



## Correlation between functional independence and risk of falls in older adults at three long-term care facilities\*

Correlação entre independência funcional e risco de quedas em idosos de três instituições de longa permanência

Correlación entre la independencia funcional y el riesgo de caídas en los ancianos en tres instituciones de larga permanencia

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### ABSTRACT

**Objective:** To verify the correlation between functional independence and the risk of falls in a group of institutionalized older adults. **Method:** A cross-sectional, observational, quantitative study conducted in three Long-Term Care Facilities for older adults in the Municipality of Belém, involving both genders and assessed using the Katz Index and Tinetti Index. Pearson's Chi-squared test was used for analysis, adopting a p-value significance level of < 0.05. The data correlation was performed using the Pearson correlation test with a significance of 5% (p<0.05). **Results:** Forty-eight (48) older adults participated. Most were classified as functionally independent (89.6%) and with a low risk of falls (58.3%). There was a moderate correlation between functional independence and low risk of falls. **Conclusion:** The more independent the older adult is, the lower the risk of falls. Therefore, it is necessary to plan individualized care, considering its peculiarities and limitations, so that older adults can preserve their functional independence for longer.

### DESCRIPTORS

Aged; Homes for the Aged; Accidental Falls; Activities of Daily Living; Geriatric Nursing.

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## INTRODUCTION

The term functional independence is related to mobility and functional capacity which allows an individual to independently perform Activities of Daily Living (ADLs), indicating adequate motor and cognitive conditions to perform them<sup>(1)</sup>. The limitation to develop such activities can compromise people's daily lives, especially older adults, with the risk of falling which can cause irreparable damage to health, generating disabilities and even death<sup>(2)</sup>.

Approximately 30% to 50% of institutionalized older adults suffer falls annually, and 40% of them experience recurrent falls<sup>(3)</sup>. Falls are among the main causes of trauma among older adults, being considered the sixth cause of death from accidental and non-accidental injuries<sup>(4)</sup>. An older adult can suffer several consequences after experiencing a fall, such as serious injuries, abrasions, scratches and fractures, which can contribute to a functional decline in their performance of ADLs, social isolation and greater vulnerability to recurrence of falls<sup>(5)</sup>.

According to the National Health Surveillance Agency (*ANVISA*), a Long-Term Care Facility for Older Adults (LTCF) is a governmental or non-governmental entity designed to welcome people aged 60 or over, with or without family support, guaranteeing dignity, freedom and citizenship of older adults<sup>(6)</sup>.

Older adults face a series of limitations in their routine when institutionalized, and may experience a reduction in their autonomy, associated with greater sedentary lifestyle and a feeling of loss and abandonment. This condition can often lead to a progressive loss of functional independence and a consequent increase in the risk of falls<sup>(7)</sup>. Thus, it is essential that nursing professionals take into account the physical-environmental and biopsychosocial factors when designing the care plan in order to ensure that the older adult can perform their ADLs without risk of suffering injuries from falls<sup>(8)</sup>. Given this, the objective of this study was to evaluate how the functional independence of a group of institutionalized older adults is related to their risk of falls.

## METHOD

### STUDY DESIGN

A cross-sectional, observational study implementing a quantitative approach.

### SCENARIO

The study was carried out in three LTCFs in the Municipality of Belém, Pará state constituting one government facility maintained by the State and the other two being philanthropic. The facilities in this study are identified by the letters A, B and C. The three facilities house a total of 120 older adults.

Facility A currently houses 44 older adults, 19 men and 25 women, aged 60 to 100 years, with three degrees of functional dependence. Facility B is philanthropic and is exclusively for women, housing 24 older adult women aged 60 to 99 years, with degrees of dependency I and II. Finally, Facility C is a philanthropic entity and houses 79 older adults with three degrees of functional dependency, being 11 men and 68 women.

## SELECTION CRITERIA

The inclusion criteria were: people aged 60 or over, residing at the LTCF for at least 12 months and being lucid with the ability to answer physical and functional questions. Older adults with functional disability (restricted to bed and wheelchair users) were excluded.

The total number of older adults (N = 120) who lived in the study sites was used for the sample calculation. This reference population was obtained according to information from the facilities themselves after the sample calculation ( $n = N \times n_0 / (N + n_0)$ , in which  $n_0 = 1/E_0^2$  and  $E_0$  is the sample error)<sup>(9)</sup>. Considering an alpha value of 0.05, an estimated initial sample of (n = 46) older adults was obtained and which was reached since 48 older adults participated in the study.

