Original Article

Factors Associated with Functional Capacity in Heart Failure Patients

Leandro Marques da Silva,[1] Luiza Pinto Moreno,[2] José Albuquerque de Figueiredo Neto,[1] Thalya Brenda Mendes Lima,[2] Gedean Souza Pontes[2]

Universidade Federal do Maranhão (UFMA),[1] São Luís, MA – Brazil
Faculdade Edufor São Luís,[2] São Luís, MA – Brazil

Abstract

Background: **Heart failure (HF) is a prevalent clinical condition that significantly impacts patient survival and represents one of the leading causes of hospitalization and mortality.**

Objective: **To analyze the association between functional capacity and clinical, socioeconomic, behavioral, and cognitive factors in individuals with HF.**

Methods: **A cross-sectional study was conducted with 82 patients with HF undergoing outpatient follow-up. Functional capacity was assessed using the six-minute walk test (6MWT) and the sit-to-stand test (STS). Cognitive performance was measured using the mini-mental state examination (MMSE). Sociodemographic and clinical data were obtained from medical records and structured interviews.**

Results: **The sample consisted of 82 patients (63.4% male), with a mean age of 59.4 ± 12.9 years. In the 6MWT, the mean distance walked was significantly lower than the predicted distance (246.8 ± 86.5 m vs. 557.3 ± 47.5 m; $p < 0.001$). In the STS, participants performed an average of 15.6 ± 4.8 repetitions ($p < 0.001$). A positive and statistically significant correlation was observed between MMSE scores and functional capacity assessed by the 6MWT ($\rho = 0.290$; $p = 0.020$). Lower functional performance was also associated with older age, male sex, and poorer self-rated quality of life ($p < 0.05$).**

Conclusion: **In the sample studied, cognitive performance and clinical and sociodemographic factors were associated with functional capacity in individuals with HF.**

Keywords: **Heart Failure; Functional Status; Risk Factors.**

Introduction

Heart failure (HF) is a prevalent condition that significantly affects patient survival and is one of the leading causes of hospitalization and death in several countries, including Brazil. This disease is characterized by the heart's inability to pump blood adequately to meet the body's metabolic demands.[1]

The epidemiology of HF shows that one in five individuals will develop the condition during their lifetime, and about half of those diagnosed die within five years.[2] These mortality rates are worse than those of many types of cancer and comparable to the five-year survival rates for ovarian cancer, leukemia, and myeloma. The lack of awareness regarding the severity of HF and its high mortality risk after hospitalization – similar to that of acute myocardial infarction or stroke – results in inadequate prioritization of care for these patients.[3]

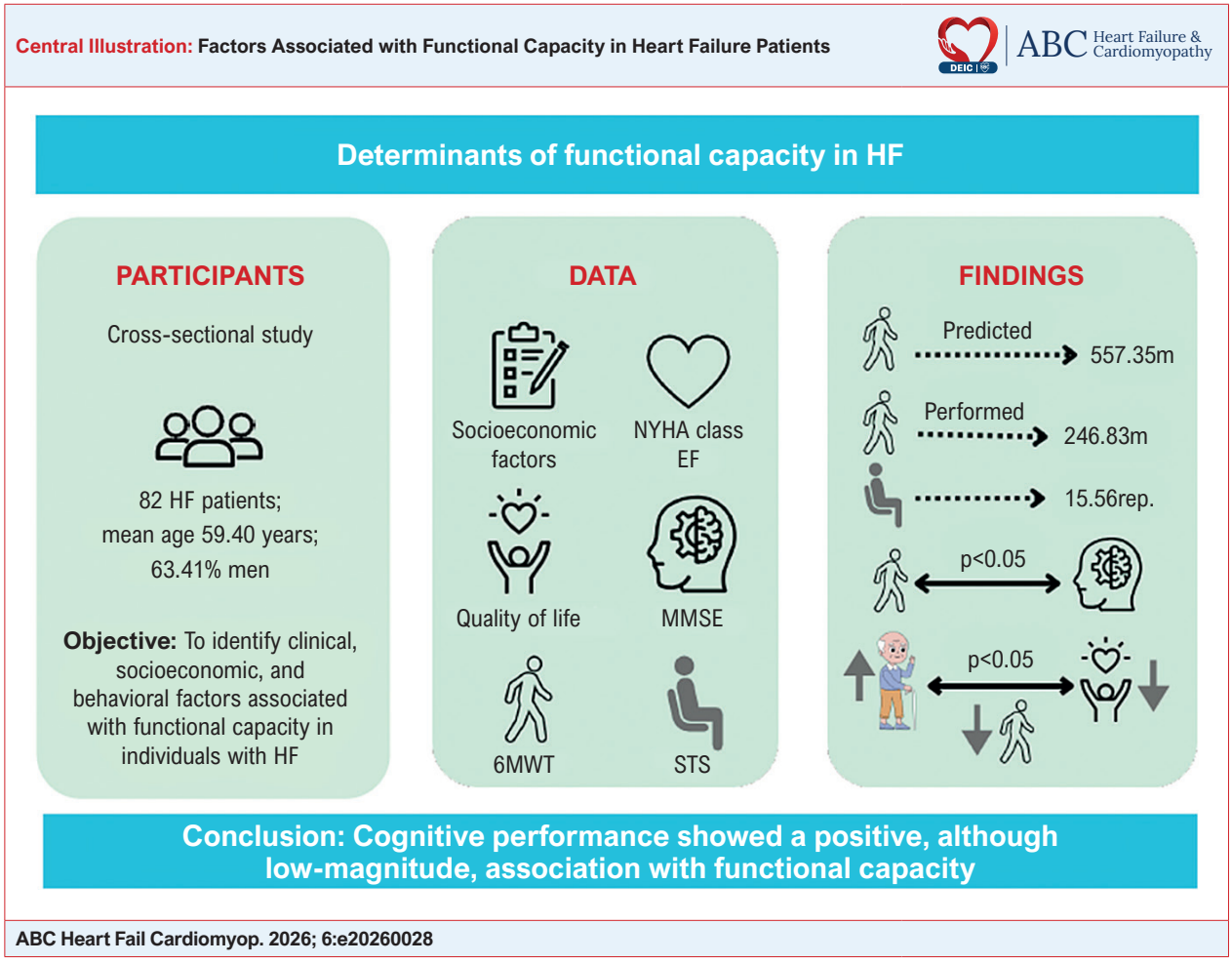
In patients with HF, exercise intolerance is widely recognized as a major cardinal symptom, a marker of poor prognosis, and an important therapeutic target.[2] It is related to central cardiovascular and skeletal muscle alterations resulting from neurohormonal modulation, exacerbation of muscular sympathetic nervous system activity, activation of the renin-angiotensin-aldosterone system, oxidative stress, muscle apoptosis, and activation of the immune system. These changes also occur in respiratory muscles, predisposing patients to early fatigue and dyspnea, thereby limiting their physical capacity.[4]

