LUMEN ET VIRTUS

Functional capacity, balance and falls in institutionalized, exerciser, and active older adults

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ABSTRACT
Aging happens through biological, psychological, and social changes, which vary from individual to individual. These changes depend on lifestyle habits, demographic regions, nutritional factors, and genetic characteristics. The factors most strongly associated with falls in the elderly are: age, gender, cognitive changes, postural changes, neurological diseases, frailty, among others. This is a quantitative cross-sectional study, which sought to evaluate the functional capacity, balance and prevalence of falls in elderly people of both sexes and over 65 years of age, separated into groups and categories: institutionalized elderly, physical exercise practitioners and active people. At first, they were submitted to the Sample Characterization Questionnaire, a Mini-Mental State Examination to assess cognitive capacity, and the International Physical Activity Questionnaire (IPAQ) to estimate the weekly time spent on physical activities. To assess balance and functional capacity, the following were used: Berg Balance Scale, Fear of Falling Assessment (FES-I) and Time Up & GO (TUGT). Results and discussion: The research was composed of 72 elderly people, both sexes, separated into groups: active (n=24), practitioners of physical exercises (n=24) and institutionalized (n=24), with a mean age of 73.16 (± 2.85 years). The group of institutionalized elderly showed a higher risk of falls and impaired mobility compared to the other groups, but it was observed that they had fewer falls, compared to the active ones, which can be explained by the lack of exposure to risks, and the protection that surrounds them in nursing homes.

Keywords: Aging, Institution, Physical Exercise, Fall.

INTRODUCTION

Certainly, one of the greatest achievements of humanity was the increase in the number of years lived.

In Brazil, in recent decades, a decrease in birth and death rates can be observed, which has led to an increase in the population in the age group between 60 years and over, especially those in the age group over 80 years. These data demonstrate a reality of increasing life expectancy, which requires adaptation to this new reality, to this new population model (Firmo, Da Silva and De Moraes, 2024).

According to world statistical data, estimates about aging are that by 2050, the number of people over 60 years of age will rise to almost 02 billion, with a forecast of 10% to 21% of the world's population (Powell, 2024, Heinberg, 2023).

Every day there is an increase in the life expectancy of human beings, partly due to better quality of life, health prevention measures, improvements in sanitary conditions and significant advances in health sciences. Which leads us to believe that population aging is one of the most significant demographic, economic and social changes of the twenty-first century. (Powell, 2024, Heinberg, 2023).

Because aging is a cumulative, irreversible, universal, non-pathological process, leading to functional decline due to morphological, biological and biochemical changes in the mature organism, which can incapacitate the individual in performing Activities of Daily Living (ADLs), which does not mean the presence of diseases, but the process of senescence (Tier et al, 2004); (Lopes-Otin et al, 2023).

The cessation or decrease in reproductive capacity is a fundamental manifestation of aging. Sex hormones play an important role in our bodies' homeostasis throughout life, however their impact is particularly evident in postmenopausal women. This disruption of natural sex hormones can cause an acceleration in age-related processes and can cause subsequent decline in physical and cognitive health (Sieck, 2018); Tier et al, 2004); (Lopes-Otin et al, 2023).

These changes vary from individual to individual and depend on lifestyle habits, demographic regions, nutritional factors, and genetic characteristics. Biological changes happen through physiological changes at the molecular, cellular, and tissue levels. (Paula, 2010).

Among the main intrinsic factors that occur in the aging process, some components can be highlighted as of greater importance in relation to the risk of falls, such as age-related physical and mental changes, decreased functional capacity, appearance of chronic diseases, balance alteration, osteoarticular diseases, inactivity, vision and hearing alterations, and vertigo. Another major problem is associated with the loss of muscle strength, since sarcopenia and muscle weakening is a universal feature of aging. (Pinho, 2012).