## DATA COLLECTION

Data collection took place from January to March 2018. The older adults initially responded to an instrument developed by the researchers themselves, divided into three parts: sociodemographic, health and risk of falls data. In addition, Calf Circumference (CC) was also measured by the researchers to identify sarcopenia, based on the reference value proposed by the European Consensus for the Diagnostic Definition of Sarcopenia<sup>(10)</sup>. CC was measured bilaterally with a tape measure, bypassing the greater curvature of the calf. The normal value of  $\geq 31$  cm was considered. Measures below this value were considered indicative of sarcopenia.

The independent variables of the study were divided into sociodemographic characteristics, clinical characteristics and the exposure situation to falls. Sociodemographic characteristics included: age, gender, origin, marital status, number of children, education, initiative to live in the facility and residence time in the facility. The clinical characteristics included: comorbidities, self-reported vision and calf circumference. The exposure situation to falls was surveyed based on the following information: history of falls, use of assistance to move, assessment of the risk of falls and environmental assessment. Finally, the outcome variable was "functional independence regarding the risk of falls", according to the Katz Index and Tinetti Index<sup>(11)</sup>.

The Katz Index<sup>(11)</sup> was applied in order to know the degree of functional independence in daily life activity, based on the observed performance of ADLs. The scale consists of six items which measure the ability to perform actions related to self-care, namely: showering, dressing, toileting, transfer, continence and feeding<sup>(11)</sup>.

The categories were classified after the evaluation as suggested by Katz: independent, moderate dependence and very dependent<sup>(11)</sup>. Those who scored between five and six points were considered independent; those who had three to four points were moderate dependent; and those who had one to two points as very dependent. This classification was obtained from the sum of the values related to each criterion. In this case, a zero score was indicative of dependence and need for supervision to carry out their activities, while a score of one corresponded to independence in carrying out these activities.

The Tinetti Index<sup>(11)</sup> was used to assess the risk of falls, which enables assessing balance and gait in older adults. This scale has 16 items, with each score between 0 to 1 or 0 to 2. Zero indicates the maximum level of disability, while 1 or 2 corresponds to varying degrees of disability, where the maximum score can be 1 or 2 depending on the exercise assessed. The scale evaluates balance, which has a maximum score of 16; and gait, with a maximum score of 12. The sum of these assessments can reach a maximum of 28 points, and can be classified as low (25 to 28 points), medium (19 to 24 points) or high risk of falls (less than 19 points) from the total score of the assessment<sup>(12)</sup>.

The Tinetti Index<sup>(11)</sup> and the Katz Index<sup>(11)</sup> tests were performed with the help of a nursing undergraduate student who was trained to perform these tests. This assessment was carried out in the recreational yards of the institutions which had good light and the ground was flat and regular.

A checklist recommended by the Ministry of Health<sup>(13)</sup> was applied by the research team at the time of data collection to check the environmental conditions of the facilities in which the older adults live, observing aspects such as walking areas, lighting, flooring, and steps, among others. The final score of this instrument is given for each negative answer, which is worth one point. The final score is the sum of all items on the scale, with the maximum score being 14 points. The higher the score, the greater the environmental risk for falls. This environmental assessment was carried out by observing the facilities' rooms.

#### DATA ANALYSIS AND PROCESSING

Pearson's non-parametric Chi-squared test was used for trend/adherence between nominal variables, adopting a p-value significance level of < 0.05. Pearson's correlation test was used to verify the correlation between the functional independence of older adults and the risk of falls, with a 95% confidence level and 5% significance level. The correlation coefficient value (r) must be judged considering the sample size (n) for the Pearson's test to have statistical significance<sup>(14)</sup>. The r value is considered to be:  $0 < r < 0.25$  or  $-0.25 < r < 0$ : small or null correlation;  $0.25 < r < 0.50$  or  $-0.50 < r < -0.25$ : weak correlation;  $0.50 < r < 0.75$  or  $-0.75 < r < -0.50$ : moderate correlation;  $0.75 < r < 1.00$  or  $-1.00 < r < -0.75$ : strong or perfect correlation (perfect if  $r = -1$  or  $r = 1$ ).

The data were analyzed using descriptive and inferential statistics through Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) version 24.0, all in the Windows 7 OS environment.