Cardiopulmonary exercise testing is the gold standard for assessing functional capacity. However, due to high costs and the need for specialized professionals, submaximal tests such as the six-minute walk test (6MWT) have been used and show good correlation with maximal tests. The 6MWT is a simple and widely used test to evaluate physical function in patients with various conditions, including HF. Its ease of implementation, performance, and interpretation make it a practical tool in clinical practice.[5]

In addition to the 6MWT, the one-minute sit-to-stand test (1-min STS) has gained attention for its practicality, minimal space requirements, ease of monitoring, and applicability

Mailing Address: Leandro Marques da Silva •
Universidade Federal do Maranhão (UFMA) – Av. dos Portugueses, 1966. Postal Code 65080-805, São Luís, MA – Brazil
E-mail: leandromks16@hotmail.com
Manuscript received July 15, 2026, revised manuscript August 25, 2026, accepted September 15, 2026
Editor responsible for the review: Germano Conceição-Souza

DOI: https://doi.org/10.36660/abchf.20260028i



Factors associated with functional capacity in patients with heart failure. HF: heart failure; NYHA: New York Heart Association; EF: ejection fraction; 6MWT: six-minute walk test; STS: one-minute sit-to-stand test.

in patients with conditions such as chronic obstructive pulmonary disease and cystic fibrosis, and it is increasingly being considered for patients with HF.[6]

Methods

A cross-sectional and exploratory study was conducted between June 2022 and August 2023 with patients diagnosed with HF who were receiving outpatient follow-up through the Brazilian Unified Health System in two reference cardiology hospitals in the state of Maranhão (Brazil): the University Hospital of the Federal University of Maranhão (HU-UFMA) and the Dr. Carlos Macieira High-Complexity Hospital (HCM), both located in the city of São Luís.

The study was conducted in accordance with ethical principles for research involving human subjects, following the guidelines of Resolution 466/12 of the National Health Council. It was approved by the Research Ethics Committee of HU-UFMA (CAAE: 24168819.2.0000.5086, Opinion No. 3.902.939) (ANNEX C). All participants were informed in advance about the objectives of the research and were invited to sign the Informed Consent Form, with assurance of confidentiality and anonymity.

Patients with HF were selected through simple random sampling from a list of eligible medical records from the cardiology outpatient clinics of the participating institutions. Patients of both sexes and all age groups were included, provided they had no medical contraindications to exercise and were able to perform the functional capacity tests. The diagnosis of HF was established according to the criteria of the Brazilian Heart Failure Guideline (2021).[7]

Patients were excluded if they were experiencing acute HF decompensation, had cancer, severe psychotic disorders, severe physical disability, cognitive impairment that prevented understanding instructions or proper execution of the proposed tests, hypertrophic cardiomyopathy, unstable angina, acute myocardial infarction, cardiac surgery performed within the previous six months, and/or recent hospitalization. Patients with mild cognitive impairment who were able to understand instructions and perform the assessment procedures remained eligible.

A questionnaire was administered containing socioeconomic data, functional class according to the New York Heart Association (NYHA), comorbidities, and ejection fraction (EF) from the previous six months, obtained from the analysis of medical reports. Participants were then asked about their overall quality of life and satisfaction with their own health. Responses followed a Likert-type scale (from 1 to 50, with higher scores indicating better quality of life/health satisfaction). The mean score of these questions was used to define the patients' self-assessment of quality of life.

