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ASSOCIATIONS OF BODY COMPOSITION (FATT-MASS AND FATT-FREE MASS) WHITH MUSCLE STRENGH AND PHYSICAL PERFORMANCE IN THE ELDERLY.

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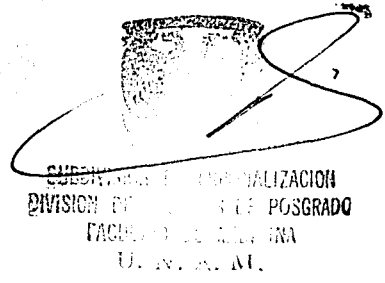

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ABSTRACT

The expected increase on the proportion of elderly people over the next century underscores the need to identify modifiable risk factors responsible for disability on this population group. Some of the risk factors are weight and sarcopenia which may contribute to the risk of disability. However, there is confusion and controversy regarding health risks associated with these factors in old age. **OBJECTIVE**: To evaluate the relationship between body composition (fat-mass and fat-free mass), and skeletal muscle strength in relation to functional performance in the elderly. DESIGN: Cross-sectional study. **SETTING**: Geriatrics Clinic, Instituto Nacional de Ciencias Medicas y de la Nutrición Salvador Zubiran (Mexico City). **PARTICIPANTS**: The sample included 122 ambulatory elderly patients (65 years and older) under geriatric evaluation, randomly selected. **MEASUREMENTS**: Body composition: % fat-free mass (FFM) and % fat mass (FM) were estimated by the anthropometric method proposed by Durnin & Womersley, applying skinfold thickness measurements (four skinfold measures: biceps, triceps, sub scapular and iliac crest). Physical performance was evaluated by self-report on the ability to perform activities of daily living (ADLs) assessed by the Katz index and ability on instrumental activities of daily living was assessed by Lawton index. Other mobility-related abilities were assessed by using 2 specific tasks: walking 1km (5-6 blocks) and walking up 10 steps. Grip strength was used as an indicator of muscle strength. **RESULTS:** A negative association was observed between low fat mass and disability. The increase in percentage of fat-

mass was associated with a decrease in 2.3 times the risk of disability on basic activities (ADLs) OR of 0.43 (IC 95% 0.20-0.93) and a decrease in 2.6 times the risk of disability on instrumental activities (IADLs) OR of 0.30 (IC 95% 0.19-0.77). There was no association between fat-free mass with functional performance and muscle strength. Grip strength was positively associated with walking up 10 steps task OR 0.49 (95% CI 0.24-0.97) and ADLs OR 0.23 (95% CI 0.01-0.58) and male gender. Grip strength was not related with fat-free mass . These results could not be explained by age, education, smoking, fat-free mass, body mass index, chronic conditions or depression. **CONCLUSIONS**. This findings suggest, contrary to the sarcopenia hypothesis that low fat mass and low muscle strength have a negative impact over functioning, while lean mass evaluate by fat-free mass is less significant in old age.

Key words: *body composition, fat-mass, fat-free mass, functional status, activities of daily living, instrumental activities, skeletal muscle strength.*

INTRODUCTION

Functional limitation, defined as a restriction in the physical (or mental) performance of tasks required for independent living, is a precursor of disability and a significant predictor of morbidity and mortality [2].

Although often a direct consequence of pathology, impaired physical performance and functional limitation may also arise as a direct or an indirect result of prior predisposing social and behavioral factors [1]. According to this model, factors such as increased physical activity and decreased body mass have the potential to decrease the risk o developing functional limitation, both by delaying the onset of pathology and disease and by lessening the impact of pathology on physical functioning [3].

