

# Functional flexibility in institutionalized sedentary older adults

## A flexibilidade funcional em idosos sedentários institucionalizados

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**Abstract** – The aging process leads to deterioration in physiological functions, decreasing functional capacity. Since physical exercise reduces deleterious effects, measuring physical condition is necessary in older adults. The aim of this study was to verify the evolution of the range of motion in institutionalized sedentary older adults. The sample consisted of 19 volunteers aged 65–95 years who completed the Chair Sit-and-Reach test (CSR) and the Back-Scratch test (BS) to measure flexibility of the lower and upper limbs, respectively, before and after a period of 12 weeks without intervention. The results showed significant decrease during the control period (BS,  $p=0.004$ ; CSR,  $p=0.001$ ). These findings confirm that physical inactivity could lead to important loss of flexibility of institutionalized individuals, indicating decline of the elastic properties of musculoskeletal tissues and of connective tissues of joints. Therefore, the participation of institutionalized older adults in properly prescribed and guided physical exercises should be continuous and regular.

**Key words:** Flexibility; Older adults; Sedentary Behavior.

**Resumo** – O envelhecimento implica uma deterioração das funções fisiológicas, podendo diminuir a capacidade funcional. O exercício físico poderia minimizar esses efeitos deletérios, por isso é necessário conhecer a condição física dos idosos. O objetivo deste estudo é verificar a evolução da amplitude de movimento em idosos institucionalizados e sedentários. A amostra foi composta por 19 voluntários, com idades entre 65 e 95 anos, que concluíram os testes Chair Sit and Reach (CSR) e Back Scratch (BS) para medir a flexibilidade dos membros inferiores e superiores, respectivamente, antes e depois de um período de 12 semanas sem intervenção. Os resultados mostraram uma diminuição significativa durante o período de controle (BS,  $p=0.004$ ; RSE,  $p=0.001$ ). Esses achados confirmam que a inatividade física pode implicar uma perda significativa de flexibilidade dos idosos institucionalizados, indicando uma diminuição nas propriedades elásticas do tecido musculoesquelético e dos tecidos conjuntivos nas articulações. Portanto, a participação de idosos institucionalizados no exercício físico orientado e adequadamente prescrito deve ser contínua e regular.

**Palavras-chave:** Flexibilidade; Idosos; Comportamento Sedentário.

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## INTRODUCTION

The increasing age of the population requires the implementation of public, health and social policies focused on the care of the elderly. The objective of these measures should consider that the aging process should occur with the least possible deleterious effect on the functional capacity of people for the benefit of both quality of life of individuals and society itself in terms of reduction of health expenses for the care of individuals with functional impairments. In this sense, it is well known that physically active older adults are less likely of developing chronic diseases<sup>1</sup>.

All physiological changes inherent to aging can directly or indirectly influence the level of physical activity of older adults as it is a conditioner of functionality and health status of an individual<sup>2</sup>. In addition to the increased risk of diseases and injury in this age group, aging leads to difficulties in the performance of activities of the daily living (ADL) and instrumental activities of the daily living (IADL), reducing the ability to perform these tasks autonomously and independently. In other words, functionality or functional capacity understood as the physical ability to carry out normal daily activities in an independent manner and maintaining adequate physiological reserve<sup>3</sup> can be aggravated with aging.

Such limitations in the functional capacity of older adults can result in a situation of disability, feared on many occasions by the aging population, which struggles to accept and adapt to changes inherent to this stage of life. In turn, aging is considered to be a complex process and, in most cases, a traumatic transition phase. However, there are few studies focused on the assessment of the health status and physical condition of institutionalized older adults; although it is essential to maintain the physical condition of this population at minimum level to keep functionality and independence for satisfactory aging and with the least possible deleterious effects<sup>4</sup>. In addition, it is known that institutionalized older adults are at greater risk of suffering from loss of physical functionality in the performance of ADL and IADL compared to those who live at their homes<sup>5</sup>.

To influence the functional capacity and physical condition in the elderly, the best strategy is to use interventions based on multicomponent physical exercises. Thus, interventions based on the development of muscle strength have been shown to prevent the risk of falls<sup>6</sup>, improve performance in ADL and IADL<sup>7</sup>, reduce locomotion problems and gait disturbances<sup>8</sup>, among other benefits. The development of flexibility or range of motion is also essential in the elderly, as it is closely related to quality of life<sup>9</sup>, performance of daily tasks<sup>10</sup> and improvement of functions in general<sup>11</sup>.

