Physical Fitness and Cognitive Function in Persons with Dementia and their Family Care Partners

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Introduction

- An estimated 5.7 million Americans have a diagnosis of Alzheimer's dementia as of 2018, and over 16 million individuals currently provide unpaid care as family care partners (FCPs).[1]
- FCPs are more likely to rate their health as "fair" or "poor," have higher levels of stress hormones, and lower levels of antibody responses when compared to age-matched peers.[1,2]
- Persons with dementia (PWD) are at a higher risk of falls, mortality, and sustaining fall related injuries than cognitively healthy older adults.[3]
- There is currently a critical need for research regarding the effect on physical health of the FCPs of PWD.[4]

Study Purpose and Hypotheses

- The purpose of this exploratory cross-sectional research study was to investigate the relationship between physical markers of functional fitness, using the Senior Fitness Test (SFT), and memory impairment, using the Mini Mental State Exam (MMSE) and Clinical Dementia Rating Scale (CDRS), in FCPs and PWD to determine group differences and deviations from clinical thresholds for loss of functional independence.
- It was hypothesized that: 1) the relationship between the SFT and MMSE will be different for the FCPs and PWD, 2) the FCPs and PWD will fall below the normative values for the SFT, and 3) MMSE scores will predict SFT performance for the PWD group.

Method

Participants

- Fifteen FCPs (age mean ± standard deviation = 60.4 ± 13.7 years) and 15 PWD (age mean ± standard deviation = 76.9 ± 3.9 years) participated in the study.
- The FCP group consisted of 5 males and 10 females, and the PWD group consisted of 5 males and 10 females.

Inclusion criteria

Persons with dementia:
- All ambulatory persons 18 years and older with a diagnosis of dementia or Alzheimer's disease.
- Physically capable of performing all tests and measures.

Healthy older adults:
- All community dwelling persons 18 years and older without signs of dementia.
- Physically capable of performing all tests and measures.

Exclusion criteria

- Musculoskeletal or neurological disease or impairments affecting balance or gait performance.
- Medications affecting balance or gait performance.
- Current reports of dizziness, vertigo or loss of balance.
- History of falls in the past 6 months.
- Unable to communicate in English.

- The stage of dementia was determined using the Clinical Dementia Rating Scale (CDRS).
- The MMSE was used to assess global cognition and has a range of 0 - 30, where a higher score indicates better performance.
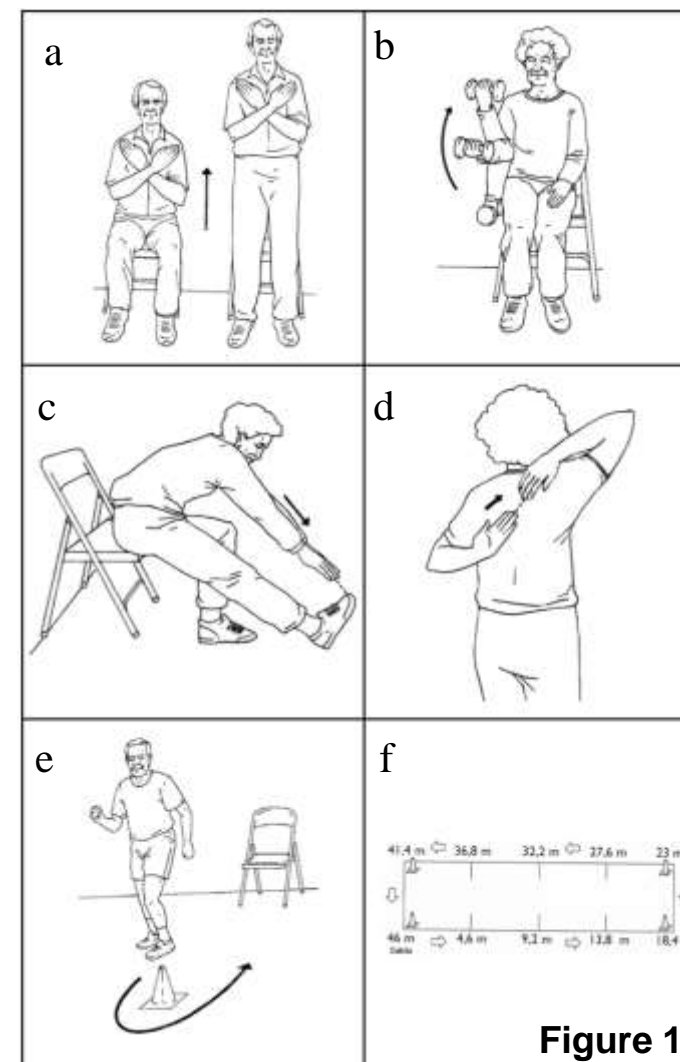
Assessment of Physical Fitness