Cognitive function was assessed using the Mini-Mental State Examination (MMSE), which evaluates specific cognitive domains: temporal orientation (five points), spatial orientation (five points), registration of three words (three points), attention and calculation (five points), recall of three words (three points), language (eight points), and visuospatial ability (one point). Scores range from 0 to 30, with higher scores indicating better cognitive performance. Results were adjusted according to educational level: 20 points for illiterate individuals; 25 points for 1–4 years of schooling; 26.5 points for 5–8 years; 28 points for 9–11 years; and 29 points for more than 11 years of schooling.[8]

The 6MWT and 1-min STS were also performed to assess functional capacity. All participants were instructed not to eat two hours before arriving at the clinical research unit where the assessments were conducted. They were also instructed not to consume alcohol or caffeine on the day of the evaluation. The tests were conducted in selected hospital corridors chosen for having low pedestrian traffic.

The 6MWT is a valid, reliable, and objective method for assessing submaximal exercise capacity, measuring the distance an individual can walk in six minutes on a flat 30-meter course. The 6MWT score corresponds to the distance walked in meters, with higher scores indicating better exercise capacity. Additionally, the predicted distance was calculated using a reference equation developed in a multicenter study with Brazilian participants:

$$890.46 - (6.11 \times age) + (0.0345 \times age^2) + (48.87 \times sex) - (4.87 \times BMI)$$

where male sex = 1 and female sex = 0.

Based on the results, individuals were classified as having preserved exercise functional capacity (EFC) (≥ 300 meters) or reduced EFC (< 300 meters).[9] A distance greater than 300 meters is associated with higher event-free survival at 36 months.[10]

For specific analysis of the 1-min STS, participants were stratified into two groups exclusively based on test performance: group A, composed of patients who completed fewer than 15 repetitions, and group B, composed of those who completed 15 or more repetitions. The cutoff of 15 repetitions was defined based on the sample's mean performance and values similar to those reported in previous studies with HF patients. This value was used solely as an operational criterion for comparative purposes between groups and does not represent a previously validated prognostic threshold. Therefore, its use should be interpreted only within the exploratory context of this study.

In both tests, patients were supervised by two physiotherapists. If a patient showed signs or symptoms indicating the need to interrupt the test, experienced any adverse events, or expressed a desire to stop, the assessment was immediately discontinued according to previously established safety criteria.

The Statistical Package for the Social Sciences (SPSS), version 23, was used for statistical analysis. Data were subjected to the Kolmogorov-Smirnov test to assess normality. The chi-square test was used for categorical variables, the Student's t-test was applied to compare continuous variables, and the Mann-Whitney U test was used to compare non-parametric samples. Spearman's correlation coefficient was used to analyze the association between the variables studied. The level of statistical significance adopted was $p < 0.05$.

Results

After applying the inclusion and exclusion criteria, the final sample consisted of 82 patients with HF, with a mean age of 59.40 ± 12.92 years, of whom 63.41% were male. The remaining sociodemographic variables are presented in Table 1.

Functional capacity was assessed using the 6MWT and the 1-min STS (Table 2). The main findings regarding the associations observed between clinical, cognitive, and functional factors are summarized in the Central Illustration. The predicted 6MWT distance was 557.35 ± 47.49 meters, whereas the actual distance walked by patients was 246.83 ± 86.53 meters. The distance walked was significantly lower than the predicted value (paired t-test; $p < 0.001$). The ratio between the walked and predicted distances was 0.44 ± 0.14. In the 1-min STS, patients performed an average of 15.56 ± 4.83 repetitions (Table 2).

The comparison of 6MWT performance among patients with HF revealed significant differences in mean age between two groups with different functional capacities. The group composed of patients who walked less than 300 meters had a significantly higher mean age (60.57 ± 12.96 years) compared with the group whose patients walked 300 meters or more, with a mean age of 52.93 ± 12.85 years ($p = 0.048$). The remaining variables analyzed are presented in Table 03.

When analyzing the correlation between the final MMSE score and functional capacity measured by the 6MWT (Figure 1), a positive correlation of low magnitude and statistically significant was observed between these variables ($\varrho = 0.290$; $p = 0.020$).

The comparison between HF patients who performed fewer than 15 repetitions (Group A) and those who performed 15 or more repetitions (Group B) in the 1-min STS revealed some significant differences (Table 4).