In the aging of bone tissue, the loss of bone mass is observed that begins in men between 50 and 60 years of age at a rate of 0.3% per year and in women between 45 and 75 years of age at a rate of 1% per year. This loss is related to genetics, hormonal and nutritional status, and the individual's level of physical activity (Matsudo, 2000); (Sieck, 2018).

Cognition is the act or process of knowing, which involves attention, perception, memory, reasoning, judgment, imagination, thought and language Cognitive deficit is common in elderly individuals, who may present with spatial disorientation, where they predispose the elderly to the risk of falls. (Paula, 2010); (Sieck, 2018).

Balance control requires maintaining the center of gravity on the support base during static and dynamic situations. This process occurs effectively by action, mainly by the visual, vestibular and somatosensory systems. These systems are altered with aging, and several steps of postural control can be annulled, reducing the compensatory capacity of the system, leading to an increase in instability. (Maciel, Guerra, 2005).

Falling is conceptualized as an unintentional displacement of the body to a level lower than the initial position, without timely correction and is determined by multifactorial circumstances that compromise stability, that is, mechanisms involved with maintaining posture. The causes caused by this event can be grouped into intrinsic factors, those related to the physiological changes resulting from the aging process, and extrinsic factors, which are linked to environmental hazards. (Gomes, Marques, Leal and Barros, 2013)

In addition to the high mortality, we must consider other consequences of falls for the health and quality of life of the elderly, such as a decline in functional capacity, limitation in physical activity, decreased mobility, fear of suffering new falls, social isolation, loss of autonomy and independence to perform activities of daily living. (Ferreira, Yoshitome, 2010)

Regular physical activity is important for maintaining functionality, but when the elderly have a fall, there is a decrease in self-confidence, which can lead to a lower level of physical activity, causing a reduction in muscle strength and consequently, an increase in the risk of falls. (Bento et al, 2010)

The World Health Organization (WHO, 2002) estimates that 17% of the world's population does not practice physical activity and approximately 60% who report that they do not exercise at 2.5 hours or 150 minutes per week as recommended.

Quality of life is associated with the condition of the elderly to be able to perform the efforts of daily living. And sedentary lifestyle, that is, the lack of physical exercise strongly present in elderly individuals, leads to a gradual decrease in all qualities of physical fitness, compromising the physical conditions of the elderly to perform such tasks. (Araújo, 2014)

Active older adults are those who are aware of the limitations imposed by aging and are able to use personal resources to maintain active control over their own lives. This active control is then characterized by the effective social participation of the aging person, in the sense of expanding their decision-making power, their active economic contribution and self-sustainability, their integration with the different age groups and the appropriation of a development that they themselves help to build. (Perracini et al. 2009)

The elderly are usually placed in institutions due to the following factors: abandonment of family members, cognitive decline, motor disabilities, neurological sequelae and often low income. A new category of elderly people in need of specialized care is then created: institutionalized elderly. (Netto, 2007).

Institutionalized elderly people have a different profile, they need attention, support and specialized services, as the vast majority are frail, have physical or mental morbidities, which makes them more prone to the occurrence of health problems. Among these problems, falls and fractures are a major concern due to their frequency, high socioeconomic cost, and increased dependence and institutionalization. (Carvalho, Luckow, Siueira, 2013). Thus, this study aimed to evaluate functional capacity, balance and correlate with the prevalence of falls in institutionalized, active and physical exercise elderly and the impact on the risk of falls and to compare functional capacity, balance and risk of falls between the groups evaluated.

METHOD

This is a quantitative cross-sectional study, approved by the Research Ethics Committee of UNISUL (141/2016), carried out with elderly people from long-term care institutions (LTCFs), Lar das mãezinhas and Centro de Repouso São José (SP), attendees of the Elderly Living Center, located in the district of São Miguel Paulista (SP) and elderly people from the community characterized as active, all research participants signed the Informed Consent Form.

A total of 72 elderly people over 65 years of age, both sexes, were evaluated, separated into three groups: (G1) – Institutionalized Elderly; (G2) Elderly Practitioners of physical exercise; (G3) – Active Elderly Non-Practitioners of Physical Exercise.

