

An Assessment of Cardiovascular Functional Capacity of a Group of Chronic Heart Failure Patients Using the 6-Minute Walk Test in a Cameroonian Urban Setting

Félicité Kamdem^{1,2*}, Chris Nadège Nganou-Gnindjio³, Dieudonné Danwe³, Franc Christ-Roi Soemessabot¹, Elysée Claude Bika Léle⁴, Ba Hamadou³, Sidick Mouliom^{1,2}, Lade Viché^{4,5}, Henri Ngoté¹, Caroline Kenmegne¹, Marie Solange Ndom Ebongue², Siddikatou Djibrilla⁶, William Ngatchou^{1,3}

¹Department of Internal Medicine, Douala General Hospital, Douala, Cameroon

²Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon

³Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon

⁴Faculty of Sciences, University of Douala, Douala, Cameroon

⁵Faculty of Medicine and Biomedical Sciences, University of Garoua, Garoua, Cameroon

⁶Faculty of Health Sciences, University of Buea, Cameroon

Email: fdjimegne@gmail.com

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Abstract

Background: Chronic heart failure is a public health problem worldwide. It has a high mortality rate and is accompanied by a decreased functional capacity and alteration of the quality of life. **Objective:** This study aimed to assess the cardiovascular functional capacity of a group of patients suffering from heart failure using the 6-minute walk test (6 MWT). **Methods:** This was a cross-sectional study carried out in the cardiology unit of Douala's general hospital for 4 months. We included all eligible patients aged 18 years or more who had stable chronic heart failure and gave informed consent. Those who had an acute coronary syndrome (≤ 1 month), tachycardia ($HR \geq 120$ bpm), high blood pressure ($SBP \geq 180$ mmHg and/or $DBP \geq 100$ mmHg) and reduced mobility due to orthopaedic reasons were excluded. A 6 MWT was done according to the American Thoracic Society guidelines. The 6 MWT result was considered poor for < 300 m distance, the average for 300 - 450 m and good for > 450 m. **Results:** We recruited a total of 81 patients (61.7% women) with a mean age of 65.9 ± 10.6 years. The most frequent risk factor for heart failure was high blood pressure (77.8%), alcohol consumption (69.1%)

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and a sedentary lifestyle (53.1%). The left ventricular ejection fraction was mostly preserved (42.0%) or mildly altered (46.9). The 6 MWT results were poor in 55.6% of cases, average in 19.8% of cases and good in only 24.7% of cases. More than half (59.3%) of the participants perceived the effort as being difficult. The cardiovascular functional capacity was significantly associated with age, heart failure stage and physical activity ($p < 0.05$). **Conclusion:** Most patients suffering from chronic stable heart failure in the general hospital of Douala have poor cardiovascular functional capacity.

Keywords

Cardiovascular Functional Capacity, Chronic Heart Failure, 6-Minute Walk Test, Cameroon

1. Introduction

Heart failure is a clinical syndrome consisting of cardinal symptoms that may be accompanied by signs, due to a structural and/or functional abnormality of the heart that results in elevated intracardiac pressures and/or inadequate cardiac output at rest and/or during exercise [1]. It is a major public health issue worldwide. The prevalence of chronic heart failure is estimated from 1% to 12% according to study results [2]. Despite some important improvements in the management, the prognosis is still poor. For all types of heart failure, the mortality rate after diagnosis was estimated to be 20% - 30% and 45% - 60% after 1 year and after 5 years [3]. These important mortality rates are accompanied by high rates of hospitalizations, decreased ability to carry out activities of daily living and impaired quality of life. The European Society of Cardiology has recommended exercise rehabilitation in all patients with chronic heart failure to reduce hospitalizations which was estimated to cost \$20 billion in the United States in 2009 and improve exercise capacity as well as the quality of life [1] [4]. However, the functional capacity of heart failure patients needs to be assessed first to determine the appropriate rehabilitation program for them and their prognosis. Bittner *et al.* and Naïbé *et al.* showed that a reduced functional capacity was associated with an increased risk of mortality [5] [6]. The Gold standard measurement method is peak oxygen consumption obtained from a cardiopulmonary exercise test [7] [8]. Since maximal intensity physical activity is not achievable by all patients, the 6-minute walk test (6 MWT) is carried out and provides an indirect measure of cardiovascular functional capacity [9]. This study assessed the cardiovascular functional capacity of stable chronic heart failure patients using the 6 MWT.

2. Methods

2.1. Study Setting and Design

This was a cross-sectional study carried out in the cardiology unit of the Douala

General Hospital, Cameroon.

2.2. Study Period

The study was performed for 4 months, from January to April 2020.

