Maturitas 114 (2018) 46–53

Contents lists available at ScienceDirect

Maturitas

journal homepage: www.elsevier.com/locate/maturitas

Cognitive impairment and the association between frailty and functional deficits are linked to abdominal obesity in the elderly

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ARTICLE INFO

Keywords:
Frailty
Functional level
Obesity
Abdominal obesity
Cognitive impairment
"Mabat-Zahav"

ABSTRACT

Objective: To evaluate whether specific obesity phenotypes in community-dwelling elderly: (a) affect differently the relationship between frailty and functional impairment and (b) are related to cognitive impairment.
Study design: A post-hoc cross-sectional analysis of the last Israeli national health and nutrition survey of the elderly (≥ 65 yrs.; n = 1619).
Main outcome measures: We implemented a previously validated frailty model based on frailty-related variables that were obtained in the survey. Mild cognitive impairment was defined using the Mini-Mental State Examination (a score < 24 and > 17). The Katz's scale of activities of daily living was used for functional assessment. Data were clustered according to different obesity phenotypes using measured body mass index (BMI) and waist circumference (WC).
Results: The link between frailty and disability was most prominent in subjects with abdominal obesity who were non-obese by BMI: compared with non-obese subjects as defined by WC and BMI, the odds ratio (OR) for functional limitations in this phenotype was 8.34 (95 % CI, 2.14–32.48) for pre-frail subjects and 69.26 (10.58–453.55) for frail subjects. The rate of cognitive impairment was 3.3 times higher (p = .023) in women who were obese by WC but not by BMI.
Conclusions: In elderly people with a large WC and BMI < 30 kg/m^2, disability is more tightly linked to frailty than for any other form of obesity. Cognitive impairment was more prominent in women with central obesity and BMI < 30 kg/m^2 than in the other anthropometric phenotypes. WC should be used for early detection of individuals at risk of progression of frailty to functional incapacity.

1. Introduction

Aging is accompanied by significant decline in lean mass and reduced muscle strength which may lead to sarcopenia. Diet and exercise have a role in slowing the progression of sarcopenia [1,2], which is at the core of frailty [3]. Frailty and disability may − but do not necessarily − overlap [4], because frailty and pre-frailty can precede and comprise a risk factor for disability [5]. Another well-recognized risk factor for disability is cognitive impairment [6]. In fact, cognitive decline has been used as an integral part of the definition of frailty by some authors [7], whereas others preferred to address physical frailty and cognitive frailty separately [8].

Obesity, a global public health issue, afflicts all ages including older adults [9]. Oversized older subjects are presently encountered in excess to the traditionally lean, often malnourished elderly individuals [9] and comprises a new type of medical challenge at this age segment [10]. According to the latest Israeli national survey of the Elderly (Mabat-Zahav 2005–2006) [11], about 20 % of subjects 65 years or older have normal body mass index (BMI) and 35.8 % are obese [11]. The increase in obesity with advancing age has led to the existence of a combined phenotype of frailty with obesity. Obesity is not only considered as a potential risk factor for disability [12], but may also play a role in

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https://doi.org/10.1016/j.maturitas.2018.05.009
Received 27 January 2018; Received in revised form 22 May 2018; Accepted 29 May 2018
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Table 1
Relation between functional status (1A), likelihood for frailty (1B) and different variables − a univariate analysis.