Group 1 – Institutionalized Elderly

Inclusion: Elderly without neurological sequelae and elderly without motor impairments.

Exclusion: Elderly people who are bedridden, in wheelchairs or with cognitive impairment.

Group 2 – Elderly Practitioners of Physical Exercise

Inclusion: Seniors

practitioners of physical exercise equal to or greater than 150 minutes per week, for a minimum period of six months.

Exclusion: Elderly Practitioners of physical exercise of less than 150 minutes per week and a period of less than six months and/or cognitive deficit.

Group 3 – Active Elderly

Inclusion: Independent older adults according to the Characterization Questionnaire and older adults able to perform their activities of daily living (ADLs).

Exclusion: Elderly people dependent on family members and elderly people with disabling factors such as visual, hearing, mental or motor disabilities.

INSTRUMENTS USED IN THE STUDY

The evaluation protocol consisted of anamnesis, physical and functional examination. All the elderly were submitted at first to the Sample Characterization Questionnaire, Mini-Mental State Examination and also to the International Physical Activity Questionnaire (IPAQ) to define the groups, meeting the inclusion and exclusion criteria, after which they were evaluated through the BERG, TUGT and FES tests.

Sample Characterization Questionnaire

- Sociodemographic data: name, age, gender, marital status, education, housing and type of income.
- Clinical data: medications, history of falls in the last 12 months, physical exercise.
- Functional data: need for assistance for basic activities of daily living: feeding, clothing, locomotion.

For cognitive assessment, the Mini-Mental State Examination (MMSE) was applied, which helps to identify the main changes in the mental health of the elderly, which consists of questions subdivided into seven items: temporal and spatial orientation, immediate memory, attention and calculation, recent memory, language, writing and drawing copying, according to the following score: 17 points for illiterate individuals, 22 points for seniors with schooling between 1 and 4 years, 23 for seniors with schooling between 5 and 8 years and 26 for those with 9 or more years of schooling. (Bruki et al, 2003).

The following tests were used to assess functional and balance:

Berg Balance Scale developed by Berg et al. (1992) is a validated instrument for the functional assessment of balance consisting of 14 tasks with five items each and a score of 0-4 for each task: 0 - is unable to perform the task and 4 - performs the task independently. Tasks range from

sitting, standing, transfers, bending down and 360° turning. The total score ranges from 0-56 points. The lower the score, the greater the risk of falls; the higher, the better the performance.

The Time up & GO (TUGT) test was also used: it evaluates seated balance, transfers from sitting to standing, stability in ambulation and changes in gait course without using compensatory strategies (Figueiredo et al. 2007).

During the test, the patients were instructed to get up from a chair, without the help of the arms, walk at a distance of three meters, turn around and return. The time was timed, and according to the score where less than 20 seconds for the performance means low risk for falls and more than 30 seconds high risk for falls.

To assess the fear of falling, the scale (FES-I) was used: Developed by Tinetti (1990), which assesses the fear of falling, that is, the confidence that the elderly have when performing the following tasks: dressing and undressing; prepare a light meal, take a shower, sit down and get up from the chair, lie down and get out of bed, answer the door or the phone, walk indoors, get to the closets, light domestic work and small shopping. The confidence that the elderly have in performing activities without falling is represented on a 10-point analog scale ranging from "No confidence" (1 point) to "Completely confident" (10 points). The FES score is the sum of the scores obtained in each of the 10 items. The minimum possible score is 10 and the maximum is 100. Therefore, the higher the score, the greater the confidence, translating into high self-efficacy. (Melo, 2011).

DATA ANALYSIS

Numerical variables were analyzed using Mean and Standard Deviation and categorical variables using Percentage (%) data were tabulated and analyzed using an Excel spreadsheet. In the comparison between the groups of elderly people, the results of the Mini-Mental State Examination (MMSE), FES, BERG and TUG were evaluated by the ANOVA test considering a value of $p \leq 0.01$.

