

Reduced functional capacity of community-dwelling elderly: a longitudinal study

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Abstract *This study aimed to identify the incidence and risk factors for the reduced functional capacity of community-dwelling elderly. A prospective, two-stage cohort study was conducted in 2011 and 2014. The study population consisted of 202 initially independent older adults for the basic activities of daily living. The relative risk (RR) and its respective 95% confidence intervals (CI) were used as a measure of association and were estimated by log-binomial regression with robust variance. The incidence of lower functional capacity was 15.3%. The risk factors for the functional decline were unmarried status (RRadj = 2.75; 95%CI: 1.15–6.57) and depressive symptoms (RRadj = 2.41; 95%CI: 1.15–5.06), even after adjusting for gender, age group, per capita household income, diabetes, use of medication and level of physical activity. The high incidence of reduced functional capacity and its association with marital status and mental health aspects reveals the need to consider such factors in the planning of health actions aimed at maintaining and restoring the functional capacity of the seniors.*

Key words *Elderly health, Aging, Daily activities, Functional disaas bility*

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Introduction

Aging is characterized by several changes in the human body and metabolism, which potentially produce reduced individual ability to adapt to the environment¹. People's capacity to decide and act on their activities of daily living independently has been considered as functional capacity². Thus, the basic activities of daily living (BADL) of self-care such as bathing, dressing, using the toilet, feeding, moving and continence have been deemed an essential indicator of the elderly's functioning³. Lower functional capacity and its implications for the older adults' health, relatives, and the health system should be taken as an essential issue to be addressed with the advancement of the aging population. According to a study by López *et al.*⁴ with individuals 65 years of age or older, reduced functional capacity was observed in 11.9% of the elderly. Functional decline is associated with health conditions, such as poor self-perception of health, stroke, diabetes mellitus and heart disease; sociodemographic characteristics, such as being female, age ≥ 80 years, living alone, being widowed, low level of schooling or illiteracy; as well as factors such as sedentary lifestyle and reduced daily activities^{5,6}.

Reduced functional capacity consists of the lack of abilities to provide self-care by the older adults, who, by becoming dependent on relatives or caregivers, produces social, family and health costs that must be investigated. The study of risk factors for impaired functional capacity may contribute to the proposal of policies and interventions that aim at minimizing the impacts caused by the loss of the seniors' functionality. Thus, this study aimed to identify the incidence and risk factors for lower functional capacity of community-dwelling elderly.

Methods

This prospective cohort study was conducted using data from a population-based epidemiological survey entitled "Nutritional status, risk behaviors and health conditions of the elderly in Lafaiete Coutinho, Bahia". The study was conducted with older adults living in the municipality of Lafaiete Coutinho, Brazilian State of Bahia, located 356 km off the State capital, with 3,901 inhabitants, spread over urban (53.9%) and rural (46%) areas, all registered under the Family Health Strategy (ESF)⁷.

The study population consisted of all non-institutionalized individuals aged 60 years and over,

of both genders and living in the urban area. The baseline study was conducted in 2011 (Phase I) with the census of the 355 elderly enrolled in the Family Health Strategy (ESF). Of these, only 260 were considered independent in performing the BADL and were eligible for follow-up. In phase II, in 2014, 202 elderly individuals with responses to the BADL scale were identified, thus resulting in 58 losses (22.3%), which were due to death, moving to another city and not found even after three attempts.

Data were collected through a home interview, and the anthropometric measurements were scheduled and performed at the municipal health facility. A cognitive screening was conducted through the modified and validated version of the Mini-Mental State Examination (MMSE) before the interview, seeking to evaluate the preservation of recent memory to respond to the questionnaires⁸. The cut-off point was ≥ 13 points (not compromised) and ≤ 12 points (compromised)⁹. The research was continued with the assistance of an informant for those elderly individuals who scored less than or equal to 12 points. Informants were people residing in the same household and who knew how to provide information about the elderly respondent. Pfeffer's Functional Activities Questionnaire (FAQ) was applied to informants, continuing the interview with them if the sum of the questionnaire was six or more, and with the elderly, if the sum was five or less¹⁰. Thus, the combination of these two instruments, the MMSE and FAQ sought to ensure a higher specificity in the identification of the elderly with a more severe cognitive decline, given the bias produced by low schooling¹¹.

