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VALIDITY AND RELIABILITY OF THE PHYSICAL PERFORMANCE TEST IN GREEK OLDER ADULTS

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Abstract:
The aim of this research was to examine the validity and reliability of the Physical Performance Test (PPT) in elderly men, members of the Open Care Centers for the Elderly (KAPI) in Western Athens. A total of 154 men, aged 65-89 years (age 75.94 + 5.73 years, body weight 80.01 + 10.94 kg, height 1.68 + 0.06 m), participated in the study. Participants completed questionnaires assessing cognitive status, depression, and functional abilities. Subsequently, they performed two functional performance tests, the PPT and the Timed Up and Go Test (TUG). Repeat measurements of the PPT were conducted after 15 days on 40 randomly selected individuals to assess reliability. The concurrent validity of the PPT was examined using two criteria: the functional status questionnaire and the TUG test, showing correlations of -.584 ($p<0.001$) and -.757 ($p<0.001$), respectively. The PPT demonstrated structural validity, as statistically significant differences in performance were observed between functionally independent and dependent individuals in the functional status questionnaire. The internal consistency reliability of the PPT was satisfactory (Cronbach's alpha = .7669), and test-retest reliability was high ($r=.95$, $p<0.001$). Low to moderate correlations were observed between PPT scores and age, number of chronic diseases, cognitive function, depression, and falls. Conclusively, the PPT is a valid and reliable functional performance test, useful for assessing the functional ability of elderly individuals.

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1. Introduction

In the next decades, the number of older adults will increase dramatically, which may cause serious medical and socioeconomic challenges (Beard *et al.*, 2016). Typical changes with aging include declines in cognitive and physical function, which can lead older adults to the loss of their autonomy, falls, health and quality of life. As the physical performance reflects the reduced ability to accomplish physical tasks necessary for daily living, both basic (BADL) – bathing, eating, dressing - and instrumental (IADL) activities – household activities- of daily living, and is inversely associated with the hospitalisation, institutionalization and mortality in older adults (Carey *et al.*, 2004; Kuh *et al.*, 2004; Luppa *et al.*, 2010). The determination of the level of physical performance in older adults can be achieved through interviews, questionnaires, observation, and physical performance tests (Patrizio *et al.*, 2021; Rozzini *et al.*, 1993). The development of physical performance-based instruments became necessary due to the research interest about the categorization of functional disability of older adults, the reliability, validity, sensitivity and precision to changes in physical performance of older adults (Reuben *et al.*, 1995).

A widely used physical performance test is the Physical Performance Test (PPT) that typically combines the performance of a wide variety of daily activities (writing, eating, dressing, lifting and picking up an object, turning and walking) evaluating both lower and upper bodily function (Reuben & Siu, 1990). Although PPT is a valid and reliable test for assessing the physical performance of older adults, previous studies have reported different level of associations between PPT and other physical performance tests, functional questionnaires, cognitive and social status, falls and health related variables in various populations of older individuals with different characteristics, including those living in medical centers, protective care centers, individuals with Parkinson's disease, individuals with difficulties in performing daily activities, elderly cancer patients and those living independently (Branch & VanSwearingen, 2002; Brown *et al.*, 2000; Paschal *et al.*, 2006; Morala & Shiomi, 2004; Reuben & Siu, 1990; Rozzini *et al.*, 1993; Terret *et al.*, 2011). In addition, in the Greek context, there is a lack of sufficient research studies regarding the validity and reliability of methods for assessing the physical performance of older adults, which is crucial for implementing interventions and strategies to promote independence, health, and, consequently, the quality of life of older individuals. For these reasons, the purpose of this research was to examine the validity and reliability of the Physical Performance Test, as well as the impact of physical performance on mental, falls and health-related variables in Greek older men, members of Open Care Centers for the Elderly in Western Athens.

2. Material and Method

2.1 Participants

This study included men aged 65-89 years who were members of the Open Care Centers for the Elderly in Western Athens. All participants were informed about the study's purpose and voluntarily agreed to participate. Inclusion criteria were the ability to walk a distance of 15.2 meters without assistance from another person, with the option to use a walking stick. Exclusion criteria included the presence of severe illnesses (recent surgical intervention or neurological disease). The final participants in this study were 154 men (75.9 + 5.73 years, 80.01 + 10.94 kg, 1.68 + 0.06 m).