The range of motion is impaired by aging<sup>12,13</sup>, reductions can occur in certain joints of up to 20–40%<sup>14</sup>. In addition, sedentary behavior is another important aggravating factor of decreased flexibility<sup>15</sup>, and reduced levels could increase the risk of back pain in different populations<sup>16</sup>, important gait limitations<sup>8</sup> and higher risk of falls in older people<sup>17</sup>.

Therefore, the American College of Sports Medicine<sup>18</sup> highlights the

need for older people to maintain adequate level of range of motion in all joints to preserve functional capacity, maintain greater degree of autonomy, better performance in ADL, minimize the appearance of body pain<sup>19</sup> and maintain or improve quality of life<sup>20</sup>.

Specifically, the flexibility of some joints such shoulder has more importance in ADL and IADL such as dressing and undressing, combing, reaching high objects, cleaning, etc., and its maintenance is crucial for the functional independence of older adults<sup>21</sup>. Similarly, minimizing the loss of flexibility in lower limbs is essential for this population, especially of hamstring muscles, since loss of flexibility negatively affects the mobility of the pelvis and leads to unwanted biomechanical changes in the distribution of pressures in the spine, allowing the appearance of postural restructuring and spinal conditions<sup>22</sup>. This situation could lead to significant limitations when sitting and standing up, bending down or changing positions; among other everyday actions.

Given the importance of flexibility for older individuals in their functional performance<sup>20</sup> and the need to provide more data on the status of this physical component in one of the population segments with the highest risk of suffering functional dependence<sup>5</sup>, this study aims to evaluate the joint mobility of the upper and lower limbs in institutionalized sedentary older adults.

## METHODS

The number of older adults who initially participated in the first application of the tests was 21 subjects, but two cases were lost in the second measurement. Therefore, the final sample consisted of 19 volunteers (11 men and 8 women) aged 65-95years ( $M= 75.3 \pm 9.8$  years).

All participants were permanent residents of institutions for the elderly located in the city of Belo Horizonte, Brazil. Residences were private, belonging to a single owner, and offered monthly medical services, biweekly nutritionist, weekly physiotherapy, specialized caregivers and recreational activities such as board games, bingo and cards. In addition, family members could visit their relatives and leave the residence with them at any time for a walk or even for the weekend.

It is important to mention that the practice of physical activity offered by institutions was very limited and not guided by professionals. Physical activities were limited to the performance of personal care tasks, room organization, short walks through physical spaces of the institution, non-active leisure activities and weekly physiotherapeutic service only for those who needed some type of rehabilitation procedure.

As inclusion criteria, it was established that all institutionalized participants were 65 years of age or older, functionally independent and had characteristics that, according to Cabrera de León et al.<sup>23</sup>, classified them as sedentary people. Likewise, participants should have a medical certificate for the performance of physical activities and no signs of suffering

from musculoskeletal and cognitive limitations that could compromise the execution of movements.

It is important to mention that, before the final sample selection, an interview was carried out with the respective managers of institutions and with caregivers who were most familiar with participants to assess their functional dependence through relevant questions<sup>24</sup> in order to make preselection consistent with the defined inclusion criteria. Regarding ethical aspects, the norms established by the Research Ethics Committee of the Autonomous University of Madrid (Spain) were respected, preserving the anonymity and confidentiality of institutions and participants. Authorizations for the study were obtained and all participants were duly informed about the objectives and procedures of the research, as well as their voluntary participation and ethical standards.

## Procedures

This is a longitudinal, non-interventionist, observational study on the evolution of flexibility in sedentary and institutionalized older adults. To determine the study variable, the chair sit-and-reach test (CSR) and the back-scratch test (BS) were used in order to measure flexibility of lower and upper limbs. The aforementioned flexibility tests of the SFT test battery created by Rikli and Jones<sup>3</sup> not only are highly reliable ( $r=0.96$  and  $r=0.95$ , respectively) with proven validity, but also safe and easy to apply.

A semi-open interview was conducted with each participant before the application of tests in order to find out a little more about the profile of each participant, including their physical and emotional state and level of functional independence. The administration of tests was always carried out in the morning and in institutions themselves to avoid the influence of environmental and temporal conditions. Tests were carried out twice (Pre-Test and Post-Test), with a period of 12 weeks between them, which is considered minimum to observe physiological adaptations or mismatches.