Figure 1

Senior Fitness Test (Figure 1)
a) Chair stand - lower body muscle strength
b) Arm curl - upper body muscle strength
c) Sit and reach - lower body flexibility
d) Back scratch - upper body flexibility
e) 8 foot up and go - dynamic agility
f) 6 Minute walk test - aerobic endurance

Data Analysis

- Data is presented as the mean ± standard deviation (SD) for demographics and SFT tasks.
- A one-way ANOVA was conducted to determine group differences between FCPs and PWD for all SFT measures.
- Linear regression and Pearson's correlation coefficients were used to analyze the relationship between the 6 Minute Walk Test and the MMSE for the PWD group. Statistical significance was set at $p < 0.05$. (see Table 1 below).

Results

Table 1. Mean (SD) for MMSE and SFT tasks for FCP, PWD, and NR groups

Group	FCP	PWD	NR[a]
MMSE	26.97 (1.99)	15.07 (4.82)	28.40 (1.17)
Chair Stand (# in 30s)	13.53 (4.52)	8.67 (4.72)	11.70 (5.12)
Arm Curl (# in 30s)	15.07 (5.31)	11.93 (4.08)	13.80 (2.78)
Sit & Reach (in)	1.01 (4.40)	-2.49 (2.98)	0.70 (3.95)
Back Scratch (in)	-3.47 (6.85)	6.78 (5.90)	-4.30 (5.10)
8 ft. up and go (s)	6.78 (1.80)	13.48 (6.42)	6.85 (0.95)
6 Min Walk (yds.)	430.29 (116.43)	284.51 (119.14)	503.00 (100)

[a]Norm-referenced Rikli and Jones (1999)

Table 2. Mean (range) of SFT scores and % below cut-off scores for recommended fitness standards for predicting the ability to function independently in later years. [b]

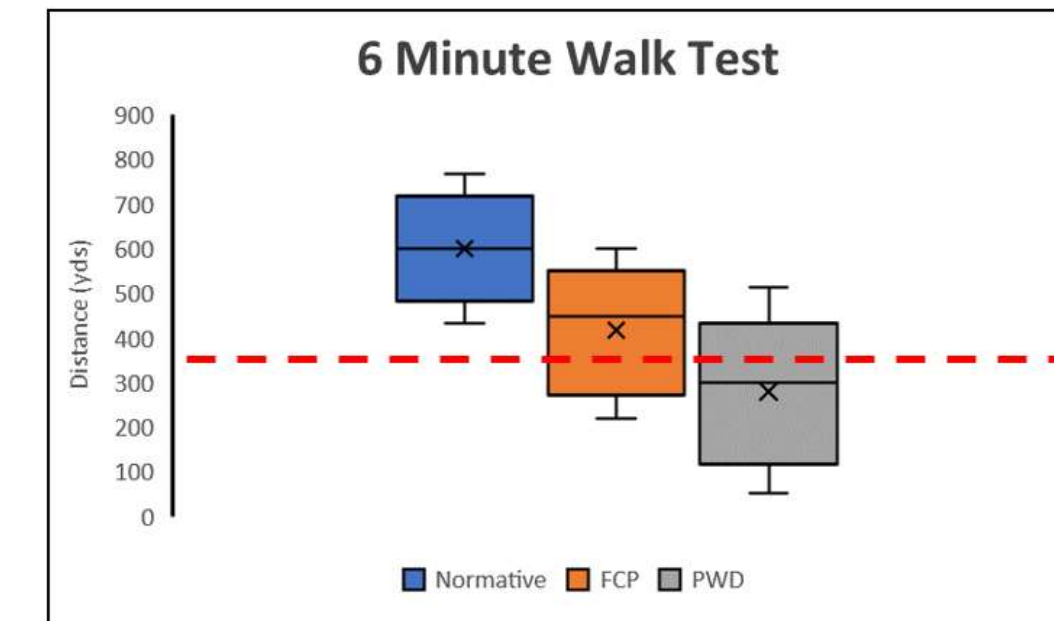| Item	FCP	PWD	% of FCP below cut-off score	% of PWD below cut-off score
Chair Stand (# in 30s)	13.5 (8.0- 23.0)	8.7(0.0-18.0)	0.0	46.7
Arm Curl (# in 30s)	15.1 (7.0-25.0)	11.9 (5.0-18.0)	20.0	40.0
8 ft. up and go (s)	6.8 (4.3-9.8)	13.5 (5.7-27.0)	13.3	73.3
Sit & Reach (in.)	1.0 (-11.0 - 6.8)	-2.5 (-9.0 - 0.6)	6.7	40.0
6 Min Walk (yds.)	430.3 (217.4-600.0)	284.5 (50.4-514.4)	26.7	80.0

