Cognitive Aging and Physical Activity: Identifying a Relationship Between Physical and **Cognitive Performance in a Sample of Older Adults** Megan Suen¹ • Brian Follick, M.S.² • M'Kenzie Finn¹ • Laura Zettel-Watson, Ph.D.¹ • Barbara J. Cherry, Ph.D.¹ California State University, Fullerton • Department of Psychology¹ • Department of Health Science²

Introduction

- Study aim: To examine the potential association between physical and cognitive function in healthy older adults using performance measures.
- Previous investigations have identified positive relationships between physical activity and cognitive functioning/performance in both clinical and healthy populations.

Williamson et al.,2008

- Sedentary persons at increased risk for disability
- Examined physical activity, health education and cognitive assessments
- Physical activity was shown to be predictive of lower rates of dementia and cognitive decline

<u>Bielak A. A. M., Hughes T. F., Small B. J., Dixon R. A. (2007).</u>

- Victoria Longitudinal Study
- Examined physical and cognitive self report measures
- Physical activity was a significant predictor of information processing efficiency in older adults

<u>Cherry et al., 2012</u>

- Adults with chronic pain (fibromyagia)
- Physical performance and objective cognitive assessments
- Better balance and aerobic physical measures predicted enhanced cognitive function
- The current investigation examined the association between physical performance measures and cognitive performance measures in healthy older adults.

Method

Analysis of data collected from a 2010 cross-sectional study

• Fibromyalgia Research Center at California Sate University, Fullerton

Participants

- 49 participants (Mage = 69.7 years)
- Had to be 50 years or older
- Mini Mental Status Exam (MMSE) score of 25 or higher

Procedures

- Prior to Assessment
- Informed consent
- Demographics, medications
- On the Day of Assessment
- Blood pressure, waist circumference, height, weight
- Beck Inventory Test (BDI-II) and Everyday Problems Test (EPT)
- Cognitive & Physical tasks

The Following Measures were included in the current analysis, however other measures were included on test day. For a complete list of Physical and Cognitive Performance Measures, please see Jones, Rutledge, and Aquino (2010)

Physical Performance Measures

- Fullerton Advance Balance scale (FAB)
- 6-minute walk test

Table 1

Demographic information	N	Valid %		
Gender				
Female	32	65.3		
Male	17	34.7		
Race				
Caucasian	43	87.8		
Asian/Pacific Islander	4	8.2		
Multi-racial	2	4.1		
Education				
Trade/Technical/Some College	8	16.3		
College Degree	19	38.8		
Professional/Graduate Degree	22	44.9		
Marital Status				
Never Married	1	2		
Divorced/Separated	10	20.4		
Widowed	8	16.3		
Married	30	61.2		
Income				
10-39 K	8	17.4		
40-79 K	18	39.1		
80 K & Above	20	43.5		
	1	1		

Measures

Cognitive Performance Measures

- Mini Mental State Examination (MMSE)
- Stroop Color-Word Test
- Digit Symbol Substitution Test (DSST)
- Everyday Problems Test (EPT)

- Hierarchical Linear Regression
- Assess relationship between Physical Function/Balance and Cognitive Performance
- Three Outcome variables were used:
- Stroop CW (Time to completion),
- DSST
- EPT (Time to completion)
- Composite Cognitive Function Score (CCF)
- Sum of Z Score values for Stroop CW, DSST & EPT
- For each outcome variable 2 hierarchical models were tested. (Fig. 1 & 2) • Age, Gender, Education and BDI score were evaluated as potential control variables. Only **Age** and **Gender** were included in the resulting analysis.

Model 1: Balance Performance as measured by the Fullerton Advance Balance Scale (FAB)



Figure 1. Diagram of the Regression model used to test the relationship between the Fullerton Advanced Balance Scale (FAB) and Cognitive Measures.

Model 2: Physical Performance as measured by the 6 minute walk



Figure 2. Diagram of the Regression model used to test the relationship between the 6 minute walk and Cognitive Measures.

Analysis

Results

Model 1

- With age and gender entered first, Scores from the Fullerton Advanced Balanced scale (Balance) approached significance in predicting overall cognition (CCF) • $\Delta R^2 = .05, P < .07$
- The FAB approached significance in predicting scores on the Stroop Color Word task (Executive Function) • $\Delta R^2 = .04, P < .07$

Model 2

- With age and gender entered first, scores on the 6 Minute walk task (Aerobic Endurance) significantly predicted Composite Cognitive Function scores. • $\Delta R^2 = .07, P < .05$
- Additionally the 6 Minute walk predicted scores on the Digit Symbol Substitution Task (Processing speed) • $\Delta R^2 = .07, P < .05$
- - The 6 Minute walk also predicted scores on the Stroop Color Word Task (Executive Function)

• $\Delta R^2 = .07, P < .05$

Table 2. Heirarchical Regression Results for Physical Measures Predicting Cognitive Function

	Stroop – CW (Time)			EPT (Time)		DSST			CCF			
3 Step Model	В	SE B	β	В	SE B	β	В	SE B	β	В	SE B	β
FAB		n=49			n=48			n=48			n=47	
Age	2.64	.65	.51†	.18	.06	.42 ⁺	71	.27	37*	.16	.04	.48†
Gender	-12.58	9.82	14	-1.30	.93	18	4.90	3.85	.16*	-1.03	.59	20
FAB Score	-2.46	1.33	23	11	.13	13	.928	.524	.27	158	.08	26
R ² Step 1		.413 [‡]			.26‡			.27‡			.39 [‡]	
ΔR^2 Step 2		.01			.02			.02			.03	
Δ R ² Step 3		.04*			.01			.05			.05*	
6 Minute Walk		n=49			n=48			n=48			n=47	
Age	2.39	.59	.46‡	.19	.06	.44 ⁺	.71	.26	.38†	.16	.04	.48 [‡]
Gender	-20.15	9.68	23*	-1.33	.98	19	-6.73	3.99	22	-1.33	.61	26*
6 Minute Walk Score	16	.05	38†	00	01	.55	04	.02	30*	01	.00	31*
R ² Step 1		.41‡			.26‡			.27‡			.39 [‡]	
Δ R ² Step 2		.01			.02			.02			.03	
ΔR ² Step 3		.11‡			.01			.07†			.07†	

NOTE: Coefficeients are from the final 3-step model (Step 1: age; Step 2: gender; Step 3: FAB/6 Minute Walk). *P<.07; [†]P<.05; [‡]P<.01.

Conclusions

- Physical ability is strongly associated with cognitive function independent of age and gender
- Better global balance scores approached significance in predicting higher overall cognitive functioning
- Greater aerobic fitness was associated with better overall cognitive ability
- Higher scores on individual measures of executive functioning and processing speed.
- These results further support previous research showcasing a connection between physical activity and cognitive ability

Implications and Future Directions

- Future research should expand the types of physical and cognitive measures used.
- It would also be beneficial to investigate, in detail, the interrelationship between physical performance and cognitive function as age progresses.
- Larger scale investigations into the relationship between balance and cognitive performance may help to further delineate the relationship between the two.

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