

Reliability and Validity of the Turkish Version of the Performance Measure for Activities of Daily Living-8 for Patients with Mild Symptomatic Heart Failure

Hafif Semptomatik Kalp Yetersizliği Olan Hastalar İçin
Günlük Yaşam Aktiviteleri-8 Performans Ölçümü Türkçe
Versiyonunun Güvenilirliği ve Geçerliliği

ORIGINAL ARTICLE
KLİNİK ÇALIŞMA

ABSTRACT

Objective: The Performance Measure for Activities of Daily Living-8 (PMADL-8) for patients with congestive heart failure is an International Classification of Functioning, Disability, and Health-based Activities of Daily Living (ICF) questionnaire to evaluate disease-specific functional limitations in chronic heart failure (CHF). The purpose of this study was to investigate the reliability and validity of the Turkish version of the PMADL-8 in CHF patients.

Methods: In this study, 50 patients with CHF were included. Test-retest reliability of the PMADL-8 was assessed by intraclass correlation coefficient and Cronbach's alpha was calculated for internal consistency. Correlation coefficients between the PMADL-8 and New York Heart Association (NYHA) functional class, Chronic Heart Failure Questionnaire (CHQ), Nottingham Health Profile (NHP) were analyzed for construct validity.

Results: The Cronbach's alpha value of the PMADL-8 test and retest scores were recorded as 0.996, indicating that the scale is highly reliable. Test-retest reliability results of the PMADL-8 (mean intraclass correlation coefficient=0.996) were excellent. The PMADL-8 score was moderately correlated with the NHP total score ($r=0.629$, $P<.001$) and NHP physical abilities score ($r=0.517$, $P<.001$). The PMADL-8 score was weakly correlated with the NYHA functional class ($r=0.385$, $P<.006$), CHQ dyspnea ($r=-0.475$, $P<.001$), CHQ fatigue ($r=-0.340$, $P=.016$), and total score ($r=-0.367$, $P=.009$).

Conclusion: The Turkish version of PMADL-8 is a reliable and valid assessment tool that could be used to determine activity limitations in CHF. The PMADL-8 is also useful for health professionals during the ICF evaluation of CHF patients.

Keywords: Chronic limitation of activity, congestive heart failure, reliability, validity

ÖZET

Amaç: Konjestif kalp yetersizliği hastaları için Günlük Yaşam Aktiviteleri-8 Performans Ölçümü (PMADL-8), kronik kalp yetersizliğinde (KKY) hastalığa özgü fonksiyonel kısıtlanmaları değerlendirmek için İşlevsellik, Yetiyitimi ve Sağlığın Uluslararası Sınıflandırması (ICF) tabanlı bir ankettir. Çalışmanın amacı; PMADL-8 anketi Türkçe versiyonunun KKY'li hastalarda geçerlilik ve güvenilirliğini araştırmaktır.

Yöntemler: 50 KKY'li hasta çalışmaya dahil edildi. PMADL-8'in test-tekrar test güvenilirliği sınıfıçı korelasyon katsayısı (ICC) ile değerlendirildi ve iç tutarlılık için Cronbach alfa hesaplanmıştır. Yapı geçerliliği için PMADL-8 ve New York Kalp Derneği (NYHA) fonksiyonel sınıfı, Kronik Kalp Yetersizliği Anketi (CHQ), Nottingham Sağlık Profili (NHP) arasındaki korelasyon katsayıları analiz edilmiştir.

Bulgular: PMADL-8 test ve tekrar test puanlarının Cronbach alfa değeri 0,996 olarak kaydedilmiş olup, ölçeğin yüksek düzeyde güvenilir olduğunu göstermektedir. PMADL-8'in test-tekrar test güvenilirlik sonuçları (ortalama ICC = 0.996) çok iyiydi. PMADL-8 skoru NHP total skoru ($r=0,629$, $P<,001$) ve NHP fiziksel yetenekler skoru ($r=0,517$, $P<,001$) ile orta derece koreledi. PMADL-8 skoru NYHA fonksiyonel sınıfı ($r=0.385$, $P<,006$), CHQ dispne ($r=-0,475$, $P<,001$), CHQ yorgunluk ($r=-0.340$, $P=,016$) ve total skoru ($r=-0,367$, $P=,009$) zayıf düzeyde ilişkiliydi.

