

Adiposity of Elderly Women and Its Relationship with Self-reported and Observed Physical Performance

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NOTE

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ABSTRACT

Background and Purpose: There is a societal trend toward increasing obesity and a natural tendency for physical performance to decrease with age. Our purpose was to describe the adiposity of elderly women participating in a health screening and to determine the relationship between their adiposity and both observed and self-reported physical performance. **Methods:** Subjects were 104 community-dwelling elderly women (74.9 ± 7.5 years). Their adiposity was described using body mass index (BMI), waist circumference, and waist to hip ratio. Physical performance was characterized using timed sit-to-stand, unilateral standing, 25-foot walk and the Physical Functioning subscale of the SF-36. Habitual activity was summarized as the number of daily hours patients estimated they spent moving about on their feet. **Results:** The majority of women had excessive adiposity. Greater adiposity was associated with worse physical performance. Both Pearson correlations and multiple regression revealed BMI to be significantly predictive of all physical performance measures. Age added to the explanation of walking time and unilateral stance time. Time moving about contributed to the explanation of self-reported physical functioning. **Conclusions:** Adiposity should be documented as part of the physical therapist examination of elderly women. It may be an appropriate target of intervention if physical performance is limited.

Key Words: body composition, adiposity, obesity, age, functional limitations, gait, balance

INTRODUCTION

An increasing proportion of Americans is overweight or obese.¹ Excessive adiposity is associated with numerous dis-

eases, conditions, and outcomes that accompany aging including: osteoarthritis,^{2,3} joint pain,⁴ respiratory disorders,³ cardiovascular disease,⁵⁻⁷ diabetes,⁸ cancer,⁹ and early mortality.¹⁰ Although higher levels of adiposity are also known to be associated with lower levels of physical performance,¹¹⁻¹⁶ the relationship merits further scrutiny if its implications are to be addressed by physical therapists. As physical performance typically declines with aging,¹⁷⁻²⁰ higher levels of adiposity could be particularly consequential to the elderly. We, therefore, sought to describe the adiposity of elderly women participating in a health screening and to investigate the relationship between their adiposity and physical performance. As physical activity also decreases with aging^{21,22} and relates to physical performance,^{11,23,24} we included it (and age) in our investigation to determine if they had a modulating effect.

METHODS

Subjects

This study employed data gathered from 104 nondisabled community-dwelling women attending health screenings conducted at 5 senior centers in the state of Connecticut. Their age range was 60 to 90 years, with a mean of 74.9±7.5 years. Prior to participation, all subjects read and signed a consent form approved by the institutional review board of the University of Connecticut.

Measurements and Procedures

Relevant independent variables included demographics, medical history, adiposity, and self-reported physical activity. Dependent variables included self-reported physical function and 3 measures of physical performance.

Adiposity was described using 3 simple measures advocated by the Centers for Disease Control: body mass index (BMI), waist circumference, and waist to hip ratio.²⁵ All are based on anthropometric measures and were obtained by experienced practitioners (ie, physical therapists, exercise physiologists) from subjects whose excess clothing (eg, shoes, coats) was removed. Weight was measured on a Precision Dial Health Scale (model 68970, Country Technology, Inc., Gay Mills, Wisc) to the nearest 0.10 kg. Height was assessed to the nearest 0.10 cm using a plastic tape measure and an Ultralevel 6 Stadiometer (model 50602, Zircon Corp., San Diego, Calif). Waist circumference, a measure of abdominal adiposity,²⁶ was taken at the narrowest part of the torso and hip measurement at the maximum width of the hip above the gluteal fold to the nearest 0.10 cm. Subjects' BMI was calculated using the formula mass (kg)/height (m²). Waist-to-hip ratio was determined by dividing waist circumference by hip circumference.

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Habitual daily physical movement typical of the past month was assessed with a single question from the Yale Physical Activity Survey, which was developed specifically for measuring physical activity of older adults.²⁷ The utility of the question has been demonstrated previously for older adults.²⁸ The question was: "About how many hours a day do you spend moving around on your feet while doing things? Please report only the time that you are actually moving." The 5 categories of response were: < 1, 1 to < 3, 3 to < 5, 5 to < 7, and \geq 7 hours/day, and were reduced to 2, <5 and \geq 5 hours/day for the statistical analyses due to the small number of people in the low and high categories. Health care professionals cited examples of low- to moderate intensity physical activities (eg, level walking, heavy housework), that ranged between 2 and 4 metabolic energy equivalents for this age segment of the population,²⁹ to assist respondents in answering the question.