2.3. Participants

Inclusion criteria: we included patients aged 18 years or more who had stable chronic heart failure and gave informed consent.

Exclusion criteria: any patient who had an acute coronary syndrome (≤ 1 month), tachycardia (HR ≥ 120 bpm), high blood pressure (SBP ≥ 180 mmHg and/or DBP ≥ 100 mmHg) and reduced mobility due to orthopaedic reasons were excluded.

Sampling: all eligible patients were included throughout the study period.

2.4. Procedure

For all the participants, the following data were collected in a predesigned collection form: personal information, past medical history, symptoms and signs of heart failure, vital and anthropometric parameters, paraclinical investigations and treatment modalities.

A 6MWT was then performed during which blood pressure, heart rate, and oxygen saturation were monitored. Patients could stop and rest if needed. The test was immediately interrupted in case of the apparition of one of the following symptoms: chest pain, palpitations, mental confusion or impaired coordination of gait, malaise, intractable dyspnoea, leg cramps or extreme tiredness and any other reason justified clinically.

The theoretical distance to be attained by a healthy subject was calculated using the following formula: 6 MWT (in meters) = $218 + [5.14 \times \text{Height in cm}] - [5.32 \times \text{age}] - [1.8 \times \text{Weight in Kg}] + [51.31 \times \text{gender}]$ with gender = 0 for women and 1 for men.

The overall cardiovascular functional capacity was considered as good for a distance > 450 m, average for a distance between 300 - 450 m and poor for a distance < 300 m.

2.5. Statistical Analysis

Data were analysed using R software version 3.6.2. The Chi-square test was used to compare the distribution between categorical variables. Differences were considered statistically significant for a p-value < 0.05 .

2.6. Ethical Considerations

This study was carried out with strict respect for all ethical principles and by the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethical Review Board of the University of Douala. A research authorization was also obtained from the Douala General Hospital.

3. Results

We included 81 patients (61.7% of women) in the study. Their mean age was 65.9 ± 10.6 years. **Table 1** shows the sociodemographic characteristics of the study population. The most frequent risk factors for heart failure were hypertension, alcohol consumption and a sedentary lifestyle (**Figure 1**). Almost all of the

Table 1. Sociodemographic characteristics of the study population.

	Number (n)	Percentage (%)
Gender		
Male	31	38.3
Female	50	61.7
Age categories		
[30 - 40[	02	2.5
[40 - 50[	03	3.7
[50 - 60[	20	24.7
[60 - 70[	39	48.1
70+	17	21.0
Marital Status		
Single	13	16.0
Married	37	45.7
Divorced	28	34.6
Widower	03	3.7
Profession		
Unemployed	23	28.4
Employed	32	39.5
Retired	26	32.1

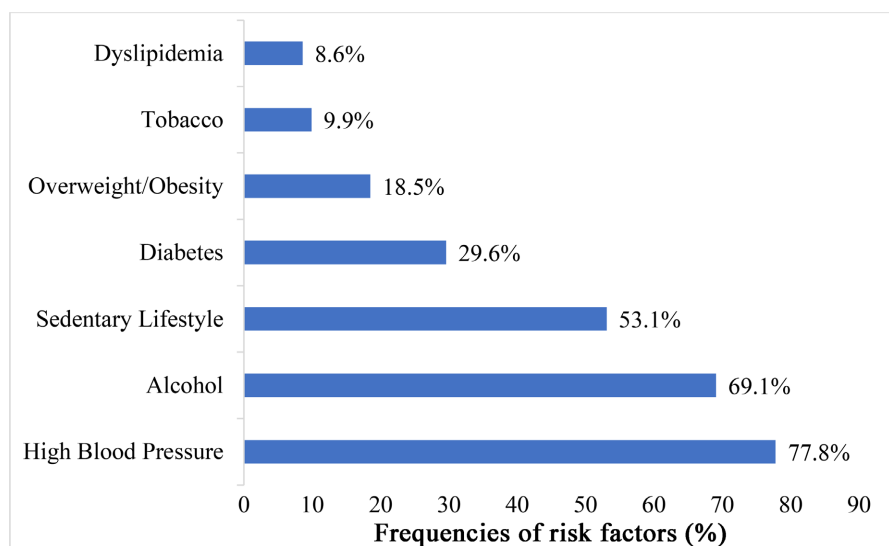


Figure 1. Frequencies of risk factors of heart failure in the study population.

participants were in class I (43.2%) or II (53.1%) heart failure according to the New York Heart Association classification. Only three were in class III. One-third (29.6%) of the participants were in atrial fibrillation and nine (11.1%) had tachycardia on resting ECG. Most of the participants had a preserved (42.0%) or mildly altered (46.9%) left ventricular ejection fraction. More than half of the participants had poor cardiovascular functional capacity (**Figure 2**) and 59.3% of them perceived the effort as being difficult. The cardiovascular functional capacity was significantly associated with age, heart failure stage and physical activity (**Table 2**).

