

Daily sitting time and physical performance in oldest adults

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Abstract

The aim of this study was to verify the physical performance (PP) and daily sitting time in the oldest population in a rural community dwelling in southern Brazil. In addition, to analyze the association between physical performance tests (PPT) and daily sitting time (ST). This was a cross-sectional, population-based household study. All residents aged 80 years and older were examined in 2010. PPT included standing balance (four measures of static balance), five times "sit-to-stand" test and "pick up a pen" test (assessed by time). Daily ST was estimated by questionnaire. Women of the younger age groups displayed better results in the PPT compared to older women. The men had good results in the tests, independent from their age group (except for 95–100 years of age). For women, the mean time in the "sit to stand" test decreased with the advancing age, whereas for men, we observed the opposite. Men and women displayed similar means in the "pick up a pen" test. The mean daily ST increased with the advancement of age. After adjustment for sex, age, and number of morbidities, the daily ST was ~52 minutes lower for those with better balance (β -52.6; $p = 0.001$). For those with better performance in the "sit to stand" test, the time was ~35 minutes lower (β -35.8; $p = 0.001$). Men and women differ in the rate of decline in PPT. The results suggest that longer sitting time is a limiting factor of good performance in tests for the oldest of the population.

KEYWORDS: Sitting; Aging; Sedentary lifestyle; Physical performance; Time and motion studies.

Introduction

The longevity of the Brazilian population requires attention due to the increase in the number of people aged 80 or older¹. The 2010 census revealed approximately three million Brazilian people in this age group, with 24,236 elderly persons over 100 years of age². With aging comes chronic diseases and functional limitations, which are predictors of disability in older people³ reduce their quality of life⁴. Physical performance tests can assess functional limitations and make it possible to introduce actions to prevent or treat incapacities³ along with structured physical activity programs.

Physical activity levels are one of the aspects related to physical function⁵. Active older people have a lower risk of functional limitation and disability. Recently, SEGUIN et al.⁶ showed a strong association between

sedentary time and diminished physical function. Interest in the health effects of sedentary behavior has increased in the last decade⁷, and the time spent sitting has recently been used to identify sedentary behavior^{6,7}. In Brazil, there have been few studies addressing time spent sitting among adults⁸ or only among older people⁹. Specifically, for the oldest population, no national studies were found relating physical performance tests and daily sitting time.

The objectives of this study were to assess the physical performance and daily sitting time in the oldest population in a rural community dwelling in southern Brazil. The population was examined according to sex and age group. Another objective was to analyze the association between physical performance tests and daily sitting time.

Method

Setting and study population

This was a cross-sectional study based on baseline data from an epidemiological household-based population survey (*“Effectiveness of health actions, physical activity and nutrition in older adults of Antônio Carlos – SC”*). The survey was conducted with older adults (≥ 60 years) residing in the municipality of Antônio Carlos (AC-SC), state of Santa Catarina, South of Brazil. Details about the setting and study population have already been published¹⁰ and will be presented in a shortened form. The municipality of AC-SC has a high human development index (HDI: 0.827) and is the biggest vegetable producer in Santa Catarina. In 2010, the population of AC-SC consisted of 7,458 inhabitants (12.8% were 60 or over) and its population is mostly (~70%) distributed across small farms².

The present study utilizes data of all residents aged 80 years or older, identified by information from the Family Health Strategy Program (Portuguese acronym: ESF), in 2009. The ESF is a primary healthcare program that covers the whole municipality. We identified 135 individuals, and this number is in accordance to Brazilian census data². One person was absent during the data collection (criteria for sample loss), resulting in 134 attendees.

Data were collected using a form based on the questionnaire and physical tests of the SABE survey. The SABE survey was accomplished in Brazil and six more countries in Latin America and the Caribbean using validated instruments and was considered appropriate to identify what is relevant to the aging process in the region¹¹.

Two trained interviewers collected the data during on home visit (February to April 2010) and the performance tests were conducted after the questionnaire. The older adult with cognitive impairment had a proxy informant (parent or caregiver) to answer the questions. The precision and accuracy of the physical performance measures were confirmed before the collection of data (intra-observer technical error = 0.93; inter-observer technical error = 0.89). The Human Beings Research Ethical Committee of the Universidade Federal de Santa Catarina (Case No. 189/09) approved the research. Participation was voluntary, and a signed informed consent form was obtained.

Physical performance tests

The older adults were excluded from analysis if they refused to take the tests or failed to understand the instructions due poor interpretation. Persons who were unable to perform the measurements due physical limitations were included in the analysis (unable category) and comprise the following: a) individuals who needed help to remain standing up or could not walk; b) those who had paralysis of a limb, used a prosthesis, or could not keep their balance; c) older adults who had undergone eye surgery (cataract or retina) in the past 6 weeks did not take the “pick up a pen” test.