2.2 Instruments

Initially, individuals who volunteered to participate were informed about the study's purpose and provided their consent to participate. Subsequently, all participants completed questionnaires to record their demographic information (age, body weight, height, educational level, marital status) and medical history (medication, chronic illnesses, falls in the last five years). Following the completion of the biographical notes and medical history questionnaires, participants were administered assessments of cognitive status (Mini Mental State Examination, MMSE) (Folstein *et al.*, 1975), depression (Geriatric Depression Scale) (Sheikh & Yesavage, 1985), and a self-reported functional questionnaire (SFQ) (Kempen & Suurmeijer, 1990).

Self-reported functioning was assessed using an 18-item scale designed for independently living older individuals (Kempen & Suurmeijer, 1990). This scale includes 18 questions evaluating the performance of basic (BADLs) and instrumental activities of daily living (IADLs) (Kempen & Suurmeijer, 1990). Each question was accompanied by a three-point response scale indicating the degree to which the individual can perform the activity (without difficulty, with difficulty, with assistance). A value of 0, 1, or 2 is assigned to each scale, respectively (Kempen & Suurmeijer, 1990).

Subsequently, participants performed two functional performance tests, the Physical Performance Test (PPT) (Reuben & Siu, 1990), and the Timed Up & Go Test (TUG) (Podsiadlo & Richardson, 1991). The PPT evaluates the functional capacity of the elderly, specifically assessing upper extremity function, balance, mobility, coordination, and endurance (Reuben & Siu, 1990). The PPT has two versions; the first includes seven activities that simulate activities of daily living of various degrees of difficulty (writing a sentence, simulated eating, turning 360 degrees, putting on and removing a jacket, lifting a book and putting it on a shelf, picking up a penny from the floor and a 15.2m walk test), while the second version adds two additional activities involving stairs (Reuben & Siu, 1990). In this study, the seven-test version was used to accommodate measurement space limitations. Each item is scored on a five-point scale (0-4), with a score of 4 given when the individual completes the test in less than 10 seconds, a score of 1 when completed in more than 20 seconds, and a score of 0 when the individual cannot perform the task (Reuben & Siu, 1990). The PPT score, based on the seven items, ranges from 0 to 28.

The Timed Up & Go Test (TUG) was designed to assess mobility in older individuals (Podsiadlo & Richardson, 1991). The TUG test records the time (seconds) required for the individual to rise from a chair, walk a three-meter distance, turn, walk back to the chair, and sit down (Podsiadlo & Richardson, 1991). Materials used included a chair (height 44 cm, with backrest and armrests), a 3-meter long tape, and a precision stopwatch (Morris, Morris, Iansek, 2001). A 3-minute break was provided between functional performance tests to avoid fatigue. Participants completed two attempts for each functional performance test, and the best attempt was used for statistical analysis. The mean of these attempts was used for statistical analysis. Repetitive measurements of the PPT were conducted after 15 days on 40 individuals randomly selected to assess reliability.

2.3 Statistical Analysis

The statistical processing and analysis of the data were conducted using the statistical package SPSS for Windows (ver. 10.0). In the present study, structural validity, internal consistency, and test-retest reliability were examined. To determine the structural validity of PPT, participants were divided into functionally independent and functionally dependent (at least in one skill) based on their responses to the self-reported functional questionnaire. An independent samples t-test was conducted to identify statistically significant differences in PPT scores between individuals who claimed to perform skills without any difficulty and those who reported at least one skill with difficulty in the self-reported questionnaire. Two criterion tests, the SFQ and the Timed Up and Go test, were used in this study to determine the concurrent validity of PPT. Pearson correlation analysis was used to determine if there was a statistically significant relationship between variables. All variables were transformed into z-scores due to different measurement scales. Reliability measures the stability of measurements. The test-retest measurements were determined using the Pearson correlation coefficient (r). Internal consistency reliability of PPT, indicating the degree of agreement of individual test performances, was assessed using Cronbach's alpha.

3. Results

The present study was completed with 154 male volunteers aged over 65. Anthropometric characteristics, family and educational status, presence of chronic diseases, cognitive level, functional ability as assessed by the functional ability questionnaire, PPT, and TUG are presented in Table 1.

Table 1: Participant physical and functional characteristics

	Mean ± SD	**Percentage (%) of Successful Implementation**
Age (yrs)	75.94 ± 5.73	
Body Weight (kg)	80.01 ± 10.94	
Height (m)	1.68 ± 0.06	
Body Mass Index	28.03 ± 3.38	
Non smokers		81
Smokers		19
Family Situation		
Married		81.8
Non-married		18.1
Educational Level		
Primary School		75
High School		20.3
University		4.7
Diseases		
Hypertension		68.8
Cardiovascular Diseases		53.9
Arthritis		39.6
Diabetes Mellitus		22.7
Osteoporosis		7.1
Falls		35.3
MMSE		
>24	26.87 ± 6.59	21.4
<24		78.6
GDS		
>5	3.33 ± 2.71	82.8
<5		17.2
Functional Performance Questionnaire		
=18	22.37 ± 5.07	20.5
>18		79.5
PPT	18.88 ± 3.78	
TUG (sec)	8.59 ± 3.14	