4. Discussion

Cardiopulmonary exercise testing (CPET) with measurement of oxygen consumption during maximal exercise tests is the gold standard method for measurement

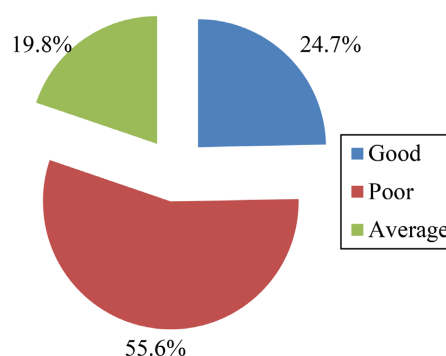


Figure 2. Distribution of the study population according to functional capacity.

Table 2. Factors Associated with cardiovascular functional capacity.

	Cardiovascular functional capacity			<i>p</i> -value
	Good n (%)	Average n (%)	Poor n (%)	
Age category				
[30 - 40[	2 (100)	0 (0.0)	0 (0.0)	<0.001
[40 - 50[	2 (66.7)	0 (0.0)	1 (33.3)	
[50 - 60[	10 (50.0)	5 (25.0)	5 (25.0)	
60+	6 (10.7)	11 (19.6)	39 (69.7)	
HF class (NYHA)				
I	19 (54.3)	11 (31.4)	5 (14.3)	<0.001
II	1 (2.3)	5 (11.6)	37 (86.0)	
III	0 (0.0)	0 (0.0)	3 (100)	
Physical activity				
Yes	18 (47.4)	11 (28.9)	9 (23.7)	<0.001
No	2 (4.7)	5 (11.6)	36 (83.7)	

HF: heart failure; NYHA: New York Heart Association.

of functional cardiovascular capacity [7] [8]. It is used in various clinical situations, particularly in chronic heart failure. In a patient who cannot afford maximal exercise, the 6-minute walk test which is a sub-maximal effort test has been shown to strongly correlate with the results of CPET [9] [10]. The 6 MWT is also a prognostic factor and help's to improve the functional capacity of heart failure patients. In this study, we assessed the cardiovascular functional capacity of a group of patients suffering from chronic stable heart failure [6] [11]. The mean age of the participants was higher than those of other studies in Africa. This difference can be explained by the greater proportion of women in our study population and both the low male/female sex ratio and older age account for the high proportion of heart failure with preserved left ventricular ejection fraction [12] [13]. The participants in our study had in the greatest proportion a poor functional capacity with a distance walked less than 300 metres. One-fifth also had an average capacity between 300 and 450 meters. These results are close to other studies which have also found mean distance walked by heart failure patients in Africa comprised between 300 and 400 meters [6] [10] [14]. There was an association between poor functional capacity during the 6 MWT with advancing age, heart failure class and the lack of regular physical activity. The restriction in physical activity may be in this case a consequence of reduced functional capacity secondary to heart failure. We didn't find an association between 6 MWT and other factors which were described in the literature such as older age, female sex, low body mass index, anaemia, increased heart rate at rest, diabetes and decrease in the estimated glomerular filtration rate [15]. This may be related to the small sample size of our study or differences in study design. Some other factors such as depression and N-terminal pro-brain natriuretic peptide were not assessed in this study [15]. The association between performance on the 6 MWT and echocardiographic parameters such as E/E' and E wave deceleration time were not evaluated. These are some limitations of our study which need to be addressed during further studies in our setting.

5. Conclusion

The cardiovascular functional capacity of heart failure patients followed up at the Douala general hospital is mostly poor and seems to be associated with advancing age, class of heart failure according to the NYHA classification and physical activity.

Authors' Contributions

Conception and design: FK, DL

Data collection: FCS, FK

Data analysis and interpretation: FCS, FK, DD

Manuscript drafting: DD, CNNG

Manuscript revision: FK, CNNG, DD

Approval of the final manuscript: All the authors.

Availability of Data and Materials

The datasets used for this study are available from the corresponding author upon request.