#### ETHICAL ASPECTS

This study was developed in accordance with the guidelines and regulatory standards for research involving human beings, expressed through Resolution No. 466 of 12/12/2012 of the National Health Council. It was approved by the Ethics Committee (CEP) of the Universidade do Estado do Pará, according to Opinion No. 2.700.091, on 06/07/2018.

#### RESULTS

There were 48 participants included in the study, with a mean age of 76.5 ( $\pm 10.2$ ) years, 72.9% were women and 27.1% were men. There was a predominance of single older adults (58.3%), followed by those who were widowed (27.1%), with 56.3% of the older adults having no children. Most of the research participants had a low level of education, with 22.9% never studying and 45.8% having studied between one and five years. It was found that 52.1% of the older adults went to live at the facility on their own initiative, and the institutionalization time for the majority of the older adults varied between one and five years (60.4%).

Regarding the existence of illness, 81.3% of the older adults reported suffering some type of morbidity, with arterial hypertension (50.0%) being the most prevalent, followed by diabetes mellitus (25.0%). For the state of self-reported vision, 37.5% considered their vision as good, and 25.0% as excellent. However, it was found that 33.3% consider their vision between bad and very bad, and of these, 10.4% declared having great difficulty in performing ADLs.

For CC, it was observed that 83.3% of the older adults have a calf circumference greater than or equal to 31 cm. It was found that the 16.7% of the older adults who had a CC less than 31 cm were female, which corresponds to 22.9% of all women participating in the study.

It was also found that 45.8% of the older adults have already suffered a fall in the last year, of which 39.6% declared having suffered from one to four falls, and 6.3% suffered more than five falls. Among the reasons reported by them, 45.5% stated that imbalance was the main reason for falls and that the places with the highest frequency of falls were the bathroom (31.8%) and the bedroom (31.8%). Only 35.4% of the older adults said they needed assistance with walking, with a cane (64.7%) being the main assistance item used. Table 1 shows the classification of falls according to the assessment performed using the Tinetti Index<sup>(11)</sup>. In this case, most older adults were classified as having a low risk of falls (58.3%), which is a significant trend ( $p < 0.05$ ).

**Table 1** – Classification of the risk of falls according to the Tinetti Index in institutionalized older adults – Belém, PA, Brazil, 2018.

Classification of the risk of falls (Tinetti Index)	N	%	p-value <sup>(*)</sup>
Low risk of falls	28	58.3	
Medium risk of falls	9	18.8	<0.0001
High risk of falls	11	22.9	

(\*) Pearson's Chi-squared test for trend (p-value < 0.05).

Note: (N=48)

Regarding the environmental assessment of the risk of falls, 31.58% of the older adults live with non-uniform flooring or non-fixed carpets in the movement areas, and 17.9% of the older adults live with movement areas without support bars in the LTCFs. It was observed that 17.9% of the older adults live with insufficient lighting to fully brighten the interior of each room, including steps. In the bathrooms, 13.6% of the older adults reported that the

shower area does not have a non-slip floor. In addition, 19.0% of the older adults live in a facility where the stair flooring does not have a non-slip coating.

Table 2 shows the classification of functional dependence according to the evaluation performed using the Katz Index<sup>(11)</sup>. Most older adults were classified as functionally independent (89.6%), which is a significant trend ( $p < 0.05$ ).

**Table 2** – Classification of functional dependence according to the Katz Index in institutionalized older adults – Belém, PA, Brazil, 2018.