Discussion

The main findings of this study are summarized in the Central Illustration. Overall, the sample consisted predominantly of male individuals (63.41%), which is

consistent with most studies involving patients with HF,[11-13] as well as with the European Society of Cardiology guidelines (2021). Regarding age, patients had a mean of 59.40 ± 12.92 years. Investigations conducted in Brazil, Europe, and North America report comparable demographic profiles, reinforcing the external consistency of the results observed.[11,12,14]

The assessment of functional capacity using the 6MWT revealed that patients with HF walked a significantly shorter distance than predicted, with a mean of 246.83 ± 86.53 meters compared with the predicted 557.35 ± 47.49 meters. This discrepancy highlights the functional limitation of these patients, further reinforced by the walked/predicted distance ratio of only 0.44 ± 0.14, meaning less than 50% of the expected value. International studies report mean 6MWT distances between 300 and 450 meters in patients with stable HF, whereas national investigations often describe values below 350 meters, especially in populations treated within the public health system. The shorter distance observed in the present study may be related to a higher proportion of patients with multiple comorbidities, older age, and lower socioeconomic status.[5]

In contrast, a cross-sectional observational study with 105 individuals aged 59.5 ± 12.0 years, 64% female, BMI = 31 (5.8) kg/m², with suspected HF with preserved ejection fraction (HFpEF), demonstrated that even with a high probability of HFpEF, participants still walked an average of 356 ± 96 meters in the 6MWT. This notable difference suggests that patients with HF in the present study exhibited even more impaired functional capacity than those with a high probability of HFpEF.[15] The histological, metabolic, and functional alterations of skeletal muscle – including respiratory muscles – resulting from HF lead to early fatigue and dyspnea, consequently limiting functional capacity.[4]

A prospective observational study with 118 patients compared the mean distance walked in the 6MWT among individuals with acute HF who were readmitted at different periods after discharge (30, 60, and 90 days) and those who were not readmitted over 90 days. It was observed that 25% of patients were readmitted by the end of the 90-day period, with most readmissions occurring within the first 30 days post-discharge. A shorter six-minute walk distance at discharge emerged as a significant predictor of readmission within 30 days, with a cutoff point of 200 meters proving reasonable for that sample. In addition, shorter walking time and reduced walking speed during the test were also identified as significant predictors of early readmission. These findings highlight the importance of the 6MWT as a useful clinical tool for identifying patients at higher risk of early readmission, enabling timely interventions to improve post-discharge outcomes in patients with acute HF.[16]

Data analysis reveals that the group of patients with reduced functional capacity was characterized by older individuals, predominantly male, and with lower scores on the cognitive screening test (MMSE). Natural aging often results in decreased physical and cognitive abilities, which may explain the poorer performance in the 6MWT and possibly the lower MMSE scores. Additionally, a higher frequency of male individuals was observed among those who walked shorter distances in the 6MWT. However, this finding should be interpreted with caution, since the reference equation used for the test predicts greater distances for males. Thus, the present analysis was based on the absolute distance walked, which does not allow concluding that males necessarily exhibit poorer functional performance relative to what is expected for their sex.[17]

The present study demonstrated a positive, low-magnitude association between cognitive performance, assessed by the MMSE, and functional capacity measured by the 6MWT ($\rho = 0.290$; $p = 0.020$). Although statistically significant, this association was weak, suggesting that other clinical and sociodemographic factors also contribute to the functional capacity of these patients. Therefore, interventions aimed at improving functional capacity may have positive impacts not only on physical health but also on cognitive health in this population.[10]

The association observed between cognitive performance and functional capacity in individuals with HF can be interpreted in light of shared pathophysiological mechanisms. Evidence suggests that reduced cardiac output and endothelial dysfunction may compromise cerebral perfusion, promoting neurovascular alterations that negatively affect cognitive functions such as attention and memory. Furthermore, the chronic inflammatory state characteristic of HF, mediated by pro-inflammatory cytokines, has been associated with structural and functional changes in the central nervous system. These processes, combined with factors such as hypoxemia, neurohormonal activation, and lower levels of physical activity, may simultaneously contribute to both cognitive and functional decline.[12,14]

Moderate-to-vigorous physical training is effective in increasing cardiorespiratory fitness, improving vascular function, and reducing cardiovascular risk factors and inflammation. In addition to benefiting cardiovascular health, exercise significantly improves cognitive function, including attention, psychomotor function, executive function, and memory. Individuals with higher cardiorespiratory fitness also show improvements in brain health, including greater mean resting cerebral blood flow velocity, attributed to increased angiogenesis and vascular remodeling induced by exercise. These findings highlight the importance of exercise in promoting cognitive and vascular health, suggesting potential benefits for patients with HF and cognitive impairment.[17]

In the 1-min STS, patients performed an average of 15.6 ± 4.8 repetitions, indicating reduced functional capacity. These findings are consistent with results from a prospective cohort study,[6] in which patients performed an average of 18 ± 7 repetitions in the one-minute STS. It is noteworthy that, in the referenced study, the application of the STS was safe and feasible, causing no adverse events or significant increases in pulmonary edema, even in patients with acute decompensated HF.[6]

In patients with HF, the one-minute STS has proven to be highly reliable and valid for assessing functional capacity. One study showed that the STS has excellent test–retest reliability (ICC = 0.932) and presents significant correlations with the 6MWT, functional class, pulmonary function, quadriceps muscle strength, and physical activity.