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Sonuç: Geçerli ve güvenilir değerlendirme aracı olan PMADL-8'in Türkçe versiyonu, KKY'de aktivite limitasyonlarını belirlemekte kullanılabilir. PMADL-8, KKY hastalarının ICF tabanlı klinik değerlendirmesi sırasında sağlık profesyonelleri için de yararlıdır.

Anahtar Kelimeler: Geçerlilik, güvenilirlik, konjestif kalp yetersizliği, kronik aktivite kısıtlanması

Chronic heart failure (CHF), a major public health problem with varying degrees across different geographical regions, has a prevalence of 1%-2% in developed countries and 2.9% in the Turkish adult population.^{1,2} Chronic heart failure results in many different critical complications, such as frequent hospitalizations, fatal arrhythmias, and death in the progress of the disease.¹ Chronic heart failure also reduces physical activity level of patients, typically dyspnea, and fatigue perceptions which have negative effects on daily life activities with an eventual result of detrimentally affecting the overall quality of life.^{3,4} Physical inactivity is strongly associated with cardiac structure and function abnormalities even in CHF with a preserved ejection fraction (EF).⁴ As a result, patients with CHF have impaired and limited exercise capacity leading to an increased fear of being active due to exercise-induced dyspnea symptoms.^{5,6}

Chronic heart failure leads to physical restrictions and functional limitations in daily life which places a significant burden on the patients, their families, and society.³ The systemic contributors to functional limitation in CHF are decreased pulmonary and cardiac reserve, structural and/or functional skeletal muscle dysfunction, and other limiting factors like anemia/iron deficiency, obesity, and peripheral vascular abnormalities.⁵

Although there are objective evaluation methods for activities of daily living (ADL) limitation and functional capacity in patients with CHF,^{5,7} self-report questionnaires are reported to be a reliable and accurate methodology for obtaining information about functional limitations and examining the impact of intervention programs.⁸⁻¹⁰ Despite various ADL instruments specific for CHF are available, there is still need for studies to find proper instrument for using in clinics and research.¹¹ Shimizu et al¹² developed an International Classification of Functioning, Disability, and Health (ICF)-based ADL questionnaire to evaluate disease-specific functional limitations in CHF. The aim of this study was to investigate the test-retest reliability and convergent validity

of the Turkish version of the Performance Measure for Activities of Daily Living-8 (PMADL-8) for Patients with Congestive Heart Failure in the Turkish population. Because disease-specific self-report measures are a more streamlined way of more accurately quantifying clinically relevant domains and sensitively recording clinical change than measures of general health status, this tool will be a guide to identify functional limitations of patients with CHF and to evaluate the efficacy of rehabilitation interventions for rehabilitation professionals.

Methods

The study was conducted between February and August 2021. The study was carried out at the Ahi Evren Thoracic and Cardiovascular Surgery Training and Research Hospital Department of Cardiology. The sample size of the study was determined as 5 times the number of items used in the scale.¹³ We tried to reach as many participants as possible to increase the statistical significance of the study with a minimum target of 40 patients (5-fold of 8 items).