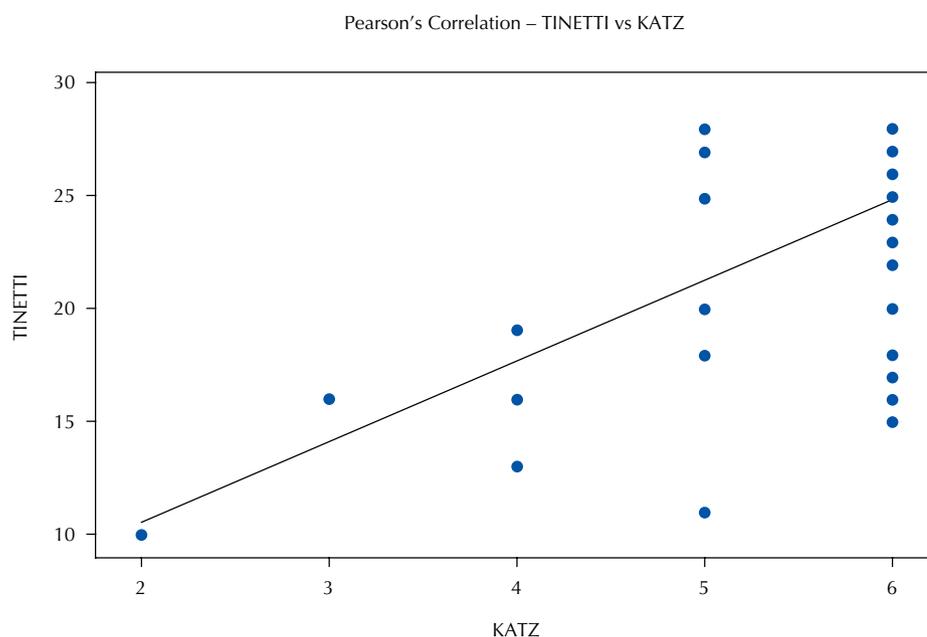
Katz Index	N	%	p-value <sup>(*)</sup>
Independent	43	89.6	
Moderately dependent	4	8.3	<0.0001
Very dependent	1	2.1	

(\*) Pearson's Chi-squared test for trend ( $p$ -value < 0.05).

Note: (n=48)

When correlating functional independence for activities of daily living (Katz Index) and the risk of falls in institutionalized older adults (Tinetti Index), the result of this

coefficient was 0.602, which indicates a moderate correlation, considering a  $p$ -value of < 0.05. This result can be demonstrated through the Figure 1.



**Figure 1** – Pearson's correlation test between functional independence for activities of daily living and the risk of falls in institutionalized older adults.

Pearson's correlation test shows that there is a moderate ( $r = 0.602$ ) and significant ( $p < 0.05$ ) positive correlation between the score obtained by the older adults on the Katz Index<sup>(11)</sup>, which measures the degree of functional independence, and the Tinetti instrument, which points out the risk of falls among the evaluated older adults. The high score obtained on the two instruments points

to evidence that the greater the functional independence, the lower the risk of falls.

## DISCUSSION

The average age of the participants in the present study was similar to another study with institutionalized older adults<sup>(15)</sup>. Most of the study participants were women,

corroborating other studies with institutionalized older adults in which female participants also predominated<sup>(15-16)</sup>. This phenomenon can be explained by the greater survival of women, the greater probability that they have the worst health conditions and functional capacity, in addition to an unfavorable position in family relationships since men are more likely to be cared for by their spouses, thus remaining more time with the family<sup>(17)</sup>.

Regarding marital status, most were single followed by those who were widowed, thereby corroborating the data from a similar study<sup>(15,17)</sup>. The absence of a partner and weakened social support are factors which can lead to older adults being institutionalized<sup>(16)</sup>.

Most of the older adults evaluated herein did not have children. The fact of not having children is often described as a predisposition to be institutionalized. Thus, it is possible to identify a vulnerability in the family's knowledge on how to care for older adults, which can be observed when the responsibility for care is directed to non-family caregivers due to a decrease in independence and functional capacity<sup>(16)</sup>.

There was a low level of education among the older adults assessed in this study. This situation reflects a legacy of past decades, when manual and domestic work were more valued than intellectual training<sup>(18)</sup>.

In addition, it was found that most of the research participants went to live at the facility on their own initiative, contrary to data from another study<sup>(19)</sup> in which all the older adults declared that they lived there because they had no other option. The literature points out that among the reasons associated to older adults being institutionalized is the fact that they have no caregiver, family conflicts, abandonment, "being sick" and do not have a place to live<sup>(20)</sup>. Most of the older adults have lived at the LTCF from one to five years. The length of stay and sense of belonging to the place is relevant, since the home not only comprises a physical space, but also represents a place which is part of the residents' lives, such as the experienced histories, memories, a place for rest and protection<sup>(20)</sup>.

Regarding the health conditions of the studied older adults, it was observed that the majority declared the existence of some disease, and the most prevalent chronic disease was systemic arterial hypertension. This finding corroborates other study carried out at a LTCF<sup>(18)</sup>.

Regarding the state of vision, it was observed that some older adults indicated having vision between "bad" and "very bad". It is important to make it clear that no ophthalmological evaluation was performed at the time of the research. These data were based on the self-reported state of vision by the participants themselves. Compromised vision can contribute to loss of balance, as vision helps in postural control. In addition, low environmental brightness and inadequate infrastructure can increase the risk of falls<sup>(7,21)</sup>.