Table 1 – Socioeconomic and clinical characteristics of patients with heart failure evaluated in the study — São Luís/MA, 2025 (n = 82)

Characteristics	Mean ± SD or median (P25 - P75)	n (%)
Age (years)	59.40±12.92	
Sex		
Female		30 (36.59%)
Male		52 (63.41%)
School attainment		
Some elementary school		34 (41.46%)
Elementary school		18 (21.95%)
Some high school		3 (3.66%)
High school		20 (24.39%)
Some higher education		2 (2.44%)
Higher education		5 (6.10%)
Income		
< 1/2 Minimum wage		11 (13.41%)
1/2 - 1 Minimum wage		39 (47.56%)
1 - 2 Minimum wage		29 (35.37%)
2 - 5 Minimum wage		3 (3.66%)
Follow-up time (years)	2.71 (1-4)	
Waist-to-hip ratio	0.96 (0.92-1.02)	
BMI (Kg/m²)	26.38 (23.04-29.23)	
Ejection fraction (EF) classification		
EF ≥ 50%		42 (51.22%)
EF 40% - 49%		15 (18.29%)
EF < 40%		25 (30.49%)
NYHA		
I		25 (30.49%)
II		28 (34.15%)
III		24 (29.27%)
IV		5 (6.10%)
Family hisitory of HF		
Yes		53 (64.63%)
No		29 (35.37%)
Diabetes		
Yes		25 (30.49%)
No		57 (69.51%)
Hypertension		
Yes		60 (73.17%)
No		22 (26.83%)

BMI: body mass index; EF: ejection fraction; HF: heart failure; SD: standard deviation; Student's t-test; Pearson's chi-square test; Mann–Whitney test.

Table 2 – Functional capacity of patients with heart failure according to the six-minute walk test and the sit-to-stand test — São Luís, Brazil, 2025 (n = 82)

Variable	Mean ± SD
Predicted distance – 6MWT	557.35±47.49
Walked distance – 6MWT	246.83±86.53
Walked/predicted ratio – 6MWT	0.44±0.14
Repetitions – 1 min STS	15.56±4.83

SD: standard deviation; 6MWT: six-minute walk test; 1-min STS: one-minute sit-to-stand test; Student's t-test.

Table 3 – Comparison between patients with heart failure and functional capacity below and above/equal to 300 m in the six-minute walk test – São Luís, Brazil, 2025 (n = 82)

Variable	< 300m (n= 59)	≥ 300m (n= 23)	p
Age	**60.57±12.96**	**52.93±12.85**	**0.048**
Sex			
Female	19 (32.20%)	11 (47.83%)	0.030
Male	40 (67.80%)	12 (52.17%)	
School attainment			
Some elementary school	28 (47.46%)	6 (26.09%)	
Elementary school	12 (20.34%)	6 (26.09%)	
Some high school	2 (3.39%)	1 (4.35%)	
High school	14 (23.73%)	6 (26.09%)	0.357
Some higher education	1 (1.69%)	1 (4.35%)	
Higher education	2 (3.39%)	3 (13.04%)	
Income			
< 1/2 Minimum Wage	7 (11.86%)	4 (17.39%)	
1/2 - 1 Minimum Wage	27 (45.76%)	12 (52.17%)	
1 - 2 Minimum wage	22 (37.29%)	7 (30.43%)	0.524
2 - 5 Minimum wages	3 (5.08%)	0 (0.00%)	
NYHA			
I	19 (32.20%)	6 (26.09%)	
II	19 (32.20%)	9 (39.13%)	
III	17 (28.81%)	7 (30.43%)	0.479
IV	4 (6.78%)	1 (4.35%)	
Ejection fraction (EF) classification			
EF ≥ 50%	30 (50.85%)	12 (52.17%)	
EF 40% - 49%	7 (11.86%)	8 (34.78%)	0.099
EF < 40%	22 (37.29%)	3 (13.04%)	
Family hisitory of HF			
Yes	37 (62.71%)	16 (69.57%)	0.599
No	22 (37.29%)	7 (30.43%)	
Diabetes			
Yes	20 (33.90%)	5 (21.74%)	0.658
No	39 (66.10%)	18 (78.26%)	
Hypertension			
Yes	44 (74.58%)	16 (69.57%)	0.850
No	15 (25.42%)	7 (30.43%)	

Follow-up time	2.935±2.93	2.190±1.28	0.216
Body mass index	26.70±4.50	26.13±3.70	0.589
Waist-to-hip ratio	0.97±0.10	0.94±0.08	0.310
Self-assessent of QL	3.38±0.89	3.36±0.71	0.943
MMSE final score	24.23±4.27	26.86±3.46	0.042

SD: standard deviation; 6MWT: six-minute walk test; HF: heart failure; EF: ejection fraction; QL: quality of life; MMSE: mini-mental state examination; Student's t-test; Pearson's chi-square test