Participants

The inclusion criteria for participants were being aged 20-75 years, conscious, able to answer all questions, able to communicate in Turkish, diagnosed with CHF patients with New York Heart Association (NYHA) functional classifications II-III, and having been agreed to participate in the study. Chronic heart failure patients with NYHA functional class I or IV, who were hospitalized, who are unable to cooperate, and who are not willing to participate were excluded. The diagnosis of CHF was made according to the presence of symptoms (breathlessness, fatigue, and ankle swelling) and/or signs of CHF and objective assessment of cardiac dysfunction. Chronic heart failure phenotype was determined as HF with reduced EF (HFrEF), HF with mildly reduced EF (HFmrEF), and HF with preserved EF (HFpEF).¹⁴ Hacettepe University Non-Interventional Clinical Research Ethics Committee approved the study on February 2, 2021, with the registration number GO 20/1171. All participants were informed about the study protocol.

Translation Process for the Performance Measure for Activities of Daily Living-8

First of all, the permission to investigate the convergent validity and test-retest reliability of PMADL-8 in the Turkish population was obtained from the developer of the PMADL-8. The PMADL-8 was translated by 2 native Turkish speakers who have a good command of English. A common version was formed with the synthesis of the 2 translations. Two independent native English speakers who were proficient in Turkish and had not studied the first translation process performed retranslation (from Turkish to English). The original and re-translated versions of the PMADL-8 were compared and reviewed by an expert committee that consists of 3 physiotherapists and the pre-final version was created. A pilot group of 30 patients with CHF

ABBREVIATIONS

ADL	Activities of daily living
BMI	Body mass index
CAD	Coronary artery disease
CHF	Chronic heart failure
CHQ	Chronic heart failure questionnaire
EF	Ejection fraction
HFmrEF	Heart failure with mildly reduced ejection fraction
HFpEF	Heart failure with preserved ejection fraction
HFrEF	Heart failure with reduced ejection fraction
ICC	Intraclass correlation coefficients
ICF	International Classification of Functioning, Disability, and Health
LVEF	Left ventricular ejection fraction
NHP	Nottingham Health Profile
NYHA	New York Heart Association
PMADL-8	Performance Measure for Activities of Daily Living-8 for Patients with Congestive Heart Failure
SPSS	Statistical Package for the Social Sciences

assessed the understandability of the scale and gave their inputs. According to pilot testing results, all of the participants completely understood the expression in the 2, 3, 4, 6, 7, 8 items and 18.0% of participants and 28.0% of participants partially understood the expression in the first and fifth items, respectively. Therefore, first item was modified from "Getting up and off from the floor without tools" to "Standing up from and sitting down on the floor without the use of an aid" to make the question more understandable to the Turkish population. The fifth item was also modified from "Pulling and closing a heavy sliding door" to "Opening and closing a heavy door" for cross-cultural adaptations. After the pilot group assessments were completed, the final form of the PMADL-8 was given by the committee based on the findings.¹⁵

Assessments

Demographic variables (age, sex, height, body weight, and body mass index), educational level, and marital status of the participants were recorded. The presence of the comorbidities and the number of coronary artery disease (CAD) were also recorded. Dyspnea, fatigue perception, angina pectoris, and palpitation symptoms were questioned. Patients' left ventricular EF (LVEF) values were recorded using echocardiography.

The PMADL-8 for Patients with Congestive Heart Failure questionnaire evaluates functional limitations in patients with CHF based on the ICF model. The PMADL questionnaire includes 8 items using a 4-category response scale (1=very easy, 2=somewhat easy, 3=somewhat hard, 4=very hard). Higher scores indicate severe functional limitations.¹² In addition, the comprehensibility of the items was questioned on a 3-point Likert scale (I completely understood the expression, I partially understood the expression, I did not understand the expression at all) as a pilot test.