It was identified that 22.9% of the participants, all female, had a CC below 31 cm, which can be considered an indication of sarcopenia. The literature points out that this pathology is predominant in women<sup>(22)</sup>, and

that its occurrence may be associated with low weight, presence of chronic diseases, limitations and functional disability<sup>(23)</sup>.

Despite the data not showing a high prevalence of participants with CC < 31, it is necessary to pay more attention to obese older adults who may have normal or increased CC, even in the presence of sarcopenia, which may be indicative of sarcopenic obesity. However, the Body Mass Index (BMI) was not verified in this study to assess nutritional status.

With regard to data on the occurrence of falls, it was found that 45.8% of the older adults had suffered falls, similar to the result of a study conducted with institutionalized older adults in Uberlândia, Minas Gerais state<sup>(20)</sup>, in which 42.8% of the participants reported having fallen. Of these older adults who had fallen, it was identified that women fell more than men, corroborating data in the literature<sup>(23)</sup> which found 71.42% occurrence of falls in women. According to the authors, one of the justifications which can contribute to this event is the higher incidence of chronic degenerative diseases among female older adults.

It is important to highlight the presence of "older adult fallers" in LTCFs, i.e. those who have had more than two falls in the last year<sup>(24)</sup>. This event is more frequent in institutionalized older adults due to their greater fragility and functional dependence, as they are more exposed to diseases and to the use of a greater amount of medication, which can contribute to a greater risk of falls<sup>(25)</sup>. Taking into account the "older adult faller", it is worth highlighting the importance of checking aspects related to mood changes such as the presence of anxiety, depression and fear of falling, as these can constitute factors which can have implications on mobility by making it more restricted, in addition to contributing to new fall occurrences<sup>(26)</sup>.

It was identified that imbalance was the most prevalent reason for falls, followed by slipping. A balance deficit is present in individuals who have already fallen, as they present greater anteroposterior oscillation in an upright position compared to those who have never fallen<sup>(27)</sup>.

According to the reports of the older adults about the fall location, most fell in the bathroom and in the bedroom. Therefore, it is of utmost importance to conduct monitoring of these places by the health team<sup>(21)</sup> who must receive training in preventing falls aiming at the quality of care and safety of older adults. Regarding the need to use a mobility aid device among the older adults, it was found that the cane is the main aid device used among those who needed some walking assistance, thus corroborating data from a previous study in which it was used by 10% of the older adults<sup>(28)</sup>.

It was identified that the presence of non-uniform floors in some of the LTCFs evaluated in the study can contribute to the occurrence of falls. According to studies, falls on uneven floors are common, even if they are not wet<sup>(18)</sup>. Another environmental factor found in one of the LTCFs was the lack of support bars in the movement areas. The National Health Surveillance Agency (ANVISA)

recommends that circulation areas with widths greater than or equal to 1.50 m must have handrails on both sides; and circulation areas less than 1.50m wide may have handrails on only one side<sup>(4)</sup>.

For lighting, it was found that the lighting was insufficient during the day in some rooms such as circulation areas and rooms in an LTCF of the present study, thereby making it difficult to see steps or objects which were in the way. The use of artificial light could complement the safety of older adult residents. RDC (governmental resolution) No. 283/2005<sup>(4)</sup> recommends that the internal circulation areas should have permanent vigil light, and dorms and cafeterias should be equipped with vigil light.

The bathrooms in two LTCFs of this study did not have non-slip flooring in the shower areas. This was a relevant complaint among the older adults. According to RDC 283/2005<sup>(4)</sup>, the bathroom must not have any unevenness in the form of a step or flooring which produce glare or reflections.

According to the assessment of functional independence using the Katz Index<sup>(11)</sup>, it was found that the majority of the older adults were classified as functionally independent. This result is in contrast to the study carried out in LTCFs in Uberlândia, as the proportion of independent older adults for their ADLs was 33%<sup>(20)</sup>.

Regarding the assessment on the risk of falls, it was noted that the majority had a low risk of falls, corroborating the result of another study<sup>(29)</sup>. In addition, all older adults who were at high risk of falls were female. Although these data reinforce the literature and are compatible with particularities of the physiology and the female aging process<sup>(30)</sup>, it is necessary to take into account the disparity of female participants in the sample of this study with a proportion almost three times greater in relation to the male population.