The 3 measures of physical performance were the timed 5 repetition sit-to-stand, unilateral stance, and 25-foot walk. All physical performance measures were assessed with subjects wearing shoes. Timed sit-to-stand involved moving from sitting in a standard chair to a standing position with recording begun when the subject initiated rising from the chair and ending when the volunteer sat down on chair for the fifth time.¹⁷ For the timed unilateral stance test for balance, participants were instructed to stand on one lower limb as long as possible with arms crossed and not to rest the lifted limb on the standing limb, and to keep their eyes open.¹⁹ Both limbs were tested, but only right limb measures were used for statistical analysis as there was no statistically significant differences between sides. The 25-foot walk test started with subjects standing behind a red line and being instructed to walk as quickly and safely as possible across a second line.¹⁸

Self-reported physical function was described using the Physical Functioning subscale of the Medical Outcomes Study Short Form (SF) health survey SF-36.²⁰ The Physical Functioning subscale documents respondents' ability to take part in 10 activities such as carrying groceries, climbing stairs, and walking moderate distances.

Statistical Analysis

All statistical analysis was performed using SPSS (version 11.0). Relationships were examined using Pearson correlations. Thereafter, multiple regression was employed to explore the relationship of age, physical activity and adiposi-

ty with self-reported physical function, and each physical performance measure. As the 3 measures of adiposity were correlated significantly with one another and as only BMI was correlated significantly with all physical performance measures, BMI was the only adiposity measure employed in the forward regression analysis.

RESULTS

Table 1 reports descriptive statistics for the independent and dependent variables. On the basis of cut point values presented by the Center for Disease Control,²⁵ the women participating in the health screenings tended toward excessive adiposity. Fifty-three (51.0%) had a waist circumference exceeding 88 cm, 74 (71.2%) had a waist to hip ratio of greater than 0.80, and 68 (70.2%) had a BMI greater than 25.0 (overweight). Thirty-one (29.8%) had a BMI of at least 30.0 (obese). Correlations between independent variables and physical performance are reported in Table 2. The majority of correlations between adiposity (as reflected in waist circumference, waist to hip ratio, and BMI) were significant. All adiposity measures correlated significantly (-0.266 to -0.397) with self-reported physical function. The correlations demonstrate that as adiposity increased, physical performance decreased. Regression analysis (Table 3) showed that BMI was predictive of all physical performance measures. Age added to the explanation of walk test performance and unilateral stance time. Time moving about contributed to the explanation of self-reported physical functioning.

DISCUSSION

This study showed that elderly women participating in community health screenings tended to be overweight or obese, regardless of the measure used. This discovery among a specific population reinforces what is already known to be a growing problem.¹

Our results showed that as adiposity increased, both observed and self-reported physical performance tended to decline in elderly women. The relationships between BMI and all physical performance measures were significant. These findings corroborate those of previous research.¹¹⁻¹⁶

Age augmented considerably the relationship between BMI and 2 of the 4 performance measures (walk test and unilateral stance time), suggesting that higher BMI may have a more deleterious effect on function as women get older. We suggest that such a result could be predicted on the basis of

Table 1. Descriptive Statistics from 104 Community Dwelling Elderly Women

Variable	Mean	Median	Standard Deviation	Minimum-Maximum
Age	74.9	75	7.5	60-90
Waist Circumference (cm)	90.4	88.8	14.7	61-137
Waist / Hip Ratio	0.83	0.82	0.06	0.64-0.95
Body Mass Index (kg/m ²)	28.1	26.5	6.7	16.0-54.5
Time Moving About (category)	3.4	3.0	1.1	1-5
Sit To Stand Time (sec)	11.5	11.0	4.1	6.0-34.5
Walk Test (sec)	6.0	5.7	1.8	3.5-13.8
Unilateral Stance Time (sec)	8.9	4.1	12.3	0.5-60.0
Physical Functioning (%)	69.4	77.5	26.8	0-100