The “five times sit to stand” test (a measure of functional lower limb muscle strength/resistance)¹² consisted of the time taken in seconds to rise five times from an armless chair (with crossed arms). This test was considered to be successfully accomplished when completed in <60 seconds. The classifications used were “unable” (time > 60 seconds), “weak” (>16 to 60 seconds), “good” (>10 to 16 seconds), and “very good” (≤ 10 seconds)³.

For the “pick up a pen” test (for mobility)¹³ the participants had to bend down, pick up a pen from the floor (at a distance of 30 cm from the tip of the toes), and return to the initial position within ≤ 30 seconds. For this test, the classifications used were “unable” (time > 30 seconds), “weak” (>6 to ≤ 30 seconds), “good” (>2 to ≤ 6 seconds), and “very good” (≤ 2 seconds)³.

Balance was determined by four measures¹², performed in sequence (10 seconds each): side-by-side stand; full tandem stand; one-leg (right) stand; and one-leg (left) stand. If the interviewee could not complete the first measure, the subsequent measures could not be completed. The classification for this test was taken from BARBOSA et al.³.

Daily sitting time

Daily sitting time was measured by domain 5 of the International Physical Activity Questionnaire (IPAQ)¹⁴. This domain corresponds to the time that a person spends sitting down at different places (at home, community groups, and other places), doing activities such as craft work, watching television, reading, making phone calls, having meals, and resting. Sitting time was registered in minutes during

one weekday and one weekend day. The final result was obtained according to the following calculation:

Total sitting time (minutes/week) = Minutes sitting time on one weekday * 5 weekdays + Minutes sitting time on a weekend day * 2.

To ascertain the mean sitting time, the value obtained was divided by seven days of the week. Non-walking individuals ($n=21$) were excluded from the statistical analyses for this variable.

Literacy (yes; no), living arrangement (alone; accomplished), number of morbidities (0; 1; 2 or more), and cognitive status (normal; altered) were used to characterize the population. A screening

test (Mini Mental State Examination)¹⁵ verified the cognitive status.

Statistical procedure

For descriptive analysis of the variables, we used the mean, median, standard deviation, and proportion of individuals according to sex and age groups (80-84, 85-89, 90-94, and ≥ 95 years). The associations between the dependent variable (sitting time) and the explanatory variables (physical performance tests) were carried out using multiple linear regression (crude and adjusted; 95% confidence interval). The statistical program SPSS (version 16.0) was used to analyze the data. The significance level adopted was $p < 0.05$.

Results

The age of the participants ($n=134$) varied from 80 to 100 years (84.7 ± 4.6 years). The mean ages were 85 ± 4.3 years among men and 84.4 ± 4.7 years

among women. The sample comprised mostly women, individuals with no cognitive impairment, and individuals with 2 or more morbidities (TABLE 1).

TABLE 1 – Distribution (%) of older adults for sex according to socio-demographic and health conditions.

	Men		Women	
	<i>n</i>	%	<i>n</i>	%
Age (years)				
80 – 84	33	58.9	52	66.7
85 – 89	14	25.0	15	19.2
90 – 94	08	14.3	05	6.4
95 – 100	01	1.8	06	7.7
Literacy				
Yes	42	75.0	69	88.5
No	14	25.0	09	11.5
Living arrangement				
Alone	06	10.7	17	21.8
Accompanied	50	89.3	61	78.2
Cognitive Status				
Cognitive deficit	11	19.6	25	32.1
No cognitive deficit	45	80.4	53	67.9
Number of morbidity				
0	12	22.6	08	10.3
1	17	32.1	24	30.8
2 or more	24	45.3	46	58.9

Women of the younger age groups displayed better results in the physical performance tests compared to older women. The men had good results in the tests, independent from their age group, except for the

oldest man (95-100 years of age) who was classified as “unable.” The lowest daily sitting time (median of 1,845 minutes/week or 4 hours/day) was observed in younger men and women (80-84 age group) (TABLE 2).

TABLE 2 – Physical performance tests and daily sitting time according to age and sex.