The questionnaire of the "Health, Welfare and Aging" (SABE)¹² survey was applied along with the International Physical Activity Questionnaire (IPAQ)¹³, Brazilian extended version. The interview process consisted of a home visit made to search for aspects such as sociodemographic characteristics, health conditions, and behavioral factors. Elderly's weight and height measurements were performed in two Municipal Family Health Facilities, with prior scheduling. Interviews and direct measurements were performed by trained interviewers and submitted to a calibration process.

Functional capacity was taken as a dependent variable and evaluated through the Katz *et al.* scale¹⁴, with information about performing the basic activities of daily living (BADL) such as controlling sphincters, bathing, feeding, lying down and getting out of bed, going to the restroom and

dressing up. The elderly were asked about the difficulty or need for assistance in each basic activity. Independent people are those reporting no need for help to perform any BADL, and dependent people those reporting requiring help in at least one of the BADLs. Sociodemographic characteristics were considered independent variables: gender (female and male); age group (≥ 60 to ≤ 79 , ≥ 80); reads and writes a message (yes, no); marital status (married, unmarried); per capita household income (> 510.00 , ≤ 510.00) referring to the minimum wage in 2011 and participation in religious activity (participates, does not participate). Behavioral factors were level of physical activity assessed by IPAQ, long version¹³ (≥ 150 minutes of weekly moderate or vigorous physical activity = active and < 150 weekly minutes = insufficiently active)¹⁵; alcohol consumption (yes, no); tobacco use (smoker, former smoker, never smoked) and working (yes, no). Previous health conditions were evaluated by depressive symptoms through the 15-item Geriatric Depression Scale (GDS), short version, lack of depressive symptoms (≤ 5 points), and presence of depressive symptoms (> 5 points)¹⁶; a modified and validated version⁸ was used to assess cognitive status by the Mini-Mental State Examination (MMSE), not compromised (≥ 13 points) and compromised (≤ 12 points)⁹; self-perception of health was classified as positive (excellent, very good, good) or negative (fair, poor); hospitalization in the last 12 months (none, one or more); diseases referred by some health professional were hypertension, diabetes, and osteoporosis (no, yes); falls in the last 12 months (yes, no); use of medicines (none or one, two or more); (BMI < 22 kg/m² = underweight, 22 kg/m² \leq BMI ≤ 27 kg/m² = adequate and BMI > 27 kg/m² = overweight)¹⁷.

Statistical analysis

The sociodemographic, behavioral characteristics and health conditions by functional capacity were distributed by the Pearson chi-square test. The incidence of lower functional capacity was estimated using as numerator new cases of dependents for functional capacity, and the total number of elderly was the denominator. The measure of association was the relative risk estimated by log-binomial regression with a robust covariance matrix, and for statistical inference, the 95% confidence interval was estimated by the Newton-Raphson method. We inserted the statistically significant variables, those with a level of significance equal to or lower than 20% in the

bivariate analyses and those of theoretical relevance for the exploratory model in the final multivariate model. The statistical significance level was 5%, and the analyses were performed using the IBM SPSS program (IBM SPSS, 21.0, 2012, Armonk, NY: IBM Corp.). The Research Ethics Committee of the State University of Southwest of Bahia approved the research project. Participation was voluntary, and all study participants signed the Informed Consent Form.