For the realization of these tests, all the protocols established by Rikli and Jones<sup>3</sup> were respected, in regard to the previous warm-up, to provide the pertinent information to the participants about the execution of the movements, and the reproduction of the same by the evaluator to exemplify; as well as a short period of time for participants to become familiar with the movements and choose the side of preference to be evaluated, that is, the side with which the participants felt more competent. Specific standard procedures were also followed in the application of each test, its score, registration, data analysis and safety standards for execution.

The instruments used for CSR administration were a chair with a height of 43 centimeters and a 50 cm long ruler (with precision in mm). For the development of BS, only a 50 cm long ruler was used (with precision in mm).

## Statistical analysis

The statistical program Statistical Package for the Social Sciences - SPSS for Windows in version 20.0 was used for the statistical analysis. A des-

criptive analysis of the variables of the age of the sample was performed, in addition to the variables investigated containing the mean, maximum, minimum and standard deviations was applied for the variables and the Shapiro-Wilk test to verify the normal distribution of the data. The significance level adopted was  $p < 0.05$ . The t-test was applied to analyze differences between Pre-Test and the Post-Test results.

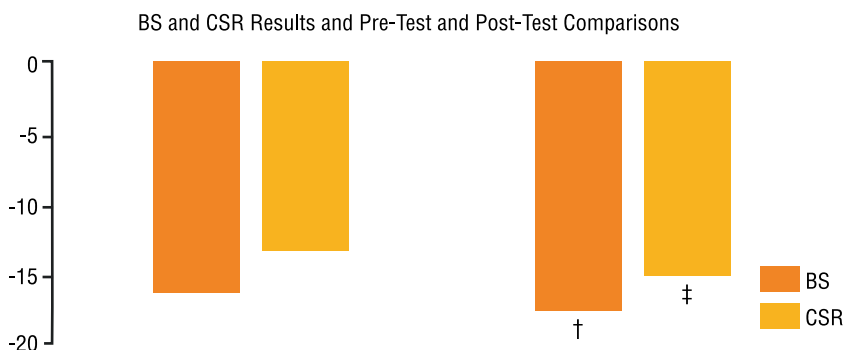
## RESULTS

Table 1 summarizes the results obtained in both tests and the comparison between the first and the second measurement with level of statistical significance between them.

**Table 1.** BS and CSR Results and Pre-Test and Post-Test Comparisons

	Results
N (sample)	19
Male	11
Female	8
Age (years)	75.3±9.8
BS (cm)	
Pre-Test	-16.5±12.60
Post-Test	-17.8±12.50†
CSR (cm)	
Pre-Test	-13.4±10.10
Post-Test	-15.4±10.40‡

Note. †  $p = 0.004$ ; ‡  $p = 0.001$



**Figure 1.** BS and CSR Results and Pre-Test and Post-Test Comparisons

Note. †  $p = 0.004$ ; ‡  $p = 0.001$

Results have shown significant loss of joint mobility in joints evaluated during the three months of the control period (BS,  $p=0.004$ ; CSR,  $p=0.001$ ).

## DISCUSSION

The results of our observational study confirm that physical inactivity could lead to significant deterioration in the levels of flexibility and range

of motion of institutionalized individuals. In this sense, it seems that the absence of physical activities directed by the institution's staff, together with the maintenance of a sedentary lifestyle by the participants of this study, in just 12 weeks of time, worsened considerably according to the results obtained in the BS and CSR tests. To these questions it is important to also add the general absence of routines and exercises aimed at improving and maintaining joint mobility that has characterized the behavior of the sample of this research. These results indicated deterioration of the elastic properties of musculoskeletal tissue and connective tissues that make up joints associated with aging, being in line with results found by other researchers<sup>12,13</sup>.

In a recent research<sup>25</sup> that included 253 institutionalized older adults from Bogota, the authors verified that the institutionalization has negative impact on the physical condition of individuals, with CSR results of  $11.4 \pm 8.2$  in men and  $-1.1 \pm 4.8$  in women; and BS of  $-16.5 \pm 10.7$  for men and  $-7.3 \pm 6.3$  for women. Despite their lack of comparisons between genders, these results are similar to those obtained here, where participants had even lower values before and after the follow-up period.