	80-84 y		85-89 y		90-94 y		95-100 y	
	n	%	n	%	n	%	n	%
Women								
Sit to stand								
Unable	15	28.8	04	28.6	03	60.0	03	50.0
Weak	15	28.8	02	14.3	01	20.0	01	16.7
Good	16	30.9	07	50.0	01	20.0	02	33.3
Very good	06	11.5	01	7.1	-	-	-	-
Pick up a pen								
Unable	11	21.2	04	26.7	03	60.0	02	33.4
Weak	04	7.7	-	-	-	-	02	33.3
Good	36	69.2	11	73.3	02	40.0	02	33.3
Very good	01	1.9	-	-	-	-	-	-
Balance								
Unable	08	15.4	04	26.7	03	60.0	02	33.4
Weak	10	19.2	03	20.0	02	40.0	02	33.3
Good	23	44.2	03	20.0	-	-	02	33.3
Very good	11	21.2	05	33.3	-	-	-	-
Daily sitting time[†]								
<4 hours/Day	23	52.3	06	46.2	-	-	01	25.0
≥4 hours/Day	21	47.7	07	53.8	02	100.0	03	75.0
Men								
Sit to stand*								
Unable	03	9.1	03	25.0	02	25.0	01	100.0
Weak	06	18.2	01	8.3	03	37.5	-	-
Good	16	48.5	07	58.3	03	37.5	-	-
Very good	08	24.2	01	8.3	-	-	-	-
Pick up a pen**								
Unable	01	3.0	03	23.1	02	25.0	01	100.0
Weak	02	6.1	-	-	-	-	-	-
Good	29	87.9	09	69.2	06	75.0	-	-
Very good	01	3.0	01	7.7	-	-	-	-
Balance								
Unable	01	3.0	03	21.4	02	25.0	01	100.0
Weak	02	6.1	01	7.1	01	12.5	-	-
Good	08	24.2	06	42.9	02	25.0	-	-
Very good	22	66.7	04	28.6	03	37.5	-	-
Daily sitting time^{††}								
<4 hours/day	20	62.5	02	18.2	04	66.7	-	-
≥4 hours/day	12	37.5	09	81.8	02	33.3	01	100.0

*n=54 **n=55

[†]Women: non-walking individuals were excluded (n=15)

^{††}Men: non-walking individuals were excluded (n= 6)

For women, the mean time in the “five times sit to stand” test decreased with the advancing age, whereas for men, we observed the opposite. In relation to the “pick up the pen” test, the men and women displayed similar means in all age groups. For daily sitting time, the mean was 1,908.9 minutes/week (± 784.6). The groups of women aged 90-94 years and 80-84 years had the highest and lowest means, respectively (TABLE 3). The mean daily sitting time increased with the advancement of age for both sexes.

The daily sitting time showed an association with the “five times sit to stand” test and the balance test (TABLE 4). After adjustment for sex, age, and number of morbidities, the daily sitting time was ~ 52 minutes lower for those with better balance ($\beta -52.6$; 95%IC: -78,8 to -26.3; $p = 0.001$). For those with better performance in the “five times sit to stand” test, the time was ~ 35 minutes lower ($\beta -35.8$; 95%IC: -59.7 to -11.9; $p = 0.001$).

TABLE 3 – Mean (\bar{X}) and standard deviation (DP) of the physical performance tests (seconds) and daily sitting time (minutes) according to age and sex.

	80-84 y			85-89 y			90-94 y			95-100 y		
	n	\bar{X}	SD	n	\bar{X}	SD	n	\bar{X}	SD	n	\bar{X}	SD
Women												
Sit to stand	37	15.4	6.2	10	14.5	5.0	02	13.0	4.2	03	13.7	2.5
Pick up a pen	41	3.4	2.1	11	2.7	0.6	02	3.5	2.1	04	4.5	1.9
Daily Sitting time (minutes/week)	50	1958.9	718.9	15	1996.1	911.6	05	2730.0	96.9	06	2310.0	999.8
Men												
Sit to stand	30	12.5	4.3	09	12.3	2.5	06	16.5	7.1	01	-	-
Pick up a pen	32	2.8	1.4	10	2.2	0.6	06	2.7	1.2	-	-	-
Daily Sitting time (minutes/week)	33	1599.5	732.9	14	2138.2	548.8	08	1660.0	711.6	01	4200.0*	-

*Total value in minutes/week ($n=1$).

TABLE 4 – Analysis of linear regression to test the association between each physical performance test and daily sitting time.

	Crude		Adjusted*	
	β (95%CI)	p-value	β (95% CI)	p-value
Sit to stand	-41.6 (-64.4 to -18.8)	0.001	-35.8 (-59.7 to -11.9)	0.001
Pick up a pen	-35.8 (-71.2 to 0.4)	0.048	-26.6 (-62.9 to 9.5)	0.147
Balance	-55.8(-78.8 to -32.8)	0.001	-52.6 (-78.8 to -26.3)	0.001

* Adjusted for sex, age group and morbidities. CI 95%: Confidence interval 95%.