Results

Thirty-one new cases of dependent elderly for functional capacity were identified in a population of 202 follow-up elderly. Thus, the incidence of older adults' lower functional capacity was 15.3%. Among those who became dependent at the end of follow-up, a higher proportion of unmarried women aged over 80 years who could not read and write, with a per capita income lower than one minimum wage and insufficiently active (Table 1) was observed. According to the elderly's previous health conditions, we found a higher proportion of dependents among those with depressive symptoms, diagnosed with diabetes and using two or more medicines (Table 2). The incidence of reduced functional capacity was statistically higher among elderly individuals aged 80 years or over (RR = 2.57; 95% CI: 1.37-4.82) and unmarried (RR = 2.71; 95% CI: 1.37-5.36) (Table 3). Among the previous health conditions, a statistically higher decline in functional capacity was observed in the elderly with a history of depressive symptoms (RR = 2.94; 95% CI: 1.48 - 5.82) (Table 4). The multivariate exploratory analysis of the sociodemographic, behavioral and previous health conditions associated with lower functional capacity of the elderly revealed that unmarried elderly individuals with previous depressive symptoms were at higher risk of becoming dependent for daily living activities, regardless of gender, age group, per capita household income, diabetes, use of medicines and level of physical activity (Table 5).

Discussion

Longitudinal studies related to lower functional capacity in the context of aging are still scarce, especially with seniors living in small cities with poor health indicators. The proportion of the elderly in municipalities with up to 5,000 inhab-

Table 1. Distribution of sociodemographic and behavioral characteristics according to the functional capacity of the elderly. Lafaiete Coutinho, Bahia, Brazil. 2011-2014.

Variables	Functional capacity				p-value
	Independent		Dependent		
	N	%	N	%	
Gender					0.989
Male	77	45.0	14	45.2	
Female	94	55.0	17	54.8	
Age group					0.003*
≥ 60 to ≤ 79	136	79.5	17	54.8	
≥ 80	35	20.5	14	45.2	
Schooling					0.513
Reads and writes	60	35.1	9	29.0	
Doesn't read/write	111	64.9	22	71.0	
Marital status					0.003*
Married	110	64.3	11	35.5	
Unmarried	61	35.7	20	64.5	
Religious activity					0.820
Participates	164	95.9	30	96.8	
Does not participate	7	4.1	1	3.2	
Per capita household income (R\$)††					0.182
> 510.00	100	59.9	13	46.4	
≤ 510.00	67	40.1	15	53.6	
Physical activity					0.204
Active	103	60.6	15	48.4	
Insufficiently active	67	39.4	16	51.6	
Alcohol use					0.964
No	154	90.1	28	90.3	
Yes	17	9.9	3	9.7	
Tobacco use					0.542
Never smoke	80	46.8	13	41.9	
Former smoker	72	42.1	16	51.6	
Currently smokes	19	11.1	2	6.5	
Working					0.462
Yes	20	11.8	5	16.7	
No	149	88.2	25	83.3	

* p < 0.05; †† Referring to the Brazilian minimum wage, in Reals, 2011.

itants is 13.8%, higher than the national rate of 10.8%¹⁸. Thus, this study aims to ensure the representativeness of older adults living and residing in similar conditions in the Brazilian northeast.

In this context, the results of this study reveal an incidence of a 15.3% decline in functional capacity in community-dwelling elderly between 2011 and 2014. Seniors without a spouse or partner were at a higher risk of becoming dependent compared to those with a relationship, as well as those with previous history of depressive symptoms when compared to those without

symptoms, regardless of factors such as gender, age group, income, diabetes, use of medicines and level of physical activity. A study conducted in Spain with individuals aged 65 years and over found an incidence of functional loss of 11.9%⁴. Despite the regional, social and cultural differences among the studied populations, similar results were also found in Brazil, in studies by Figueredo *et al.*¹⁹, with an incidence of 12.3%, and Moreira *et al.*²⁰ with 21.35%. However, a study carried out in São Paulo estimated a lower functional capacity in 27.47% of the elderly, and this higher

Table 2. Distribution of preconditions of health by level of functional capacity of the elderly. Lafaiete Coutinho, Bahia, Brazil. 2011-2014.

