significantly related to higher fat mass and fat percent ($P<0.05$), but this relationship was not observed in males. Muscle wasting (as defined by EWGSOP guideline) was not related to age, gender, PAL and quality of life questionnaire subscales ($P>0.05$) or its total score ($P=0.432$). Among the cardiovascular risk factors, being overweight/obese was significantly related to lower frequency of muscle wasting ($P<0.001$). Patients with muscle wasting had significantly lower fat mass and fat percent ($P<0.001$ and $P=0.008$, respectively). They also had lower BMI ($P<0.001$). Reduced grip strength was not related to age, gender, BMI, muscle wasting, quality of life questionnaire scores or either of cardiovascular risk factors, but showed significant correlation with lower PAL ($P=0.046$).

Table 2. Fat measurements among patients

Variable	Gender	Mean (SD)
Right upper extremity	Male	1.46 (0.70)
	Female	1.67 (0.52)
Left upper extremity	Male	1.32 (0.60)
	Female	1.57 (0.52)
Right lower extremity	Male	3.40 (1.49)
	Female	4.30 (1.30)
Left lower extremity	Male	3.44 (1.43)
	Female	4.31 (1.40)
Trunk	Male	12.34 (5.83)
	Female	11.95 (4.02)
Subtotal	Male	21.97 (9.71)
	Female	23.80 (6.77)
Fat percent	Male	28.0 (7.1)
	Female	37.8 (4.2)

Table 3. Relative scores for subscales of quality of life index

Quality of life subscale	Mean	Standard Deviation
Symptoms	59.9	23.6
Physical limitation	43.3	26.8
Social	60.6	25.0
Psychological	50.2	24.2
Self-efficacy	59.2	30.1
Total score	45.1	9.00

Discussion

Body composition assessment among patients with CHF is currently considered valuable especially for prognostic and therapeutic goals. Decreased muscle mass is of special importance because it can lead to decreased functional capacity and some disabilities in the patients. Previous studies in older adults suggest that physical activity and especially strength training may be an important factor in reducing the rate of muscle wasting (10,11). In this study the association of body composition with quality of life and physical activity and also some cardiovascular risk factors were determined in patients with CHF since it was found that only grip strength and PAL were interrelated. The

Table 4. Correlation of fat mass and fat percent with subscales of quality of life questionnaire in male patients

		Symptoms	Physical Limitation	Social	Psychological	Self-Efficacy
Right upper extremity	Pearson correlation	-0.156	0.079	-0.025	0.197	0.402
	P value	0.436	0.694	0.903	0.380	0.034
Left upper extremity	Pearson correlation	-0.148	0.020	0.034	0.171	0.376
	P value	0.461	0.922	0.870	0.446	0.049
Right lower extremity	Pearson correlation	-0.130	0.134	-0.063	0.039	0.431
	P value	0.519	0.505	0.761	0.863	0.022
Left lower extremity	Pearson correlation	-0.091	0.142	0.000	0.046	0.394
	P value	0.651	0.481	1.000	0.839	0.038
Trunk	Pearson correlation	-0.094	0.048	0.105	0.068	0.483
	P value	0.643	0.813	0.610	0.765	0.009
Total fat mass	Pearson correlation	-0.110	0.077	0.053	0.078	0.464
	P value	0.586	0.704	0.796	0.731	0.013
Fat percent	Pearson correlation	-0.086	0.027	0.108	0.084	0.489
	P value	0.671	0.893	0.599	0.711	0.008

quality of life, PAL, and cardiovascular risk factors were generally not significantly related to the abnormal SMI and grip strength. The lack of association between three understudy dimensions including PAL, quality of life, and the risk factors may be due to the moderate-to-good overall quality of life in the majority of patients (40.4% and 46.1%, respectively). This may also be due to inaccuracy or recall bias in filling out the IPAQ questionnaire. However, among the subscales of quality of life, the self-efficacy subscale was significantly related to most of fat mass measurements and fat percent in male patients; though such relationship was not observed in females. We found that low physical activity is associated with low to moderate grip strength. This matter is substantially a two-tailed association while each side may empower the other side.

Different studies (19, 20) have shown that interventional approaches may be initiated after the fifth decade of life to increase the lean mass in older adults (9) and our study also confirmed this association in CHF patients. The EWGSOP guideline declaims that physical activity is useful to prevent muscular weakness (1) as shown in our study. In addition, some studies have reported increased lean mass after resistance exercise (21,22). The main limitations in this era are lack of a standard exercise program, no similarity in the measurement tools, various time protocols for exercise, etc. It has been demonstrated that the intensity of exercise should be between 30 and 80 percent and occasionally till near-fatigue experience by the patients (12). The study by Bekfani et al (23) revealed that muscle wasting and lower lean mass was related to the reduced quality of life. The study population of their study had ejection fraction (EF) values greater than 50%, which is in sharp contrast to our study with EF ≤ 35%. This relationship was not seen in our study, but the self-efficacy subscore of IHF-QoL was related to fat measurements in male patients (Table 4). Izawa and colleagues (24) reported a significant association between sarcopenia and physical activity which was measured using accelerometers. In our study, muscle wasting per se was not related to PAL, but lower grip strength (which is a part of sarcopenia definition criteria) showed a significant relationship with lower PALs assessed by IPAQ questionnaire. Oreopoulos et al (8) revealed among 140 patients that higher lean body masses and lower fat masses are associated with prognostic factors in CHF patients. They also reported a positive association between lean body mass and grip strength. However, in our study probably due to smaller sample size there was no such association. Though a negative association between grip strength and PAL was detected.

Kim et al (14) demonstrated that physical activity was associated with lower prevalence of cardiovascular diseases in the Korean population, which was independent of body composition or cardiovascular risk factors. But, in our study there was no significant association between cardiovascular risk factors and any other variables, except that in female patients the sedentary life style was associated with more body fat and fat percent. Knowing body composition in heart failure patients may have prognostic value for interventional approaches and also post-treatment evaluation of outcomes to improve the quality of life (25). However, the more commonly used anthropometric indices such as WHR (waist-to-hip ratio) and BMI are less related to outcomes in heart failure patients (8, 26), which necessitates the use of more accurate estimates of body composition like DXA in this population. Previous studies have shown body mass to be a strong predictor of outcomes in heart failure patients (26).

Conclusion

Our study showed that body composition, in general, is not related to quality of life, conventional cardiovascular risk factors, and physical activity in patients with CHF. The only exceptions were the significant correlation of fat measurements with self-efficacy subscore in male patients and also with a sedentary lifestyle in females. But the muscle strength was related to physical activity. Lack of associations may be due to recall bias or inaccuracy of IPAQ questionnaire for determination of physical activity, and the relatively good quality of life in many patients.

Limitations of the study

Small understudy sample size was our main limitation. Further studies with larger sample size would yield definite results in this era.

Authors' contribution

LS, FH and SDM designed the study, observed accuracy and validity of the study. NN, SDM and SHM collected the data. LS and FH supervised the project. FH, NN and SHM wrote the paper. All authors revised the final manuscript and accepted its publication.

Conflicts of interest

The authors declared no competing interests.

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