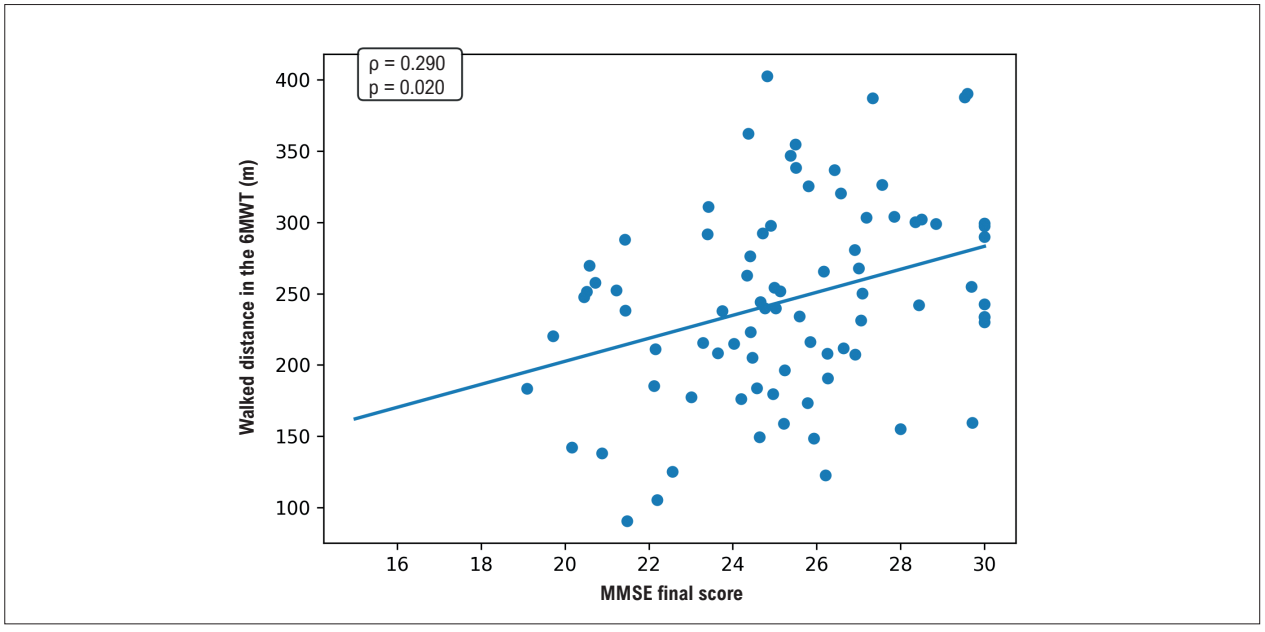


Figure 1 – *Association between mini-mental state examination (MMSE) and the distance walked in the six-minute walk test in patients with heart failure, São Luís, Brazil, 2025 (n = 82); pSpearman's correlation test.*

Moreover, the STS elicited physiological responses similar to those of the 6MWT, except for leg fatigue. These findings suggest that the STS is a valid and reliable tool, offering a practical alternative to the 6MWT when the latter is not feasible. Implementing tests such as the STS and 6MWT can provide valuable information about patients' physical condition, facilitating targeted rehabilitation interventions and potentially improving clinical outcomes.[18]

The results obtained in the STS can be explained by the combination of physiological and psychosocial factors associated with HF. Patients in group A, who performed fewer than 15 repetitions, had a significantly higher mean age, suggesting that aging may contribute to reduced physical capacity due to sarcopenia and loss of muscle mass, which are common in older adults. Additionally, the shorter follow-up time in Group A may indicate less exposure to rehabilitation interventions and health education, which are crucial for improving disease self-management. The better self-reported quality of life in group B may be related to greater functional capacity, allowing more independence in daily activities and a better perception of well-being. These findings highlight the importance of early and continuous interventions in rehabilitation programs for patients with HF, particularly focusing on improving functional capacity and quality of life, and tailoring strategies to individual needs while considering the impact of aging and follow-up duration.[5,19]

Thus, the findings indicate relevant clinical implications, highlighting that simple instruments such as the 6MWT, the 1-min STS, and the MMSE are useful in the routine assessment of patients with HF. These tests help in the early identification of functional vulnerability, support clinical decision-making, and allow feasible, low-cost evaluations, especially in outpatient settings and within the public health system.

This study presents some limitations, including its cross-sectional design and the use of tests that depend on patient motivation. Although the sample size is compatible with exploratory studies and similar to previous investigations in the field, the absence of a prior sample size calculation

Table 4 – Comparison between patients with heart failure who performed < 15 repetitions (Group A) and ≥ 15 repetitions (Group B) in the one-minute sit-to-stand test, São Luís, Brazil, 2025 (n = 82)