Note: MMSE: Mini Mental State Examination, GDS: Geriatric Depression Scale, PPT: Physical Performance Test, TUG: Timed Up and Go Test

Of the participants, 82% were married, while 75% had primary education. Twenty percent of the participants scored below 24 on the cognitive function questionnaire, and 17% showed depressive symptoms based on the GDS questionnaire. Additionally, 69% suffered from hypertension, while 40% had arthritis. One in three elderly individuals had experienced a fall in the last three years. Table 2 provides detailed mean values and the success rate of PPT tests. Specifically, 6.5% were unable to write the specific sentence, while 4% were unable to lift the pen from the ground.

Table 2: Performance in the activities of Physical Performance Test in Greek older men

	Mean ± SD	**Successful Implementation Percentage (%)**
Writing a sentence (sec)	33.71 ± 14.22	93.5
Simulated eating (sec)	13.8 ± 4.08	100
Lifting a book and putting it on a shelf (sec)	2.78 ± 1.35	98.7
Putting on and removing a jacket (sec)	17.06 ± 6.57	98.1
Picking up a penny from the floor (sec)	3.29 ± 1.64	96.1
Walking 15.2 m (sec)	13.44 ± 6.08	100
Turning 360°	2.88 ± 1.24	98.7

Table 3 presents correlation coefficients between PPT and self-reported functioning, TUG, cognitive function, depression symptoms, falls, and the number of chronic diseases.

Table 3. Correlation coefficients among PPT, TUG, functional performance questionnaire and health diseases in Greek older men

	PPT (1)	**Ηλικία (2)**	**MMSE (3)**	**GDS (4)**	**Falls (5)**	**Number of Diseases (6)**	**Functional Performance Questionnaire (7)**	**TUG (8)**
1	1.00							
2	-.451**	1.00						
3	.408**	-.063	1.00					
4	-.344**	.173*	-.040	1.00				
5	.246**	-.041	.074	-.154	1.00			
6	.256**	.002	.051	-.190*	.252**	1.00		
7	-.584**	.239**	-.191*	.462**	-.161*	-.366**	1.00	
8	-.757**	.459**	-.407**	.354**	-.095	-.156	.468**	1.00

Note: PPT: Physical Performance Test, MMSE: Mini Mental State Examination, GDS: Geriatric Depression Scale, , TUG: Timed Up and Go Test;** p< 0.005; * p< 0.05

A high degree of negative correlation was found between PPT and TUG ($r = -0.757$, $p < 0.001$), while lower correlation coefficients were reported between PPT and SFQ ($r = -0.584$, $p < 0.001$), PPT and age ($r = -0.451$, $p < 0.001$), PPT and cognitive function ($r = 0.408$, $p < 0.001$), PPT and depression symptoms ($\varrho = -0.344$, $p < 0.001$), PPT and falls ($r = 0.246$, $p < 0.001$). Internal consistency reliability of PPT was high (Cronbach's alpha = 0.7669). Also, the test-retest reliability was found to be high ($r = 0.95$, $p < 0.001$). Statistically significant differences ($p < 0.001$) were observed in PPT performance between individuals who reported performing activities without difficulty/independently and those who had difficulty performing at least one activity in the functional status questionnaire.

4. Discussion

The evaluation of the physical performance of older adults is a significant factor for promoting independence, health, and quality of life. This study demonstrates that the Physical Performance Test (PPT) is a valid and reliable test of functional performance in Greek older men, members of the Open Care Centers for the Elderly in Western Athens.

The concurrent validity was assessed using two criteria, the self-reported functional questionnaire and the Timed Up and Go Test. A high degree of correlation between PPT and Timed Up and Go Test was observed in this research, while the correlation coefficient between PPT and the SFQ questionnaire was moderate. Similar findings were reported by Reuben *et al.* (1995), indicating low–to–moderate correlations between PPT and two self-administered physical function measures, the functional status questionnaire (r=0.45) and SF-36 physical functioning scale (r=0.26) in community-dwelling older adults aged 64-92 years old. On the other side, a stronger correlation (0.677) between PPT and a more complicated level of functional measurement (Tokyo metropolitan institute of gerontology index of competence -TMIG-index of competence) was found in comparison to the basic activities of the Barthel index (0.581) (Moral & Shiomi, 2004). This may mean that physical performance tests appear to more accurately assess basic and instrumental daily activities that individuals can perform compared to questionnaires and interviews (Guralnik *et al.*, 1989). This may be attributed to the recording of activity execution time (movement speed) with functional performance tests (Brach *et al.*, 2002). Previous researchers highlight that questionnaires mainly rely on the individual's perception, while performance-based functional tests focus on their ability to perform the activity (Reuben *et al.*, 1995). For instance, the execution of an activity like walking a distance of 15.2 meters may take over 20 seconds. The assessment based on the functional status questionnaire might indicate independence, while the execution of the same activity and recording the time gives a lower score on the PPT, indicating a lower performance level. Various instruments may be tapping into physical function at different levels of hierarchy, and for this reason PPT may correlate better with TUG than with SFQ in Greek older men from Open Care Centers.