Disease-specific quality of life was evaluated by the Turkish version of Chronic Heart Failure Questionnaire (CHQ) that is a reliable and valid assessment tool. The CHQ includes 20 items and 4 dimensions (dyspnea, fatigue, emotional status, and mastery) and responses are as 7-point Likert scale type. Higher scores mean better quality of life.¹⁶

General quality of life was assessed using the Nottingham Health Profile (NHP) self-reported tool. The NHP questionnaire evaluates 6 dimensions of health (pain, energy level, sleep, physical abilities, emotional reaction, and social isolation) and includes 38 items. The answers to the questions are given as "yes" and "no" according to the current situation perception. The highest score of 100 in each subdimension corresponds to the greater severity of health problems. Total NHP score ranges between 0 and 600 and quality of life perception is negatively associated with score received.¹⁷

Statistical Analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows (Version 23.0, IBM Inc., Armonk, NY, USA). The data were expressed as mean $\pm$ standard deviation and minimum-maximum for quantitative variables and as percentage (%) for categorical variables.

The convergent validity of the PMADL-8 was measured using correlation coefficients between the Turkish version of PMADL-8

and NYHA functional class, NHP and CHQ questionnaires. The internal consistency of the PMADL-8 was assessed using Cronbach's alpha (α) coefficient. A Cronbach's alpha value of $0.60 \leq \alpha \leq 0.79$ is considered quite reliable and $\alpha \geq 0.80$ is considered highly reliable.¹⁸ The test-retest reliability was measured using the intraclass correlation coefficients (ICC). Intraclass correlation coefficient values range from 0.00 to 1.00, with values of 0.60 to 0.80 demonstrating good reliability and ICC values above 0.80 indicating excellent reliability.¹⁹ The relationships between the parameters were analyzed using Spearman's rank correlation coefficients according to the normality. The correlation coefficient was interpreted as little or no (0 to 0.25); weak (0.26 to 0.49); moderate (0.50 and 0.69); strong (0.70 and 0.89); and very strong (0.90 and 1.00).²⁰ The probability of error in the statistical analyses was determined as $P < .05$.¹⁸

Results

Fifty patients with CHF (mean age = 58.5 ± 11.0 years, female/male = 9/41) were included in the study. The mean LVEF was $31.8 \pm 10.2\%$. Eighty-six percentage of patients with CHF had HFrEF phenotype, 6% of patients had HFmrEF phenotype, and 8% of patients had HFpEF phenotype. The physical characteristics, smoking status, symptoms, CAD risk factors, comorbidities, and level of education are shown in Table 1.

Internal Consistency and Test-Retest Reliability

Internal consistency and test-retest reliability of the PMADL-8 are shown in Table 2. The Cronbach's alpha value of the PMADL-8 test and retest scores were recorded as 0.996, indicating that the scale is highly reliable (Table 2). The ICC values ranged from 0.993 to 0.998 (Table 2). According to the mean ICC value, the PMADL-8 test-retest reliability results were excellent. The PMADL-8 score was also significantly correlated with PMADL-8 retest score ($r = 0.987$, $P < .001$).

Validity

The PMADL-8 score was moderately correlated with the NHP total score ($r = 0.629$, $P < .001$) and NHP physical abilities score ($r = 0.517$, $P < .001$). The PMADL-8 score was weakly correlated with the NYHA functional class ($r = 0.385$, $P < .006$), CHQ dyspnea ($r = -0.475$, $P < .001$), CHQ fatigue ($r = -0.340$, $P = .016$) and total score ($r = -0.367$, $P = .009$), NHP pain score ($r = 0.415$, $P = .003$), NHP emotional reaction score ($r = 0.303$, $P = .033$), NHP sleep score ($r = 0.390$, $P = .005$), NHP social isolation score ($r = 0.450$, $P = .001$), and NHP energy level score ($r = 0.445$, $P = .001$). The PMADL-8 score was also moderately related with LVEF values ($r = -0.517$, $P < .001$).

Discussion

This study demonstrated that the Turkish version of the PMADL-8 questionnaire is highly reliable and has excellent internal consistency. The relationships between the PMADL-8 and NYHA functional class, general, and disease-specific quality of life supported the convergent validity of the questionnaire. The PMADL-8 is an ICF-based, simple, clinically useful, and feasible assessment tool that evaluates disease-specific functional limitations in patients with CHF.

