Predictors of Diagnostic Variables of Sarcopenia in Older Adults

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ABSTRACT

Purpose: To investigate potential predictors of diagnostic variables of sarcopenia in older adults including demographic factors (e.g., age and sex), aerobic and resistance physical activity (PA), cardiorespiratory fitness (CRF), and body composition.
Methods: This cross-sectional study included 304 older adults ≥65 years (mean age 73, range 65-95). PA and sedentary variables were assessed using a self-report survey and daily steps using an accelerometer based pedometer (Omron HJ-321). CRF was the time to complete a 400m walk in minutes, thus higher number in minutes indicates a slower walking, which is a lower level of CRF. Body composition was percentage body fat (%BF) measured by DXA and body mass index (BMI). Diagnostic variables of sarcopenia include appendicular lean mass (ALM) (kg/height in meter^2) measured by DXA, handgrip strength (kg), and gait speed (m/s) from 4 meter walk test.
Results: Univariate regression revealed significant relationships between **ALM** and CRF (p=0.012), light intensity (1.5-3.0 METs) aerobic PA (p<0.001), vigorous intensity (≥6.0 METs) aerobic PA (p=0.008), age (p<0.001), male sex (p<0.001), and %BF (p<0.001). **Handgrip strength** was related to CRF (p<0.0001), light intensity aerobic PA (p=0.002), vigorous intensity aerobic PA (p=0.002), resistance PA (p=0.031), age (p<0.001), male sex (p<0.001), and %BF (p<0.001). **Gait speed** was related to CRF (p<0.0001), daily steps (p=0.003), age (p<0.0001), and %BF (p=0.018). Stepwise variable selection (p<0.2 to enter the model, p<0.05 to remain in the model) was used to find significant predictors of diagnostic variables of sarcopenia. **ALM** was predicted by CRF (β=-0.15, p<0.001), %BF (β=-0.12, p<0.001), BMI (β=0.25, p<0.001), and male sex (β=0.29, p<0.001) (model R^2=0.93); **grip strength** was predicted by CRF (β=-2.50, p<0.001), age (β=-0.26, p<0.001), and male sex (β=14.6, p<0.001) (model R^2=0.62); and **gait speed** was predicted by CRF (β=-0.11, p<0.001) (model R^2=0.24).
Conclusion: Cardiorespiratory fitness, measured by a simple 400m walk test, was identified as a significant predictor of all three diagnostic variables of sarcopenia in older adults.

INTRODUCTION

Sarcopenia is a common geriatric disease present in about 10% of older adults. It is related to fall risk, disability, quality of life, ability to live independently, and mortality. Current established definitions (i.e. European Working Group on Sarcopenia in Older People (EWGSOP), Federal National Institutes of Health Sarcopenia Project (FNIH-SP)) require a use of a dual X-ray absorptiometer (DXA) to establish low muscle mass, one of the diagnostic variables. DXA is a costly device, it exposes patients to radiation, and requires trained personnel to operate. No screening methods for early detection of sarcopenia have been developed and agreed upon. Identification of potential predictive variables could help to classify individuals at higher risk and indicate the need for a full sarcopenia screening, including DXA scan. Therefore, the purpose of this study was to explore potential predictors associated with low muscle mass, low handgrip strength, and low gait speed.

METHODS

- **SAMPLE**
  - 304 older adults ≥65 years (mean age 73, range 65-95).
- **ANTHROPOMETRICS**
  - Height and weight were measured using a stadiometer and a digital scale, respectively.
- **PHYSICAL ACTIVITY AND FITNESS**
  - PA (light, moderate, vigorous intensity aerobic, and resistance training) and Sedentary variables were assessed using a self-report survey.
  - Daily steps and weekly aerobic steps (sum of steps at 100 steps/min for ≥10 min) were provided by an accelerometer based pedometer (Omron HJ-321).
  - CRF was the time to complete a 400m walk in minutes (a higher number indicates a slower walking, which is a lower level of CRF).
- **BODY COMPOSITION**
  - %BF from DXA and body mass index (BMI).
- **SARCOPENIA VARIABLES**
  - Appendicular lean mass (ALM) (kg/height in meter^2) measured by DXA.
  - Handgrip strength (kg).
  - Gait speed (m/s) from 4 meter walk test.

Statistical Analysis: Simple and multivariable linear regression.

RESULTS

Table 1. Participant Characteristics

	All (n=304)
Age, years	7.42 (5.8)
Female, % (n)	55 (167)
Body Composition	
Height (cm)	168.4 (9.6)
Weight (kg)	76.9 (16.6)
BMI (kg/ht^2)	27.0 (4.9)
% Body Fat	39.8 (7.7)
Lifestyle	
Heavy Alcohol Consumption	10.2 (31)
Current or Former Smoker	35 (106)
Sedentary Time (Hrs)	11.9 (5.0)
Physical Activity (MET-hrs/wk)	
Light	44.9 (24.3)
Moderate	54.5 (43.7)
Vigorous	14.1 (18.7)
Resistance Training Time	17.7 (23.1)
Total	131.1 (77.4)
Objectively-measured Physical Activity (Pedometer)	
Daily Steps	4988 (2814)
Weekly Aerobic Steps	9150 (11041)
Cardiorespiratory Fitness	
400-meter Walk (completion time in min)	4.5 (0.8)
Sarcopenia	11 (33)
Appendicular Lean Mass (ALM)	6.5 (1.2)
Handgrip Strength (kg)	29.9 (10.3)
Gait Speed (m/s)	1.1 (0.2)

Values are means (SD) for continuous variables or % (n) for categorical variables. BMI: Body mass index, Heavy alcohol consumption: > 14 weekly drinks for men, > 7 for women.