Variables	Functional capacity				p-value
	Independent		Dependent		
	N	%	N	%	
Depressive symptoms					0.002*
No	143	86.7	17	63.0	
Yes	22	13.3	10	37.0	
Cognitive status					0.348
Not compromised	118	70.7	16	61.5	
Compromised	49	29.3	10	38.5	
Self-perceived health					0.328
Positive	82	48.2	12	38.7	
Negative	88	51.8	19	61.3	
Hospitalization					0.407
None	138	80.7	23	74.2	
One or more	33	19.3	8	25.8	
Diabetes					0.130
No	148	89.7	24	80.0	
Yes	17	10.3	6	20.0	
Hypertension					0.391
No	63	37.1	9	29.0	
Yes	107	62.9	22	71.0	
Falls					0.465
No	136	80.0	23	74.2	
Yes	34	20.0	8	25.8	
Use of medicines					0.111
None or one	70	40.9	8	25.8	
Two or more	101	59.1	23	74.2	
BMI					0.778
Adequate	87	51.8	14	45.2	
Underweight	36	21.4	8	25.8	
Overweight	45	26.8	9	29.0	

* p < 0.05.

incidence can be explained by the methods used, since the latter included institutionalized elderly, as well as a modified Katz scale²¹.

The elderly without a spouse or partner had a lower functional capacity incidence about 2.7 times higher than the elderly with some relationship, married or living with a partner. Some studies have identified a greater functional decline in single, unmarried and widowed elderly individuals^{22,23}. The marital status may be related to the care provided by the partner in the most diverse aspects of life, such as health, food, leisure and occupational activities so that these realms of care can contribute to better functional capacity, or even contribute to its maintenance over time.

Older adults with depressive symptoms were approximately 2.4 times at higher risk of functional capacity impairment than those without such symptoms. Similar results were found by Tomita and Burns²⁴ with seniors in South Africa. Depressive symptoms are often accompanied by other symptoms, such as fatigue, physical weariness, loss of vitality, and unwillingness to perform daily activities²⁵, thus directly interfering with functional capacity over time and compromising the effort required to maintain functionality as well as the willingness to perform an activity.

The relationship between mental disorders such as depression, neuronal, hormonal and immune system disorders has been shown as a

Table 3. Relative risk (RR) of sociodemographic and behavioral risk factors and reduced functional capacity in community-dwelling elderly. Lafaiete Coutinho, Bahia, Brazil. 2011-2014.

Variables	N	Functional capacity	
		RR*	CI 95%†
Gender			
Male	91	15.4	1.00
Female	111	15.3	0.99 (0.51 - 1.90)
Age group			
≥ 60 to ≤ 79	153	11.1	1.00
≥ 80	49	28.6	2.57 (1.37 - 4.82)
Schooling			
Reads and writes	69	13.0	1.00
Doesn't read/write	133	16.5	1.26 (0.61 - 2.60)
Marital status			
Married	121	9.1	1.00
Unmarried	81	24.7	2.71 (1.37 - 5.36)
Religious activity			
Participates	194	15.5	1.00
Does not participate	8	12.5	0.80 (0.12 - 5.20)
Per capita household income (R\$) ‡			
> 510.00	113	11.5	1.00
≤ 510.00	82	18.3	1.59 (0.80 - 3.15)
Physical activity			
Active	118	12.7	1.00
Insufficiently active	83	19.3	1.51 (0.79-2.89)
Alcohol use			
No	182	15.4	1.00
Yes	20	15.0	0.97 (0.32-2.92)
Tobacco use			
Never smoke	93	14.0	1.00
Former smoker	88	18.2	1.30 (0.66 - 2.54)
Currently smokes	21	9.5	0.68 (0.16 - 2.79)
Working			
Yes	25	20.0	1.00
No	174	14.4	0.71 (0.30 - 1.70)

*Relative Risk; †Confidence interval; ‡ Referring to the Brazilian minimum wage in 2011.