The PPT demonstrated satisfactory structural validity, effectively distinguishing between functionally independent and functionally weakened individuals in this study. Additionally, its structural validity was confirmed by the negative correlation observed with age, as functional abilities decrease with age (Samson *et al.*, 2000). Although chronic illnesses contribute significantly to reduced functional status and disability, the correlation between PPT and the number of chronic illnesses was low. This is likely due to individuals' ability to adapt and perform their daily activities despite the constraints imposed by chronic illnesses. In the present study, correlations between PPT and cognitive function, depressive symptoms, and falls were moderate. These results are in accordance with the findings of previous studies suggesting that declines in physical performance is associated with decline in cognition, depressive symptoms, age, gender, prevalent health conditions, the fracture of a hip and smoking behavior in older adults (Tabbarah *et al.*, 2002; Broose *et al.*, 2002). Especially, studies using the Mini Mental State Examination (MMSE) have found similar results that poorer cognitive status was independently associated with greater dependency on self-reported scales of instrumental activities of daily living, and lower scores on the PPT (Rozzini *et al.*, 1993; Reuben *et al.*, 1995). The moderate relationship between PPT and cognitive function may be because performing and completing the test requires collecting and processing

information effectively. Depression is a common emotional disturbance in older adults, and older adults with depression are reported to have low levels of physical activity and mobility (Broose *et al.*, 2002). The moderate associations between GDS and PPT, TUG suggest that physical performance improvements may play an important role in preventing depression (Lee, 2015). Falls are a predominant phenomenon in the elderly, and this research found that individuals who had experienced falls in recent years had significantly lower PPT scores compared to those who had not. The results are in accordance with previous studies suggesting that lower levels of physical performance are related to higher fall and fracture risk (Cawthon *et al.*, 2008; Gaafmans *et al.*, 1996; Orwoll *et al.*, 2018; Ward *et al.*, 2015). These results highlight the need for early identification of older men with low physical performance for reducing the risk of falling with appropriate physical activity interventions.

The test-retest reliability and internal consistency of the PPT were found to be high. These results indicate significant sensitivity to changes in the PPT of elderly individuals. These findings are consistent with the results of previous study (Reuben & Siu, 1990), where internal consistency reliability was 0.79 for the PPT, and interrater reliability was 0.93. Similar results were found by Morala & Shiomi (2004), where the intraclass correlation coefficient for interrater reliability was greater than 0.95, and the intraclass correlation coefficients for test-retest reliability of the Japanese version of PPT were 0.85 and above in Japanese older adults aged 73 – 94 years old. Additionally, Paschal *et al.* (2006) have shown that the intraclass correlation coefficient for the 7-item was 0.818 for people with Parkinson's disease, aged 49 – 69 years old. It seems that PPT may be an appropriate tool to measure change in physical performance over time for older adults and people with Parkinson's disease.

The present study has a number of limitations. In the present study, only older men participated. Additionally, the participants of the present study were confined to an open care center of older adults who volunteered to participate in screening for this study. So, it is possible that the findings of the present study are not applicable to severely impaired older adults. Hence, it is noticed that older people experiencing health problems are more likely to refuse to participate in studies requiring more effort and commitment. (Portegijs *et al.*, 2019). So, the generalization of results must be used with caution.

In conclusion, this study shows that the Physical Performance Test is a reliable and valid test of functional performance in Greek older men, who are members of the Open Care Centers for the Elderly. Establishing the validity and reliability of the Physical Performance Test in the Greek population of older adults is crucial for the early diagnosis and warning of individuals approaching physical dysfunction. Also, this study provides new insights into the assessment of physical performance, cognitive function, depressive symptoms and falls among Greek older adults. Further, reliable and valid assessment of the physical performance of older adults will lead to appropriate strategies and interventions for their development.

Conflict of Interest Statement

The authors declare no conflict of interest.

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