A substantial body of evidence exists to support this model. Both cross-sectional and longitudinal studies show that regular exercise is associated with maintenance of physical performance and functional status [4]. Conversely, low levels of physical activity are associated with loss of function [2 3]. Cross-sectional and longitudinal studies also suggest a direct association between body weight or body mass index and functional limitation in relation to body composition and reported that higher levels of fat were associated with a greater likelihood of disability, while lower levels of lean of fat-free mass wire not [2] . The failure to observe a relation between low lean mass and functional limitation is contrary to

the hypothesis that sarcopenia, the age-related loss of muscle mass, decreases physical performance and results in physical impairment [5 6 7]. It is also contrary to the improvements in physical performance observed after resistance training [4]. The propose of this study was to assess cross-sectional association of self-reported physical function with absolute levels of lean and fat mass independently o each other and of overall body size. In addition, since lean mat mass and fat free mass are not biologically independent, this study also examined the influence of each relative to the other. Finally, this study explore the independent relation of fat distribution to physical performance and functional limitation.

SUBJECTS AND METHODS

This is an observational study . The sample included a total of 122 ambulatory elderly men and women patients (65 years and older) under geriatric evaluation, randomly selected.

Self-reported disability and strength

Physical performance was evaluated by self-report on the ability to perform activities of daily living (ADLs) assessed by the Katz index and ability on instrumental activities of daily living was assessed by Lawton index. Other mobility-related abilities were assessed by using 2 specific tasks: walking 1km (5-6 blocks) and walking up 10 steps. Grip strength was used as an indicator of muscle strength [4]

Mobility –relate disability was assessed by using 2 specific task that have been shown to predict mortality and nursing home admission in older: walking 1km, and walking up 10 steps. Mobility relate disability as an outcome variable was analyzed in 2 ways. We created a categorical variable for which person who reported having difficulty in performing one o more tasks received a disability score of 1 and persons with no difficulty on all tasks received a score of 0 .

Grip strength was used as an indicator of muscle strength. Grip strength was known to be positively correlated with lower-extremity strength in older person, with reported correlation coefficients between 0.47 and 0.51. Grip strength was measured using a grip strength dynamometer. The maximum strength (in kg) out of two attempts of the dominant [3].

Body composition

Body weight and body height were measure and body mass index was determinated. The body fat percentage was calculated from de sum of four skin folds (biceps, triceps, sub scapular and iliac crest) using the sex- and age-specific prediction equation of Durnin & Womersley (1974). Person were categorized by tertile of fat-free mass, this distribution is shown in Table 2.

Potential confounders

Chronic illness. Prevalence of a variety of chronic condition was collected to the medical registers: hypertension, diabetes mellitus, lung disease (bronchitis, emphysema, and asthma), cancer, heart disease cardiopaties, neurological diseases , kidney disease and arthritis.

Cognitive impairment was evaluated by the mini-mental state examination (MMSE). Depression score was determined by the Geriatric Depression Scale with values ranging from 0 (not depressed) to 30 (very depressed). Self-rates health at examination was reported as excellent, good, far or poor.

Others potentials confounders were education.

Statistical analyses

There was not differences between male and females . Logistic regression analysis was used to assess the association of disability with tertile of (%)FM and (%)FFM after adjustment for potential confounders.

RESULTS

A description of the sample is shown in table 1. The final samples comprise 122 subject with an average age of 79 years.

Functional disability on activities of daily living was reported by 26.8% and on instrumental activities of daily living was reported in 40%.

Mobility-related disability was reported by 66.7% to walking up 10 steps and 73% by walking 1 km. The average of BMI was 25.3 kg/m2. The average of %FM was 34.7% of the body composition.

The table 2 shown the distribution of the sample for tertile of %MG and %MLG.

After multivariable adjustment, a negative association was observed between low fat mass and disability. The increase in percentage of fat-mass was associated with a decrease in 2.3 times the risk of disability on basic activities (ADLs) OR of 0.43 (IC 95% 0.20-0.93) and a decrease in 2.6 times the risk of disability on instrumental activities (IADLs) OR of 0.30 (IC 95% 0.19-0.77). There was no association between fat-free mass with functional performance and muscle strength. Grip strength was positively associated with walking up 10 steps task OR 0.49 (95% CI 0.24-0.97) and ADLs OR 0.23 (95% CI 0.01-0.58) and male gender. Grip strength was not related with fat-free mass. These results could not be explained by age, education, smoking, fat-free mass, body mass index, chronic conditions or depression. Table 3.