However, the aging process should not be considered as the only factor that causes reduction in the range of motion in institutionalized individuals, since the sedentary lifestyle and the restricted use of joints in the performance of daily tasks could also accentuate this reduction. Santos et al.<sup>15</sup> observed in a sample of 312 older adults that sedentary behaviors have direct negative influence on the flexibility of the lower limbs; regardless of practice of physical activity of moderate to vigorous intensity. Thus, the authors concluded that older people who spent more time performing physical activities or less time in sedentary behaviors had better overall functional physical status.

Dogra and Stathokostas<sup>4</sup> observed in a sample of 9,478 older adults (over 65 years of age), in addition to 10,060 middle-aged adults (45-64 years) that both regular practice of physical activity and reduction of sedentary behaviors minimize the decrease in functional capacity associated with aging. In addition, physically active older people have greater autonomy compared to sedentary people in the performance of daily tasks<sup>26</sup>, so the deterioration of certain age-related physiological functions could be delayed.

Specifically, levels of flexibility and balance have been related to both functional capacity and risk of falls among individuals over 65 years of age, concluding that the performance of a proprioceptive exercise program that improves these capacities brings important benefits to their functional status<sup>17</sup>. Likewise, it has been observed that a 12-week training free period followed by a multi-component exercise program entails decreases in flexibility levels<sup>27</sup>; so it is possible to appreciate the involution of this skill if it does not develop properly.

In any case, none of the members of our sample reported great difficulties in carrying out daily activities, despite the reduced flexibility levels

presented. Considering that subjects live permanently in institutions, it is possible that the daily activities carried out on a daily basis did not reflect the need to be autonomous and / or self-sufficient. In fact, Castellanos, Gómez and Guerrero<sup>28</sup> observed that institutionalized older adults had lower fitness levels compared to those who lived in their homes, probably due to the lower need to perform daily tasks (shopping, cooking, cleaning, etc.) or also because people who begin to be more dependent are more likely of living in institutions compared to those who are more autonomous.

Regarding other important physical condition components associated with health, Preto et al.<sup>29</sup> found significant reduction in the levels of muscle strength and control of arms and legs and in dynamic agility / balance; as well as flexibility of lower and upper limbs. The authors also observed significant reduction in self-efficacy to avoid falls after 24 months of follow-up; highlighting once again, the need to stop, slow down or minimize the decrease in the functional capacity of older adults through the implementation of multi-component exercise programs within institutions and residences, encouraging active lifestyle among residents. A possible solution to diminish detriment in physical performance for this population could be to promote Vivifrail program<sup>30</sup> which includes both evaluation protocols and physical exercise prescription designed to attend the different physical needs for older people, including those with frailty syndrome.

As for limitations of our study, we highlight the difficulty in finding a sample that had the characteristics presented, as a result, the sample size could not be wider. Also, future research should consider intervening experimentally with the implementation of physical exercise programs aimed at developing flexibility and breadth of movement and comparing the results with a control group of the same population profile.

## CONCLUSIONS

The evolution of the articular mobility of upper and lower limbs of sedentary older adults who have participated in this research has significantly decreased. It could be concluded that the loss of this physical capacity is strongly associated with the lack of physical activity and establishment of habits and lifestyles compatible with the sedentary lifestyle characteristic of people living in nursing homes. Since the well-being and quality of life of older adults largely depend on their functional capacity and level of autonomy for the performance of daily tasks, it would be advisable to implement measures aimed at both prevention and intervention focused on the improvement and / or maintenance of functional capacity.

The results of the present study are similar to those obtained in previous studies and point that institutions for older adults should offer activities that encourage participation in physical exercise programs adapted to their needs in order to improve and maintain their quality of life and functional autonomy.

Among the most effective measures to achieve this goal, multi-com-



ponent exercise programs have proven to be safe and effective for older adults. Given the deterioration of flexibility associated with aging, these programs should consider the work of the range of motion and extensibility of muscles.

In the case of institutionalized older adults, participation in guided exercise programs, supervised and adapted to their characteristics should be continuous and regular; since due to the aging process, there is significant deterioration of different physical functions, worsened by physical inactivity.

## COMPLIANCE WITH ETHICAL STANDARDS

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### Ethical approval

This research is in accordance with standards set by the Declaration of Helsinki.

### Conflict of interest statement

The authors have no conflict of interests to declare.

### Author Contributions

Conceived and designed experiments: MMD; VMH; ISA. Performed experiments: MMD. Analyzed data: MMD; VMH; ISA; LAB. Contributed with reagents/materials/analysis tools: MMD; VMH; ISA; LAB. Wrote the paper: MMD; LAB.

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