RESULTS

The sample was composed of three groups, totaling 72 elderly people, who were divided according to the results of their evaluation through the characterization questionnaire and IPAQ into active (n=24), physical exercise practitioners (n=24) and institutionalized (n=24), with a mean age of 73.16 (± 2.85 years). There was no statistical difference in the age variable (p=0.29), demonstrating a homogeneity of the sample.

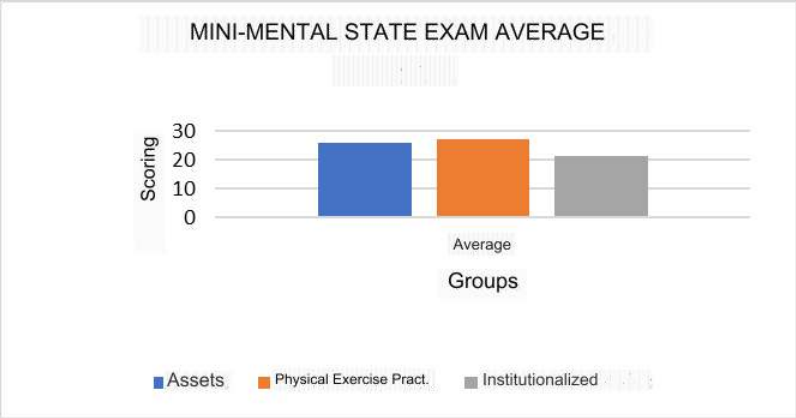
Regarding gender, 63 elderly women (87.5%) were female and 9 were male. Regarding education, 23 (31.94%) had completed primary schooling, 15 (20.83%) answered that they had not completed elementary school, and 12 (16.67%) were illiterate. In marital status, 34 (47.22%) were widowed and 22 (30.56%) were married. Of the total number of elderly people, 37 (51.39%) of them

reported falls in the last 12 months. According to the IPAQ, active elderly were classified as irregularly active (29.16%) and active (70.83%), elderly practitioners of physical exercise were classified as very active (100%) and institutionalized as sedentary (100%).

Table 1 shows the data described in detail between the groups.

The mean total MMSE score (Graph 1) for active individuals was 25.83 (±4.48), 28.25 (± 2.86) and institutionalized 21.71 (± 5.47). In the comparison between the groups, the p=000011 value, characterizing a statistical difference between the groups, where the institutionalized elderly had a lower MMSE score

Figure 1. Average obtained in the application of the Mini-Mental State Examination



Source: Authors

Chart 1 - Frequency of group characterization (gender, education, marital status, history of falls, IPAQ classification)