Discussion

To our knowledge, this is the first population – and household-based study carried out with the oldest age group from rural and urban areas in Brazilian and investigating the association between physical performance and sitting time. The time spent sitting can be an alternative to long questionnaires on physical activity levels to ascertain sedentary behavior, especially in epidemiological studies. The results of the present study showed that younger women had good results in the physical

performance tests, whereas the men of all age groups had good results in all tests. This data is similar to the results of other investigations^{3,16,17}. The difference between the sexes may be explained by the greater life expectancy of women that display a higher number of morbidity and health complications which can lead to functional limitation¹⁸. Furthermore, men are more often employed in jobs involving physical activities such as farming¹⁰, which favors the maintenance of physical performance.

In the present study, only women showed a reduction in motor performance with advancing age, in contrast to previous studies^{19,20}. The advancing age increases the degree of impairment and compromises physical performance³. The good performance of men of all ages may be related to survival bias or to shorter time spent in sedentary activities. In relation to daily sitting time, women of the 90-94 age group presented the highest daily sitting time, whereas the younger group (80 to 84 years) had the lowest mean. Our results are consistent with previous studies^{9,21,22}, which indicate increasing daily sitting time with the advancement of age. The increase in time spent in sedentary behaviors may reflect an increase of comorbidities²², a decrease of functional capacity⁴ and an increase of physical incapacity^{3,6,12}.

The results of the mean daily sitting time were similar to previous studies^{8,23,24}. The daily sitting time considered healthy or unhealthy for older people has not been established⁹. However, the identification of the time that older adults spend sitting can help in the development of actions to reduce sedentary behavior. The adjusted analyses identified an association between lower daily sitting time and better physical performance in the balance and "five times sit to stand" tests. In a study by SEGUIN et al.⁶, women who reported the largest amounts of sedentary time presented higher physical function compared to those reporting less sedentary time. These results support the deleterious health outcomes of higher time spent

sitting on physical function and performance. Daily sitting time should be taken into consideration when assessing the functional limitations of the oldest of the population. Among the limitations, we highlight that the study design does not allow for an inference of cause and effect relationships. The indirect measure of daily sitting time can be a limitation, as it takes memory bias into consideration. Furthermore, we highlight that although the IPAQ has been validated and is used in different countries, it has been used more often to assess the total level of physical activity rather than to assess sitting time.

The results give evidence for better physical performance with younger women, whereas for men, age did not influence physical performance, and all age groups displayed good results. Older adults from the youngest age group (80-84 years) showed the lowest means of time spent sitting, and women from the oldest age group (90-94 years) displayed the highest mean. Older people who remained seated for longer periods displayed the poorest results in the "five times sit to stand" and balance tests. The results suggest that longer sitting time is a limiting factor of good performance in tests for the oldest of the population. However, more studies are needed in a range of settings because of varying lifestyles. Due to the limitations of the present study, we also recommend longitudinal studies, direct assessment of sedentary behavior, and the use of different motor performance tests.

Resumo

Tempo sentado e desempenho motor em idosos longevos

Objetivou-se verificar o desempenho motor e o tempo sentado, bem como a associação entre essas variáveis em idosos longevos, residentes em um município do sul do Brasil. Estudo transversal e de base domiciliar, realizado em 2010 com idosos de 80 anos ou mais. O desempenho motor foi avaliado pelos testes: "sentar e levantar" e "agachar e pegar o lápis" (avaliados por tempo) e "equilíbrio" (quatro medidas de equilíbrio estático). A avaliação do tempo gasto sentado foi realizada por questionário. Os resultados mostraram que mulheres dos grupos etários mais jovens apresentaram melhores resultados nos testes de desempenho motor. Os homens tiveram bons resultados nos testes, independente do grupo etário (exceto para o grupo 95-100 anos). Para as mulheres, o tempo médio no teste "sentar e levantar" diminuiu com o avanço da idade, observando o contrário para os homens. Homens e mulheres tiveram resultados semelhantes para o teste "agachar e pegar o lápis". A média diária do tempo sentado aumentou com o avanço da idade. Após o ajuste para sexo, idade e número de morbidades, a média do tempo sentado diário foi, aproximadamente, 52 minutos menor para os idosos com melhor equilíbrio (β -52,6; $p=0,001$) e 35 minutos menor (β -35,8; $p=0,001$) para os idosos com melhor desempenho no teste "sentar e levantar". Homens e mulheres diferem quanto ao declínio nos

testes de desempenho motor. Os resultados sugerem que, em idosos longevos, o maior tempo sentado é limitante para o bom desempenho nos testes.

PALAVRAS-CHAVE: Tempo sentado; Envelhecimento; Estilo de vida sedentário; Desempenho motor; Estudos de tempo e movimento.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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