DISCUSSION

To our knowledge, this is the first report to show that a greater percentage of fat-mass decreases the risk of functional performance on elderly patients. It is important to point out the differences on the percentages of FM reported in the literature. The average of the MG in our study was 34.7% while those reported previously fluctuated from 39 to 50%, showing that the highest tertile of MG had a high correlation with functional impairment [7] [8]. However the intermediate tertile percentage of MG did not show an important statistical difference, therefore is not possible to conclude that those subjects with a percentage of FM over the upper limit but not on the highest tertile have an increased risk to develop functional impairment. It is important to mention that in our study the subjects that were on the highest tertile of FM correspond to those on the intermediate tertile reported on the literature.

Therefore we consider that the MG on the elderly could have a similar role to the "J " or "U" association when considering BMI and mortality as reported during the last decade on the literature [13] [15] [16]. So, we consider that if this parameter is analyzed from a functional point of view we can conclude that either a very low or a too high percentage could predict functional impairment and that the intermediate group has a low risk to develop it.

In relation to the percentage of FFM our results are similar to those reported in the literature. That is: %FFM it is not a conclusive factor on the functionality of

the subject, such as it was demonstrated by Visser and that is against the Sarcopenia hypothesis [14], and as it has been demonstrated by this and other studies, skeletal strength is more important than FFM when considering functionality on the elderly [3 8 9].

There is a need for more longitudinal studies in our population with a significant number of subjects, in order to define the role of the different body compartments and their contribution to functionality and consider what it was established by Roubenoff [17 19]. An increase on body weight trough an appropriate exercise program could increase muscle mass, strength and functionality with a minimal cardiovascular risk on a high percentage of population at risk to develop functional dependency [18 20].

Table 1.
Caracteristic of the sample.

Age (years)	79	(64-97)
Education	< 6 años	
wight (kg)	58.6	(34.8-99.8)
Haight (m)	1.33	(1.5-1.8)
Body mass index (kg/mt2)	25.3	(15.56-44.54)
(%)FM	34.7	(5.6-48.50)
(%) FFM	65.3	(51.50-94.40)
Wais-hip Index	0.92	(0.77-1.25)
Katz Index		
Lawton Index		
Disability on walking up 10 steps (%)	69.7	
Disability on walking 1km(%)	73.8	
Grip strenght (Kg)	16	(0-37)
Depression Index (GDS)	11	(1-28)
Mini-Mental State Examination (MMSE	24	(7-30)
Self-report healt (%)	23.2	
> 3 Chronic condition (%)	26.9	
Albumin (g/lt)	3.6	(1.6-4.7)
Cholesterol (mg/dl)	185	(82-289)
Lynfocites (pg/dl)	1,5	(0,226-3,4)

Table 2.
Distribution of the sample by (%)FM and (%)FFM (tertiles)

	FATT MASS	
Tertile I (low)	< 32.1 %	34.70%
Tertile II	32.2 - 37.4 %	34.70%
Tertile III	37.4 - 40 %	30.50%
	FATT-FREE MASS	
Tertile I (low)	< 62.6 %	33.70%
Tertile II	62.7-67.9 %	33.70%
TertileIII	68.0 - 2.9 %	32.60%

Table 3
Adjusted Odds ratios for funtional performance according to tertile of (%)FM, (%FFM) and grip strength.

	Katz Index	Lawton Index	Walking up 10 steps	Walking 1 km
(%) FM	p < 0.03 OR 0.43 (CI 95% 0.20-0.93)	p < 0.007 OR 0.38 (CI 95% 0.19-0.77)	p - 0.6	p - 0.7
(%) FFM	p - 0.4	p < 0.02	p - 0.09	p - 0.8
Grip Strenght	p < 0.002 OR 0.23 (CI 95% 0.09-0.5)	p - 0.1	p < 0.04 OR 0.49 (CI 95% 0.24-0.97)	p - 0.4
MMSE(*)	p < 0.001 OR 12.16 (CI 95% 3.0-48.9)	p < 0.002 OR 3.1 (CI 95% 2.0-20)	p - 0.7	p - 0.8

(*)MMSE was included becouse of its significant association

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