Variable	Group A (n= 46)	Group B (n= 36)	p
Age	**62.89 ±14.16**	**57.19±12.42**	**0.039**
Follow-up time	**2.10±1.39**	**2.89±2.13**	**0.041**
Body mass index	**26.62±4.87**	**26.58±5.18**	**0.971**
Waist-to-hip ratio	**0.97±0.09**	**0.96±0.10**	**0.534**
Self-assessent of QL	**3.19±0.80**	**3.88±0.83**	**0.033**
MMSE final score	**24.70±4.23**	**25.40±3.71**	**0.480**
Sex			
Female	15 (32.61%)	19 (52.78%)	0.780
Male	31 (67.39%)	17 (47.22%)	
School attainment			
Some elementary school	17 (36.96%)	17 (47.22%)	0.485
Elementary school	12 (26.09%)	6 (16.67%)	
Some high school	2 (4.35%)	1 (2.78%)	
High school	12 (26.09%)	8 (22.22%)	
Some higher education	1 (2.17%)	1 (2.78%)	
Higher education	2 (4.35%)	3 (8.33%)	
Income			
< 1/2 Minimum wage	4 (8.70%)	7 (19.44%)	0.954
1/2 - 1 Minimum wage	27 (58.70%)	12 (33.33%)	
1 - 2 Minimum wages	14 (30.43%)	15 (41.67%)	
2 - 5 Minimum wages	1 (2.17%)	2 (5.56%)	
NYHA			
I	9 (19.57%)	2 (5.56%)	0.639
II	18 (39.13%)	21 (58.33%)	
III	17 (36.96%)	12 (33.33%)	
IV	2 (4.35%)	1 (2.78%)	
EF classification			
Ef ≥ 50%	24 (52.17%)	18 (50.00%)	0.471
EF 40% - 49%	9 (19.57%)	6 (16.67%)	
EF < 40%	13 (28.26%)	12 (33.33%)	
Family history of HF			
Yes	29 (63.04%)	24 (66.67%)	0.701
No	17 (36.96%)	12 (33.33%)	
Diabetes			
Yes	10 (21.74%)	15 (41.67%)	0.063
No	36 (78.26%)	21 (58.33%)	
Hypertension			
Yes	31 (67.39%)	29 (80.56%)	0.182
No	15 (32.61%)	7 (19.44%)	

Student's t test; Pearson's chi-square test; Mann-Whitney test.

limits the generalizability of the findings and the inferential robustness of the results. Moreover, despite the relevance of HF etiology in the clinical heterogeneity of the disease – particularly in cases with preserved EF – this variable could not be explored in the present study and should be considered in future investigations with more comprehensive designs.

Additionally, the analyses performed were predominantly univariate. No multivariable analysis was conducted to simultaneously adjust for potential confounding factors such as age, sex, education, and comorbidities. Therefore, the associations observed may be subject to residual confounding and should be interpreted with caution. As this is a cross-sectional and exploratory study, the findings should be viewed as hypothesis-generating and may support future investigations with analytical designs and larger samples.

As strengths, the rigorous exclusion criteria stand out, allowing the assessment of patient performance in the 6MWT and STS without interference from comorbidities. Future studies with longitudinal designs are needed, including samples sized through formal sample calculations and multivariable analyses that allow a deeper understanding of the interrelationships between functional capacity, cognition, and clinical outcomes in patients with HF. Furthermore, studies aimed at exploring new perspectives for targeted therapeutic interventions and clinical management strategies are needed, reinforcing the importance of a holistic and individualized approach to the care of patients with HF.

Conclusion

This study identified and analyzed socioeconomic, clinical, behavioral, and cognitive factors associated with functional capacity in patients with HF. The results showed a positive and statistically significant association between MMSE scores and functional capacity measured by the 6MWT, indicating that better cognitive scores were related to better functional performance.

In addition, lower functional capacity was associated with male sex, older age, poorer self-rated quality of life, and shorter clinical follow-up time. These findings reinforce the importance of considering multiple factors – including cognitive, sociodemographic, and clinical aspects – in the assessment of functional capacity in individuals with HF.

As this is a cross-sectional study, the results should be interpreted as associations, not allowing causal inferences. Nevertheless, the data obtained contribute to understanding the functional profile of these patients and may support the planning of more individualized follow-up and clinical management strategies aimed at preserving functional capacity and quality of life.

Author Contributions

Conception and design of the research, Manuscript drafting and Critical revision of the manuscript for important intellectual content: Silva LM, Figueiredo Neto JA; Data collection: Moreno LP, Lima TBM, Pontes GS; Data analysis and interpretation: Silva LM, Moreno LP, Lima TBM, Pontes GS; Statistical analysis: Silva LM.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This article is part of the thesis of Doctoral submitted by Leandro Marques da Silva, from Programa de Pós-Graduação em Ciências da Saúde da Universidade Federal do Maranhão.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Hospital Universitário da Universidade Federal do Maranhão – HU-UFMA under the protocol number CAAE: 24168819.2.0000.5086, Parecer nº 3.902.939. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

All datasets supporting the results of this study are available upon request from the corresponding author.

References

1. Costa RVC. NYHA Classification and Cardiopulmonary Exercise Test Variables in Patients with Heart Failure. Arq Bras Cardiol. 2022;118(6):1124-5. doi: 10.36660/abc.20220196.
2. Seo M, Watanabe T, Yamada T, Yano M, Hayashi T, Nakagawa A, et al. The Clinical Relevance of Quality of Life in Heart Failure Patients with Preserved Ejection Fraction. ESC Heart Fail. 2023;10(2):995-1002. doi: 10.1002/ehf2.14270.
3. Ueno K, Kamiya K, Hamazaki N, Nozaki K, Ichikawa T, Yamashita M, et al. Usefulness of Physical Function Sub-Item of SF-36 Survey to Predict Exercise Intolerance in Patients with Heart Failure. Eur J Cardiovasc Nurs. 2022;21(2):174-7. doi: 10.1093/eurjcn/zvab052.
4. Seki KLM, Queiróz APL, Costa AS, Oliveira D, Oliveira P, Costa EN, et al. Physical Capacity, Respiratory and Peripheral Muscle Strength in Heart Failure. Rev Bras Med Esporte. 2020;26(4):289-93. doi: 10.1590/1517-869220202604198189.