To the best of our knowledge, there are not any published reliability and validity studies of the PMADL-8 for any language in the literature. The present study demonstrated that the Turkish

Table 1. The Clinical Characteristics of the Participants

Parameters	Patients with CHF (n = 50)	
	n	%
Age (years)	58.5 ± 11.0	24-75
Sex (female/male), n	9/41	
Weight (kg)	81.4 ± 14.0	50-115
Height (cm)	170.4 ± 8.2	150-185
BMI (kg/m²)	28.0 ± 4.5	17.3-37.7
Smoking (pack-years)	21.3 ± 26.0	0-120
CAD risk factors (n)	2.8 ± 1.2	0-5
LVEF (%)	31.8 ± 10.2	10-55
	n	%
NYHA functional class		
II	43	86.0
III	7	14.0
HF phenotype		
HFrEF	43	86
HFmrEF	3	6
HFpEF	4	8
Etiology		
Ischemic	35	70
Non-ischemic	15	30
Comorbidities, n, (%)		
Hypertension	44	88
Diabetes mellitus	19	38
Chronic obstructive pulmonary disease	19	38
Coronary artery disease	47	94
Chronic renal failure	8	16
Medication		
Diuretics	29	58
ACE/ARB	33	66
Beta-blockers	40	80
Antiaggregant drugs	30	60
Lipid regulators	27	54
Anticoagulants	8	16
Smoking history		
Non-smoker	19	38
Ex-smoker	21	42
Smoker	10	20

version of the PMADL-8 scale has a high internal consistency level with Cronbach's α value (0.996). This shows us that the PMADL-8 scores are stable over time despite a 1 week time interval between test and retest. We also found excellent ICC values for test-retest reliability and there was a strong correlation between the test and

Parameters	Patients with CHF (n = 50)	
	n	%
Alcohol		
Non-drinker	38	79
Ex-drinker	8	16
Current-drinker	4	8
Symptom perceptions		
Dyspnea	50	100
Fatigue	50	100
Chest pain	43	86
Peripheral edema	32	64
Education level		
Illiterate	2	4
Primary school	17	34
Middle school	10	20
High school	16	32
University	5	10
Marital status		
Married	41	82
Single	9	18
	Mean ± SD	Min-Max
NHP		
NHP energy level score	30.4 ± 29.8	0-100
NHP pain score	10.2 ± 12.6	0-67.6
NHP emotional reaction score	15.7 ± 17.7	0-92.9
NHP sleep score	24.5 ± 22.0	0-78.3
NHP social isolation score	15.5 ± 19.5	0-64.7
NHP physical abilities score	21.0 ± 19.6	0-78.7
NHP total score	117.9 ± 84.3	9.8-365.3
CHQ		
CHQ dyspnea score	27.5 ± 5.3	11-35
CHQ fatigue score	21.6 ± 4.1	8-28
CHQ emotional status score	33.8 ± 6.9	19-43
CHQ mastery score	19.9 ± 4.3	7-28
CHQ total score	102.6 ± 17.6	57-129

SD, standard deviation; BMI, body mass index; CAD, coronary artery disease; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; HFrEF, heart failure with reduced ejection fraction; HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; NHP, Nottingham Health Profile; CHQ, Chronic Heart Failure Questionnaire.

retest PMADL-8 scores in our study. According to the results of the pilot study, the comprehensibility of each item in the questionnaire was high which demonstrates the clinical applicability of the questionnaire. Since an excellent level of reliability of an assessment tool is a quality indicator, the Turkish version of the

Table 2. The Internal Consistency and Intraclass Correlation Coefficients Values of the PMADL-8

	First Test Median (Min-Max)	Second Test Median (Min-Max)	
PMADL-8 score	14.5 (8-31)	15 (8-32)	
	Cronbach's α	ICC	95% CI
PMADL-8 score	0.996	0.996	0.993-0.998

PMADL-8, Performance Measure for Activities of Daily Living-8 for Patients with Congestive Heart Failure; ICC, intraclass correlation coefficient.