A

	variable	Total population (n = 1619)	no limitations (n = 1313; 81.1%)	some limitations (n = 270; 16.7%)	*P between some- to no limitations†*	several limitations (n = 36; 2.2%)	*P between several- to no limitations†*	*P between several-to some†*	Any limitations (n = 306;19)	*P between any to no limitations†*
					*P among groups**					
Gender	Females (%)	52.9	50.7	61.1	–	69.4	*0.001*		62.2	*< 0.0001*
Age	Age (mean ± SD)	74.6 ± 6.1	73.8 ± 5.6	77.9 ± 6.9	*< 0.0001*	78.9 ± 6.4	*< 0.0001*	1.000	78.0 ± 6.9	*< 0.0001*
Frailty status	Robust (%)	37.6	43.3	14.1	–	5.6	*< 0.0001*		13.4	*< 0.0001*
	Pre-frail (%)	57.5	54.5	69.6	–	75.0			70.0	
	Frail (%)	4.9	2.2	16.3	–	19.4			16.6	
	Frail-prone (%)[a]	62.4	56.7	85.9	–	94.4	*< 0.0001*		86.6	*< 0.0001*
Cognitive function	Age-adjusted MMSE score (18–30)	30.84 ± 3.5	31.11 ± 3.2	30.05 ± 4.2	< 0.0001	27.19 ± 4.9	< 0.0001	< 0.0001	29.7 ± 4.4	*< 0.0001*
	Cognitive impairment (%) (MMSE < 24)[b]	3.6	1.9	7.8	–	30.6	*< 0.0001*		10.7	*< 0.0001*
Clinical and metabolic	BMI (mean ± SD; kg/m^2)	29.2 ± 4.8 (n = 1514)	29.0 ± 4.5 (n = 1277)	30.0 ± 5.8 (n = 223)	1.00	33.9 ± 9.5 (n = 14)	*0.02*	*0.01*	30.2 ± 6.1	*< 0.0001*
	General Obesity (BMI ≥30 kg/m2) (%)	38.4	37.0	45.3	–	57.1	0.022		46.0	*0.009*
	WC (mean ± SD; cm) – women	94.3 ± 12.6 (n = 805)	93.2 ± 12.2 (n = 648)	98.1 ± 12.6 (n = 143)	*< 0.0001*	106.7 ± 15.3 (n = 14)	*< 0.0001*	*0.040*	98.9 ± 13.0	*< 0.0001*
	WC (mean ± SD; cm) -men	101.2 ± 11.3 (n = 729)	101.3 ± 11.1 (n = 634)	100.2 ± 12.7 (n = 90)	1.000	100.8 ± 8.0 (n = 5)	1.000	1.000	100.3 ± 12.5	0.392
	Abdominal obesity (≥102 cm for men, ≥ 88 cm for women) (%)	59.9	58.5	66.1	–	78.9	*0.022*		67.2	*0.010*
	Osteoporosis presence (%)	25.6	22.6	37.8	–	47.2	*< 0.0001*		38.8	*< 0.0001*
	Physician diagnosed hypertension (%)	57.8	56.4	66.3	–	47.2	*0.005*		64.1	*0.014*
	Physician diagnosed diabetes (%)	28.1	25.6	39.3	–	36.1	*< 0.0001*		39.1	*< 0.0001*
	Severe diabetes [g]	1.8	0.9	5.6	–	5.6	*< 0.0001*		5.5	*< 0.0001*

B

	variable	Total population (n = 1619)	Robust (n = 610; 37.6%)	Pre-frail (n = 929; 57.4%)	*P between pre-frail- to Robust†*	Frail (n = 80; 4.9%)	*P between frail- to Robust†*	*P between frail- to pre-frail†*	Frail-prone (n = 1010;62.4%)	*P between frail-prone to Robust†*
					*P among groups**					
Gender	Females (%)	52.9	36.0	62.4	–	71.3	*< 0.0001*		63.1	*< 0.0001*
Age	Age (mean ± SD)	74.6 ± 6.1	73.9 ± 5.6	74.9 ± 6.3	*< 0.0001*	76.5 ± 6.4	*< 0.0001*	0.07	75.0 ± 6.4	*< 0.0001*
Physical function	Katz ADL score (5–15) (mean ± SD)	5.6 ± 1.5	5.2 ± 0.8	5.7 ± 1.6	*< 0.0001*	7.3 ± 2.2	*< 0.0001*	*< 0.0001*	5.9 ± 1.8	*< 0.0001*
	No functional limitations (Katz score < 6) (%)	81.0	93.3	76.9	–	36.3	*< 0.0001*		73.7	*< 0.0001*
	Some functional limitations (score 6–10) (%)	16.7	6.2	20.2	–	55.0			23.0	
	Several functional limitations (score 11–15) (%)	2.2	0.3	2.9	–	8.7			3.37	
	Any functional limitations (Katz score ≥6) (%)[d]	18.96	6.73	23.12	–	63.7			26.34	
Cognitive function	Age-adjusted MMSE score (18–30) (mean ± SD)	30.8 ± 3.5	30.9 ± 2.7	30.7 ± 3.8	1.00	30.2 ± 4.4	0.39	0.38	30.8 ± 3.9	0.766
	Cognitive impairment (%) (MMSE < 24) [f]	3.6	1.3	4.5	–	10.0	*< 0.0001*		5.0	*< 0.0001*

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