Table 3. Multiple Linear Regression of Predictors on Sarcopenia Variables using Stepwise Model Selection

	ALM (DXA)					
Variable	β	SE	STD β	STD SE	P-value	Model R^2
Intercept	4.94	0.16	4.94	0.16	<.0001	0.93
Cardiorespiratory Fitness	-0.15	0.03	-0.12	0.02	<.0001	
Percent Body Fat	-0.12	0.01	-0.92	0.04	<.0001	
BMI	0.25	0.01	1.23	0.03	<.0001	
Sex	0.29	0.07	0.14	0.03	<.0001	
	Grip Strength (kg)					
Variable	β	SE	STD β	STD SE	P-value	Model R^2
Intercept	54.68	4.68	54.68	4.68	<.0001	0.62
Cardiorespiratory Fitness	-2.52	0.53	-2.00	0.42	<.0001	
Age	-0.26	0.07	-1.53	0.41	0.0003	
Sex	14.61	0.76	7.22	0.38	<.0001	
	Gait Speed (m/s)					
Variable	β	SE	STD β	STD SE	P-value	Model R^2
Intercept	1.65	0.05	1.65	0.05	<.0001	0.24
Cardiorespiratory Fitness	-0.11	0.01	-0.09	0.01	<.0001	

Stepwise selection: p<0.2 to enter the model, p<0.05 to remain in the model.

Table 2. Simple Linear Regression of Predictor on Sarcopenia Variable

	ALM (DXA)				
Variable	β	SE	STD β	STD SE	P-value
Cardiorespiratory Fitness (400m walk time)	-0.22	0.40	-0.18	0.09	**0.01**
Daily Steps (per 1000 steps)	0.04	0.03	0.11	0.07	0.11
Weekly Aerobic Steps (per 1000 steps)	0.004	0.01	0.04	0.07	0.52
Sedentary Time (MET-hr/wk)	0.02	0.01	0.11	0.07	0.11
Light Physical Activity (MET-hr/wk)	-0.01	0.003	-0.27	0.07	**<.0001**
Moderate Physical Activity (MET-hr/wk)	0.002	0.002	0.08	0.07	0.25
Vigorous Physical Activity (MET-hr/wk)	0.01	0.004	0.19	0.07	**0.01**
Resistance Training (MET-hr/wk)	0.01	0.003	0.12	0.07	0.09
Age	-0.04	0.01	-0.25	0.07	**0.0002**
Sex	1.73	0.10	0.85	0.05	**<.0001**
Percent Body Fat (DXA)	-0.05	0.01	-0.39	0.07	**<.0001**
BMI (Ht/Wt^2)	0.15	0.01	0.71	0.06	**<.0001**
	Grip Strength (kg)				
Variable	β	SE	STD β	STD SE	P-value
Cardiorespiratory Fitness (400m walk time)	-5.13	0.69	-4.03	0.54	**<.0001**
Daily Steps (per 1000 steps)	0.36	0.21	1.02	0.59	0.09
Weekly Aerobic Steps (per 1000 steps)	0.05	0.05	0.56	0.59	0.35
Sedentary Time (MET-hr/wk)	0.12	0.12	0.60	0.59	0.31
Light Physical Activity (MET-hr/wk)	-0.08	0.02	-1.78	0.58	**0.002**
Moderate Physical Activity (MET-hr/wk)	0.02	0.01	0.85	0.59	0.15
Vigorous Physical Activity (MET-hr/wk)	0.10	0.03	1.85	0.58	**0.002**
Resistance Training (MET-hr/wk)	0.06	0.03	1.27	0.58	**0.03**
Age	-0.37	0.10	-2.09	0.58	**0.0004**
Sex	15.25	0.82	7.48	0.40	**<.0001**
Percent Body Fat (DXA)	-0.70	0.07	-5.54	0.50	**<.0001**
BMI (Ht/Wt^2)	0.23	0.12	0.94	0.59	0.11
	Gait Speed (m/s)				
Variable	β	SE	STD β	STD SE	P-value
Cardiorespiratory Fitness (400m walk time)	-0.12	0.01	-0.09	0.01	**<.0001**
Daily Steps (per 1000 steps)	0.01	0.004	0.03	0.01	**0.003**
Weekly Aerobic Steps (per 1000 steps)	0.001	0.001	0.01	0.01	0.25
Sedentary Time (MET-hr/wk)	-0.002	0.002	-0.01	0.01	0.25
Light Physical Activity (MET-hr/wk)	0.00004	0.0004	0.001	0.01	0.93
Moderate Physical Activity (MET-hr/wk)	0.0003	0.0002	0.01	0.01	0.28
Vigorous Physical Activity (MET-hr/wk)	0.001	0.001	0.02	0.01	0.13
Resistance Training (MET-hr/wk)	0.001	0.0005	0.01	0.01	0.18
Age	-0.01	0.002	-0.04	0.01	**<.0001**
Sex	0.03	0.02	0.01	0.01	0.19
Percent Body Fat (DXA)	-0.003	0.001	-0.03	0.01	**0.02**
BMI (Ht/Wt^2)	-0.002	0.002	-0.01	0.01	0.28

CONCLUSIONS

- A simple 400-meter walk test, completed as quickly as possible, was associated with each component of sarcopenia (muscle mass, muscular strength, & muscle function) in a group of older adults.
- Given the growth of the oldest segments of the population and sarcopenia's recent addition to the International Classification of Diseases, identification of predictors may help develop screening tools and improve early detection of the sarcopenia.

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