PMADL-8 questionnaire has a high level of reliability for evaluating functional limitations in patients with CHF.

Few studies in the literature focused on limitations during daily life in CHF. The effects of disease on functional status were only evaluated by disease-specific or general quality-of-life assessment tools.^{3,10,21} Functional limitation determined by the PMADL-8 questionnaire was shown to predict future adverse events and prognosis in CHF.²² Another trial also showed that the PMADL-8 could be used as an assessment tool for measuring disease severity in stable CHF patients.²³ Kono et al²³ found that without any relation to LVEF, the PMADL-8 score has a high-level correlation with age, peak oxygen uptake (VO_2), VE/ VCO_2 -slope, hemoglobin and plasma brain natriuretic peptide levels, 6-minute walk test distance, and muscle functions (grip strength and knee extensor muscle strength). In particular, the PMADL-8 score was moderately associated with functional capacity ($r=-0.557$) and strongly correlated with cardiorespiratory fitness ($r=-0.747$).²³ Shimizu et al¹² confirmed the previous findings of Kono et al²³ that patients with CHF with persistent functional limitation (PMADL-8 score ≥ 20) have increased depression levels in addition to higher age and reduced functional exercise capacity and muscle strength.²⁴ Hamazaki et al²⁵ found that forced vital capacity and one-leg standing time which is an indicator of static postural and balance control were significant predictors of functional limitation assessed using the PMADL-8 score. Whereas the PMADL-8 score weakly correlated with the NYHA functional class, there was a moderate relationship with LVEF values in our study. This was an expected finding because limitations in ADL and physical performance are compatible with the NYHA functional class. Although the NYHA has low reproducibility and poor discriminative capacity for functional limitation,^{5,26} the PMADL-8 was proven to be used as better discriminative for functional limitation even in mild patients with CHF.²³

The present study assessed the correlation between the PMADL-8 score and the NYHA functional class and NHP and CHQ subdimension and total scores for convergent validity. We demonstrated that the PMADL-8 score was moderately correlated with the NHP physical abilities and total score. Otherwise, the PMADL-8 score was weakly associated with NYHA functional class, CHQ dyspnea, fatigue and total scores, subdimension scores of the NHP-pain, sleep, emotional reaction, social isolation, and energy level. The developers of the questionnaire also demonstrated that the PMADL-8 scores have high correlations with dyspnea and fatigue scores and NYHA functional

class.¹² The correlation results supported the validity of the PMADL-8. The close relationship between CHQ dyspnea and fatigue scores and NYHA class with PMADL-8 is collectively related since all of them reflect that functional limitations are affected by symptom perceptions.^{16,26} Our results were consistent with those of the study of the original version.¹² The relationship between subdimensions as indicators of emotional status (NHP—social isolation, energy level, and emotional reaction subscores) confirms that emotional status affects limitations in daily life.²⁴

This study has some potential limitations. Our patients included mostly (86.0%) NYHA functional class II and this could limit the generalizability of the results for mild-severe patients with CHF. Another limitation of the study was that we were not able to measure respiratory and peripheral muscle strength or maximal exercise capacity of patients with CHF due to limited laboratory facilities.

Conclusion

In conclusion, the Turkish version of the PMADL-8 for patients with congestive heart failure can be used for evaluating functional limitation of Turkish patients with CHF with excellent reliability. This simple, useful, ICF-based reliable and valid assessment tool could be used to predict future adverse events and prognosis and as an indicator of disease severity in CHF. There is need for future studies that evaluate the responsiveness of patients with CHF for rehabilitation or other treatment modalities.

Ethics Committee Approval: The study was approved by the medical ethics committee of Hacettepe University.

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

Peer-review: Externally peer-reviewed.

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