causal mechanism that may predispose the elderly to other illnesses and even to declining physical health²⁶. As an example, the relationship between depression and reduced neurotransmitters such as serotonin, noradrenaline, and dopamine has been identified²⁷. Lower dopamine levels may lead to decreased motor performance and emotional modulation²⁸. Loss of interest or pleasure for almost all activities interferes with the social relationships of the older adults. Thus, social isolation, common in people with depressive symptoms, causes the elderly to participate less in community and religious events, reducing the frequency of making or receiving visits. Decreas-

ing these social relationships compromises the functional performance to perform the basic activities of daily living^{3,29}. The lack of motivation for social relationships leads to less health care, such as not seeking appropriate treatment and physical inactivity³⁰. Thus, several mechanisms related to the mental health of the elderly may explain lower functional capacity. It is necessary to detail the relative contribution of each of these possible causal ways so that public policies and interventions directed to a better functional capacity of the elderly can be improved.

Longitudinal studies addressing other risk factors for reduced functional capacity should

Table 4. Preconditions for health and reduced functional capacity in community-dwelling elderly. Lafaiete Coutinho, Bahia, Brazil. 2011-2014.

Variables	N	%	Functional capacity	
			RR*	CI 95%†
Depressive symptoms				
No	160	10.6	1.00	
Yes	32	31.3	2.94	(1.48 - 5.82)
Cognitive status				
Not compromised	134	11.9	1.00	
Compromised	59	16.9	1.41	(0.68 - 2.94)
Self-perceived health				
Positive	94	12.8	1.00	
Negative	107	17.8	1.39	(0.71 - 2.71)
Hospitalization				
None	161	14.3	1.00	
One or more	41	19.5	1.36	(0.66 - 2.82)
Diabetes				
No	172	14.0	1.00	
Yes	23	26.1	1.87	(0.85 - 4.08)
Hypertension				
No	72	12.5	1.00	
Yes	129	17.1	1.36	(0.66 - 2.80)
Falls				
No	159	14.5	1.00	
Yes	42	19.0	1.31	(0.63 - 2.73)
Use of medicines				
None or one	78	10.3	1.00	
Two or more	124	18.5	1.80	(0.85 - 3.84)
BMI				
Adequate	101	13.9	1.00	
Underweight	44	18.2	1.31	(0.59 - 2.90)
Overweight	54	16.7	1.20	(0.55 - 2.59)

* Relative Risk; † Confidence interval.

Table 5. Risk factors for the reduced functional capacity of community-dwelling elderly. (N = 178) Lafaiete Coutinho, Bahia, Brazil, 2011-2014.

Model*	RR†	CI 95%‡
Female	0.67	(0.31 - 1.41)
Age group ≥ 80	1.61	(0.75 - 3.43)
Marital status unmarried	2.75	(1.15 - 6.57)
Per capita household income ≤ 510.00 (R\$) §	1.24	(0.56 - 2.72)
With depressive symptoms	2.41	(1.15 - 5.06)
With diabetes	1.88	(0.75 - 4.70)
Use of two or more medicines	1.96	(0.61 - 6.32)
Inactive for physical activity	0.70	(0.33 - 1.49)

The following reference categories were considered: male, age 60 to 79 years, married, household income > 510.00 Reals, without depressive symptoms, without a diagnosis of diabetes, use of none or one medicine, active for physical activity.

* Multivariate model with adjustment between variables;

† Relative Risk; ‡ Confidence interval; § Referring to the Brazilian minimum wage in 2011.

be conducted, especially with a larger population and with a more extended follow-up period. The identification of potentially modifiable risk factors may become a fundamental element for the maintenance and recovery of the functional capacity of the elderly. Thus, actions of the health promotion services should seek the autonomy and independence of the elderly, primarily to perform the basic activities of daily living.

Conclusion

The results of this study indicate that the incidence of lower functional capacity in elderly people living in a community in the Northeast of Brazil was 15.3%, and the main risk factors

found were being unmarried and having depressive symptoms, regardless of gender, age group, income, diabetes, use of medicines and level of physical activity.

Collaborations

FS Matos, CS Jesus, JAO Carneiro, RA Coqueiro, MH Fernandes and TA Brito contributed substantially to the design and planning, data analysis and interpretation, and participated in the approval of the final version of the manuscript.

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