Ethical Approval and Consent to Participate

The Institutional Ethical Review Board of the University of Douala (Cameroon) approved the study. All the participants read and signed informed consent before their inclusion in the study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] McDonagh, T.A., Metra, M., Adamo, M., Gardner, R.S., Baumbach, A., Böhm, M., *et al.* (2021) 2021 ESC Guidelines for the Diagnosis and Treatment of Acute and Chronic Heart Failure. *European Heart Journal*, **42**, 3599-3726. <https://doi.org/10.1093/eurheartj/ehab368>
- [2] Roger, V.L. (2021) Epidemiology of Heart Failure: A Contemporary Perspective. *Circulation Research*, **128**, 1421-1434. <https://doi.org/10.1161/CIRCRESAHA.121.318172>
- [3] Bytyçi, I. and Bajraktari, G. (2015) Mortality in Heart Failure Patients. *The Anatolian Journal of Cardiology*, **15**, 63-68. <https://doi.org/10.5152/akd.2014.5731>
- [4] Lloyd-Jones, D., Adams, R., Carnethon, M., De Simone, G., Ferguson, T.B., Flegal, K., *et al.* (2009) Heart Disease and Stroke Statistics—2009 Update: A Report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*, **119**, e21-e181. <https://doi.org/10.1161/CIRCULATIONAHA.108.191261>
- [5] Bittner, V., Weiner, D.H., Yusuf, S., Rogers, W.J., McIntyre, K.M., Bangdiwala, S.I., *et al.* (1993) Prediction of Mortality and Morbidity with a 6-Minute Walk Test in Patients with Left Ventricular Dysfunction. SOLVD Investigators. *JAMA*, **270**, 1702-1707. <https://doi.org/10.1001/jama.270.14.1702>
- [6] Naïbé Dangwé, T., Mandi Dakaboué, G., Bamouni, J., Yaméogo Rélwendé, A., *et al.* (2018) Six-Minute Walk Test Distance and Outcome in Patients with Chronic Heart Failure. *Cardiologue à Tunis*, **14**, 91-96.
- [7] Kaminsky, L.A. and Tuttle, M.S. (2015) Functional Assessment of Heart Failure Patients. *Heart Failure Clinics*, **11**, 29-36. <https://doi.org/10.1016/j.hfc.2014.08.002>
- [8] Piepoli, M.F., Spoletini, I. and Rosano, G. (2019) Monitoring Functional Capacity in Heart Failure. *European Heart Journal*, **21**, M9-M12. <https://doi.org/10.1093/eurheartj/suz216>
- [9] Cahalin, L.P., Mathier, M.A., Semigran, M.J., Dec, G.W. and DiSalvo, T.G. (1996) The Six-Minute Walk Test Predicts Peak Oxygen Uptake and Survival in Patients with Advanced Heart Failure. *Chest*, **110**, 325-332. <https://doi.org/10.1378/chest.110.2.325>
- [10] Adedoyin, R.A., Adeyanju, S.A., Balogun, M.O., Akintomide, A.O., Adebayo, R.A., Akinwusi, P.O., *et al.* (2010) Assessment of Exercise Capacity in African Patients

- with Chronic Heart Failure Using Six Minutes Walk Test. *International Journal of General Medicine*, **3**, 109-113. <https://doi.org/10.2147/IJGM.S5533>
- [11] Koffi, D.B.J., Gnaba, L.A., Gbassi, C., Ehouman, E. and Anzouan-Kacou, J.-B. (2021) Intérêt du test de marche de 6 minutes dans l'amélioration des capacités physiques des patients insuffisants cardiaques à l'Institut de Cardiologie d'Abidjan. *Revue Internationale des Sciences Médicales d'Abidjan*, **23**, 195-200. <https://doi.org/10.14797/mdcj-13-4-216>
- [12] Bozkurt, B. and Khalaf, S. (2017) Heart Failure in Women. *Methodist DeBakey Cardiovascular Journal*, **13**, 216-223.
- [13] Fonarow, G.C., Stough, W.G., Abraham, W.T., Albert, N.M., Gheorghiade, M., Greenberg, B.H., et al. (2007) Characteristics, Treatments, and Outcomes of Patients with Preserved Systolic Function Hospitalized for Heart Failure: A Report from the OPTIMIZE-HF Registry. *JACC: Journal of the American College of Cardiology*, **50**, 768-777. <https://doi.org/10.1016/j.jacc.2007.04.064>
- [14] Nana Sede, M., Menanga, A., Mintom, P., Hamadou, B., Kaze, F., Ashuntantang, G., et al. (2013) Six-Minute Walk Test as a Predictor of Left Ventricular Function in Patients with Chronic Heart Failure at Yaoundé General Hospital. *Cardiovascular Journal of Africa*, **24**, 19.
- [15] Giannitsi, S., Bougiakli, M., Bechlioulis, A., Kotsia, A., Michalis, L.K. and Naka, K.K. (2019) 6-Minute Walking Test: A Useful Tool in the Management of Heart Failure Patients. *Therapeutic Advances in Cardiovascular Disease*, **13**. <https://doi.org/10.1177/1753944719870084>