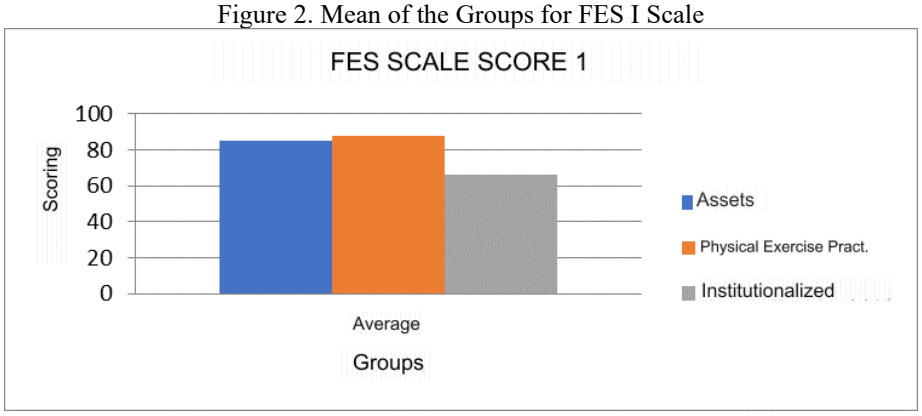
Variable	Active		Practitioners		Institutionalized		Final Average	
Age	71.50(±7.56)		71.54(±5.65)		76.46(±8.32)		73,16 (± 2,85)	
	N	**%**	**N**	**%**	**N**	**%**	**Total**	**%**
Gender								
Female	20	83,33	23	95,83	20	83,33	63	87,5
Male	4	16,67	1	4,17	4	16,67	9	12,5
Total	24	100	24	100	24	100	72	100
Schooling								
Medium	3	12,5	3	12,5	1	4,17	7	9,72
Superior	2	8,33	0	0	3	12,5	5	6,94
Fund. Incomplete	7	29,17	7	29,17	1	4,17	15	20,83
Illiterate	4	16,67	2	8,33	6	25	12	16,67
Fundamental	3	12,5	5	20,83	2	8,33	10	13,89
Primary	5	20,83	7	29,17	11	45,83	23	31,94
Total	24	100	24	100	24	100	72	100
Marital status								
Married woman	8	33,33	10	41,67	4	16,67	22	30,56
Widow	11	45,83	10	41,67	13	54,17	34	47,22
Single	2	8,33	1	4,17	5	20,83	8	11,11
Divorcee	3	12,5	3	12,5	2	8,33	8	11,11
Total	24	100	24	100	24	100	72	100
Historical Stays								
Yes	16	66,67	12	50	9	37,5	37	51,39
No	8	33,33	12	50	15	62,5	35	48,61
Total	24	100	24	100	24	100	72	100
IPAQ Rating								
Prat. of Active. Physics	0	0	24	100	0	0	24	33,33
Active	17	70,83	0	0	0	0	17	23,61
Irregul. active	7	29,16	0	0	0	0	7	9,72
Sedentary	0	0	0	0	24	100	24	33,33
Total	24	100	24	100	24	100	72	100

Source: Authors

Figure 2 shows the results obtained with the application of the FES I questionnaire, the score obtained in FES I showed that the average of the group of active elderly who reported fear of falling when performing the activities addressed in the questionnaire was 85.08 (± 15.32), the score of the group of elderly practitioners of physical exercise was 87.38 (± 13.72) and of the group of institutionalized elderly was 66.42 (± 19.94), showing that the institutionalized elderly showed more fear of falling when performing the activities addressed in the questionnaire. The value of p=0.00046 showed a significant difference between the groups.

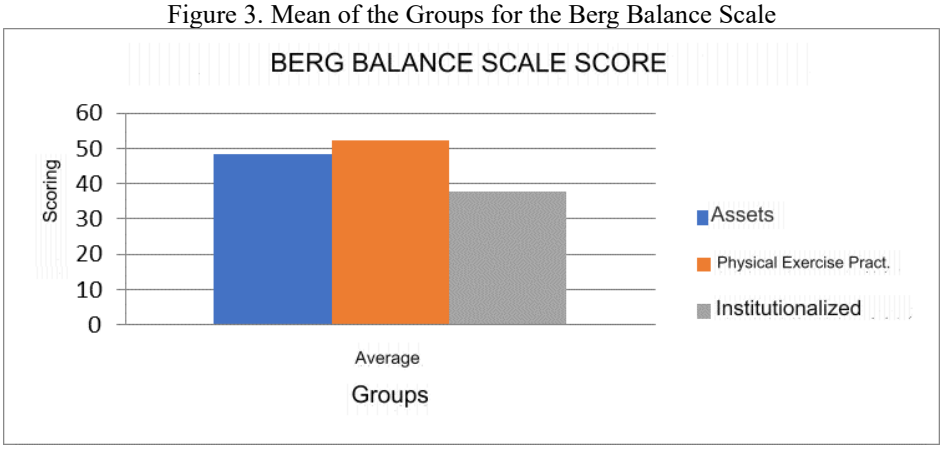
Figure 3 shows that the results obtained in relation to the Berg Balance scale, which shows that the group of active elderly had a mean of 48.29 (± 8.05), the group of practicing elderly had an average of 52.21 (± 1.67) and the group of institutionalized elderly had an average of 37.79 (± 9.66), that is, the group of institutionalized elderly are more prone to falls and loss of balance. It should be noted that there was a statistically significant difference with the value of p=0.00001.