5. Lans C, Cider Å, Nylander E, Brudin L. The Relationship between Six-Minute Walked Distance and Health-Related Quality of Life in Patients with Chronic Heart Failure. Scand Cardiovasc J. 2022;56(1):310-5. doi: 10.1080/14017431.2022.2107234.

6. Zhang X, Kang Y, Luo Z, Chen Q, Yang M, Zeng J, et al. Feasibility and Safety of 1-Min Sit-to-Stand Test in Acute Decompensated Heart Failure Confirmed by Lung Ultrasound. Front Cardiovasc Med. 2023;10:1103247. doi: 10.3389/fcvm.2023.1103247.

7. Marcondes-Braga FG, Moura LAZ, Issa VS, Vieira JL, Rohde LE, Simões MV, et al. Emerging Topics Update of the Brazilian Heart Failure Guideline - 2021. Arq Bras Cardiol. 2021;116(6):1174-212. doi: 10.36660/abc.20210367.

8. Brucki SM, Nitrini R, Caramelli P, Bertolucci PH, Okamoto IH. Suggestions for Utilization of the Mini-Mental State Examination in Brazil. Arq Neuropsiquiatr. 2003;61(3B):777-81. doi: 10.1590/s0004-282x2003000500014.

9. Britto RR, Probst VS, Andrade AF, Samora GA, Hernandes NA, Marinho PE, et al. Reference Equations for the Six-Minute Walk Distance Based on a Brazilian Multicenter Study. Braz J Phys Ther. 2013;17(6):556-63. doi: 10.1590/S1413-35552012005000122.

10. Vellone E, Chialà O, Boyne J, Klompstra L, Evangelista LS, Back M, et al. Cognitive Impairment in Patients with Heart Failure: An International Study. ESC Heart Fail. 2020;7(1):46-53. doi: 10.1002/ehf2.12542.

11. Currie K, Rideout A, Lindsay G, Harkness K. The Association between Mild Cognitive Impairment and Self-Care in Adults with Chronic Heart Failure: A Systematic Review and Narrative Synthesis. J Cardiovasc Nurs. 2015;30(5):382-93. doi: 10.1097/JCN.0000000000000173.

12. Hanon O, Vidal JS, Groote P, Galinier M, Isnard R, Logeart D, et al. Prevalence of Memory Disorders in Ambulatory Patients Aged ≥70 Years with Chronic Heart Failure (from the EFICARE Study). Am J Cardiol. 2014;113(7):1205-10. doi: 10.1016/j.amjcard.2013.12.032.

13. Cannon JA, Moffitt P, Perez-Moreno AC, Walters MR, Broomfield NM, McMurray JJV, et al. Cognitive Impairment and Heart Failure: Systematic Review and Meta-Analysis. J Card Fail. 2017;23(6):464-75. doi: 10.1016/j.cardfail.2017.04.007.

14. Cameron J, Worrall-Carter L, Page K, Riegel B, Lo SK, Stewart S. Does Cognitive Impairment Predict poor Self-Care in Patients with Heart Failure? Eur J Heart Fail. 2010;12(5):508-15. doi: 10.1093/eurjhf/hfq042.

15. Rossi G, Barboza N, Fuzinato G, Balby G, Grizante M, Moriya H, et al. Teste de Caminhada para Caracterização de Intolerância ao Esforço de Indivíduos com Insuficiência Cardíaca com Fração de Ejeção Preservada: Um Estudo Observacional. Rev Soc Cardiol Estado São Paulo. 2023;33(2B).

16. Vijayakumar B, Meganathan A, Paulchamy B, Ranganathan SD. Predicting Short-Term Readmission in Hospitalized Patients with Acute Heart Failure: The Use of 6-Minute Walk Test at Discharge. J Assoc Physicians India. 2023;71(2):11-2. doi: 10.5005/japi-11001-0174.

17. Taylor JL, Barnes JN, Johnson BD. The Utility of High Intensity Interval Training to Improve Cognitive Aging in Heart Disease Patients. Int J Environ Res Public Health. 2022;19(24):16926. doi: 10.3390/ijerph192416926.

18. Tanriverdi A, Kahraman BO, Ozpelit E, Savci S. Test-Retest Reliability and Validity of 1-Minute Sit-to-Stand Test in Patients with Chronic Heart Failure. Heart Lung Circ. 2023;32(4):518-24. doi: 10.1016/j.hlc.2023.01.008.

19. Aladin AI, Whellan D, Mentz RJ, Pastva AM, Nelson MB, Brubaker P, et al. Relationship of Physical Function with Quality of Life in Older Patients with Acute Heart Failure. J Am Geriatr Soc. 2021;69(7):1836-45. doi: 10.1111/jgs.17156.

This is an open-access article distributed under the terms of the Creative Commons Attribution License