[b]Fitness standards according to Rikli and Jones (2013)

Figure 2.
6 Minute Walk Test: Mean ±SD distance (yds.) for FCPs [430.29±116.43], PWD [284.51±119.14]. The threshold represented by the horizontal line (350 yds.) indicates that 26.7% of FCPs and 80% of PWD are at risk for loss of functional independence.
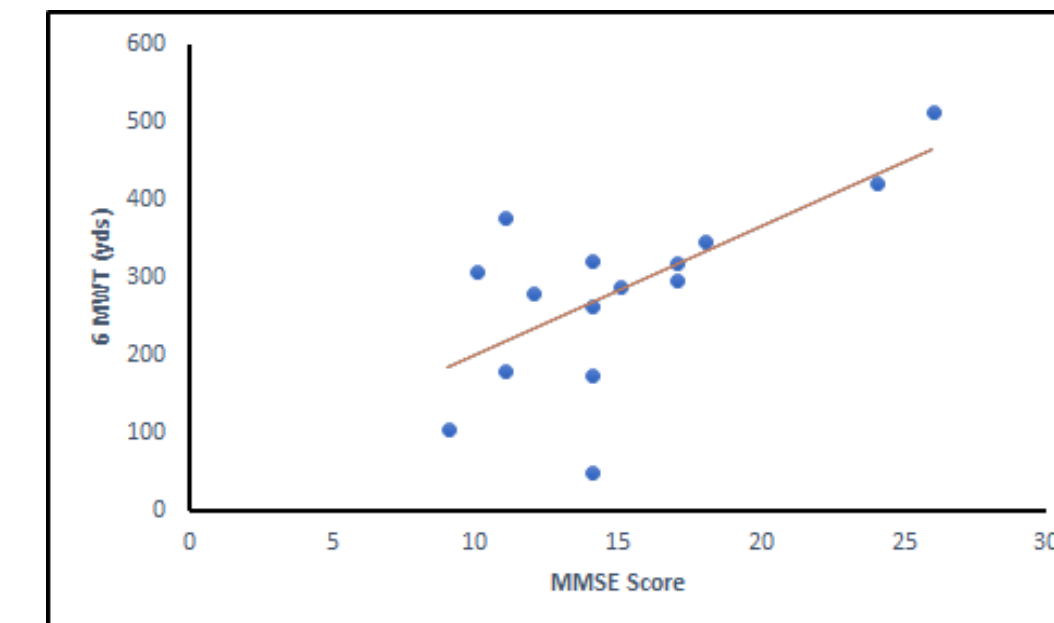

Figure 3.
MMSE scores were positively associated with aerobic endurance measured by the 6 MWT for the PWD group ($r = .672$, $p < .01$). Higher MMSE scores were associated with longer distance walked for the PWD group.

Discussion and Conclusion

- A moderately positive correlation ($r = 0.672$) was found between MMSE scores and aerobic fitness measured by the 6 Minute Walk Test for the PWD group, which indicates the implementation of an aerobic exercise program.
- Normative reference data was based upon healthy adults ages 60-65 years. At time of data collection, 1/3 of participants in the FCP group were younger than 60 years old. Despite being compared to an older reference group, FCPs as a group still performed below functional expectations.
- While it is well established that functional declines are present in PWD, it is clinically relevant to be aware that functional declines may exist in the FCP population.
- Results suggest that interventions should be developed for both FCPs and PWD to minimize potential loss of functional independence.

Future Research

- Further research should be conducted using larger sample sizes to determine a trend in the declining physical fitness and cognition of FCPs. In addition, future researchers should investigate the relationship between the severity or stage of dementia and their physical function. This will allow for more targeted interventions for PWD and education for FCPs.

References

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