Figure 2. Mean of the Groups for FES I Scale



Source: Authors

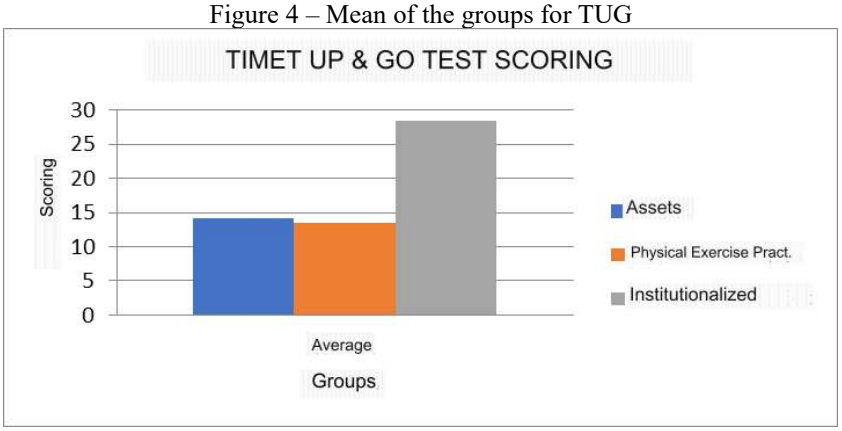
Figure 3. Mean of the Groups for the Berg Balance Scale



Source: Authors

In the TUGT test, the averages verified were that the group of active elderly was 14.16 (± 3.09), the group of elderly practitioners of physical exercise 13.42 (± 3.33) and the group of institutionalized elderly 28.43 (± 15.78), so we can see that by the average of the groups of active elderly and practitioners of physical exercise, the time spent to perform the test was less than 20 seconds, placing them in the classification of Low risk of falls. The value was p=0.41, demonstrating that there was no significant difference between the groups. (Figure 4)

Figure 4 – Mean of the groups for TUG



Source: Authors

DISCUSSION

The predominance of women in the sample studied is in line with IBGE data, which point to a process of feminization of old age that is increasingly evident, and a life expectancy of seven years more when compared to men (Hansen et al., 2016)

One of the intrinsic factors that causes falls is balance control, which is a process dependent on the integration of the vestibular, visual and proprioceptive systems, central commands, neuromuscular responses, muscle strength and reaction time, and with advancing age there is a greater decline in these functions with a greater propensity to fall. (Silva, 2010)

In a study carried out by Tamanini et al, (2012) where they evaluated the intrinsic and extrinsic factors that predispose to falls in the elderly, they show that income is a very important extrinsic value, although it is not much discussed about it, because the fact that the elderly have a higher income they have more access to health services and also more knowledge about the prevention of their body changes, thus reducing the risk of falls. Other extrinsic factors that predispose to falls are those related to the environment such as lighting, walking surface, loose carpets, high or narrow steps.

In the study by Silva, et al (2008), they mention that the Berg Balance Scale is the most accurate to detect changes in balance in healthy elderly people and the decrease in *Time Up & Go* time is a limiting factor, as this test has a great relationship with balance, gait speed and functional capacity.

Among the most common consequences of falls in the elderly is the increase in the fear of falling, this occurrence can be defined as the constant concern with the possibility of falling and is characterized as a limiting factor in the performance of activities of daily living in addition to being associated with the quality of life of the elderly. (Hauser, 2015)

According to Ishizuka (2005), the fear of falling can be a protective factor when the elderly are more careful not to expose themselves to the risk of falling, but it can also be a risk when it

causes limitation and insecurity, which is in line with the present study, which suggests that the factor of falling in the institutionalized elderly is related to the lower averages found in the scale of fear of falling.