Table 2. Pearson Correlations (probability*) Between Variables Measured from 104 Community Dwelling Elderly Women

	Age	Waist	W/H Ratio	BMI	TMA	STST	Walk Test	UST
Waist Circumference (Waist)	-0.081 (0.415)							
Waist / Hip Ratio (W/H Ratio)	0.054 (0.586)	0.697 (0.001)						
Body Mass Index (BMI)	-0.123 (0.215)	0.866 (0.001)	0.389 (0.001)					
Time Moving About (TMA)	-0.113 (0.252)	-0.126 (0.203)	-0.201 (0.041)	-0.052 (0.598)				
Sit To Stand Time (STST)	0.058 (0.562)	0.341 (0.001)	0.279 (0.004)	0.397 (0.001)	-0.054 (0.588)			
Walk Test	0.348 (0.001)	0.188 (0.056)	0.249 (0.011)	0.221 (0.024)	-0.103 (0.300)	0.561 (0.001)		
Unilateral Stance Time (UST)	-0.365 (0.001)	-0.231 (0.018)	-0.158 (0.109)	-0.233 (0.017)	0.175 (0.076)	-0.294 (0.002)	-0.375 (0.001)	
Physical Functioning	-0.060 (0.544)	-0.360 (0.001)	-0.397 (0.001)	-0.266 (0.006)	0.386 (0.001)	-0.286 (0.003)	-0.329 (0.001)	0.277 (0.004)

* Significant correlations are in bold

Table 3. Results of Forward Regression Analysis Examining the Relationship of Adiposity and Potential Modulating Variables with Four Measures of Physical Performance

Dependent Variable	Predictors	R (R ²)	F*
Sit To Stand Time	Body mass index	0.397 (0.158)	19.09
Walk Test	Body mass index, age	0.438 (0.192)	11.97
Unilateral Stance Time	Body mass index, age	0.459 (0.211)	13.50
Physical Functioning	Body mass index, time moving about	0.458 (0.209)	13.37

* All F ratios are significant at $P < 0.001$

the equation force = mass x acceleration. With less force and more mass, acceleration of the body and its segments would be decreased. Previous studies have shown a relationship of age with sit-to-stand performance¹⁷ and self-reported physical functioning.²⁰ We have no explanation for the lack of a significant correlation between these two variables in our study, but finding none, we were not surprised that multiple regression did not show age to add to the explanation of the other 2 variables in our study. Time moving about, which itself correlated with self-reported physical function, strengthened notably the relationship between BMI and self-reported physical function. This relationship could be causal, that is, elderly women who spend more time moving about are more fit and therefore perceive less limitation in their physical performance.³⁰ It could also be, however, that the measures simply covary as they are capturing the same underlying construct. It was surprising that time moving about was not related to BMI. A recent study of elderly individuals with low back pain showed an inverse relationship between their BMI and ambulatory activity; but then their activity was documented by pedometer rather than self-report.³¹

This study had several limitations associated with its design. The sample, though potentially representative of elderly women who participate in health screenings, may not reflect all community dwelling elderly women. It did not include frail women, for whom undernutrition rather than adiposity is a problem. Two of the measures merit attention. Since BMI uses total body mass in its calculation, it does not separate lean and nonlean components. While this might

exaggerate adiposity in some populations (eg, muscular young men), it is unlikely to do so in older women. That it correlated significantly with waist circumference (0.866) and waist to hip ratio (0.389) in our study supports its validity. There is always a risk that self-report measures may not reflect reality. Nevertheless, physical activity documented via surveys has been shown to correlate with daily steps documented by pedometers.^{32,33} The specific question employed in our study has been found previously to relate to central obesity.²⁸ Finally, the results and design of our study do not allow us to directly attribute diminished physical performance to adiposity. Regarding the results, too much variance in physical performance remains unexplained by adiposity to focus exclusively on the variable. Regarding design, an experiment would be required to provide evidence of causality.

CONCLUSIONS

Our study's limitations notwithstanding, it should serve to increase practitioner awareness of the possible negative consequences of adiposity on physical performance. Where physical performance is limited, impairments such as muscle weakness should not be addressed to the neglect of other modifiable factors such as excess adiposity.

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