The level of functional mobility and the risk of falls were observed by the TUG and the Berg scale, which showed that most institutionalized elderly people have a high risk of falls, but this group of elderly people demonstrated in the results a lower prevalence of falls compared to the other groups, which can be explained by the fact that the environment does not present environmental risks and due to the protective factor. Elderly people who still live in their homes, whether with their families or alone, apparently perform more activities, while institutionalized elderly people are already surrounded by nurses, cooks and caregivers responsible for the institution, which would supposedly spare them from some activities (Dias; Oak; Araújo, 2013) this may explain the fact that institutionalized older adults have fewer falls compared to active older adults who practice physical exercise.

It is important to emphasize that the quality of life of the elderly depends on their ability to perform daily tasks, which is directly linked to the variables of strength and balance. Gaining muscle strength, on the other hand, results in gains in balance, confidence when walking and a reduction in fall rates. (Magalhães, Domingues, 2016)

The elderly who practiced physical exercise attended a Senior Living Center three to five times a week, where they performed playful activities and global conditioning. This group of elderly people showed better results in all the tests applied, which is due to the maintenance of physical fitness and better functional capacity in relation to the other groups. Another study developed by Monteiro et al (2015) that aimed to evaluate the risk factors related to falls in elderly practitioners of physical exercise demonstrated that regular practice is beneficial for the development of motor coordination and balance, however, it was not able to prevent the occurrence of falls when the causes were environmental.

Another benefit promoted by the practice of exercise according to the literature is the improvement of organic and cognitive functions, ensuring greater personal independence and preventing diseases. In this way, it is believed that physical exercise could increase cerebral blood flow and, consequently, oxygen and other energy substrates, thus providing improved cognitive function. Another hypothesis that has been formulated concerns the effects of oxidative stress on the CNS, so that the practice of aerobic physical exercise could increase the activity of antioxidant enzymes in a similar way to what happens in other tissues, such as skeletal muscle, increasing the defense capacity against damage caused by reactive oxygen species (Antunes, 2006). These factors corroborate the results of the present study, showing that the elderly who practiced physical exercises obtained a higher score on the MMSE.

The result obtained in the TUG is in agreement with the study by Karuka *et al* (2011) and Santos, Borges and Menezes (2013), who found averages of 13 (+4.89) seconds and 7.61 (+1.56) seconds, respectively, for the test, which also demonstrated that most of the elderly did not present an increased risk of falls.

Weight and speed exercises are the most effective for bone mass gain, according to Souza (2010). In addition, the gain in muscle mass and the improvement in the speed of neuromuscular motor response reduce falls and the risk of fractures in patients. Comparing elderly people who practice physical activity with sedentary elderly people, there are lower incidences of fractures in the assets. Where we can correlate with the present study, witnessing the highest number of falls in the active elderly, because they are more exposed to risks, but when they suffer a fall, their bone density is prepared and the neuromuscular motor response is able to correct posture and return to the orthostatic position when compared to sedentary people who have a lower density, and which often results in increased fear of falling and limitation in their functional activities (Hshieh, et al, 2018)

CONCLUSION

It is concluded that the group of institutionalized elderly people had a higher risk of falls, impaired mobility and greater fear of falling, however, they had a lower history of falls, compared to the other groups, suggesting that the non-exposure to risks, and the protection that surrounds them in the institutions, can be a favorable factor in the prevention of falls, This was not seen in the groups of elderly people who practiced physical and active exercises, who obtained a better performance in balance, functional capacity and confidence in performing tasks of daily living, but had a higher rate of falls compared to institutionalized older adults.

There was a statistical difference for the FES scale and the BERG scale between the groups evaluated. In the TUGT test, there was no statistical difference between the groups evaluated. The theme of this study should be explored with further studies, aiming at preventing falls and providing the elderly, whether institutionalized or not, with quality of life in the aging process. The multidisciplinary team has a role fundamental.na identifying factors that may predispose to immobility in the elderly.

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