It was found in this study that there is a moderate positive correlation between functional independence and the risk of falls, meaning that the more independent an older adult is, the lower the risk of falls. It was also found that the majority of the older adults were considered independent. It is worth mentioning that the fact of being independent does not exempt an older adult from suffering a fall<sup>(30)</sup>. For example, 44.2% of the independent older adults in the present study reported that they had suffered at least one fall in the last year.

A previous fall does not seem to be enough to cause a new fall, but it can when it is associated with the interaction between the skills of the older adult, the intrinsic factors (presence of chronic diseases, functional decline, among others) and the degree of exposure to extrinsic risk factors. The combination of these factors may have contributed to a moderate correlation between independence and the risk of falls.

Therefore, maintaining autonomy and independence is important to reduce the difficulties in performing ADLs, something which is positive for both individuals and for the family and society<sup>(30)</sup>. It is worth mentioning that it is essential for the professionals who accompany

institutionalized older adults to monitor risk factors individually in order to prevent this event. For nursing, especially in the gerontogeriatric area, it is necessary to better appropriate the resources and instruments which help identify the functional level of the older adults in order to better develop health promotion strategies and actions so as to contribute to healthier aging with greater autonomy and independence.

The present study has some limitations. Firstly, the cross-sectional design adopted herein implies the impossibility of monitoring the temporal sequence between risk factors (exposure) and functional independence and risk of falls (outcome), which must be continuously monitored/evaluated. Therefore, it is suggested that further studies be carried out with other designs to assess this phenomenon in more detail.

Another limitation concerns a certain sample bias regarding the profile of the participants, more particularly related to gender, since one of the facilities where the study was conducted was exclusively female. There was also a limitation in identifying older adults who had sarcopenic obesity, as no other sarcopenia predictors such as BMI, strength (handgrip) or physical performance (gait speed) were measured. It is therefore suggested for future studies to carry out other measures and to use criteria for identifying sarcopenia.

Despite the identified limitations, the authors consider that the results of this study can contribute to the scientific production on functionality and risk of falls in institutionalized older adults in the context of the state of Pará.

## CONCLUSION

The correlation between functional independence and the risk of falls was moderate, indicating that the more independent an older adult is, the lower their risk of falls. Given this finding, it is necessary to plan individualized care considering its peculiarities and limitations, so that older adults can preserve their functional independence for longer.

For the prevention of falls, it is suggested that there is greater monitoring in the LTCFs in relation to the older adults who have already suffered some fall, since this event is a predictor for future falls. Therefore, the LTCFs are recommended to adapt the environment structure in order to make it safer, since the places in this study which had the highest record of falls were the bedrooms and bathrooms. In addition, the importance of continuing education for health professionals and caregivers is emphasized in order to enable them to identify situations which place older adults at risk of falls. Finally, it is also suggested to conduct health education with older adults about the risks of falling, prevention, the importance of using assistive devices for movement and physical activity.

The results found in this study provide guiding support for planning nursing interventions aimed at preserving functional capacity with a view to promote the safety of institutionalized older adults.

## RESUMO

**Objetivo:** Verificar a correlação entre a independência funcional e o risco de quedas em um grupo de idosos institucionalizados. **Método:** Estudo transversal, observacional, quantitativo, realizado em três Instituições de Longa Permanência para Idosos no Município de Belém, de ambos os gêneros, avaliados por meio do Índice de Katz e Índice de Tinetti. Para análise utilizou-se o teste de Qui-quadrado de Pearson, adotando-se um nível de significância de p-valor < 0.05. E a correlação dos dados foi realizada pelo teste de correlação de Pearson, com significância de 5% ( $p < 0,05$ ). **Resultados:** Participaram 48 idosos. A maioria foi classificada como funcionalmente independente (89,6%) e com baixo risco de quedas (58,3%). Houve correlação moderada entre a independência funcional e baixo riscos de quedas. **Conclusão:** Quanto mais independentes são os idosos, menor é o risco de quedas. Portanto, é necessário fazer um planejamento de cuidados individualizados, considerando suas peculiaridades e limitações, de modo que o idoso possa preservar por mais tempo sua independência funcional.

## DESCRITORES

Idoso; Instituição de Longa Permanência para Idosos; Acidentes por Quedas; Atividades Cotidianas; Enfermagem Geriátrica.

## RESUMEN

**Objetivo:** Comprobar la correlación entre la independencia funcional y el riesgo de caídas en un grupo de ancianos institucionalizados. **Método:** Estudio transversal, observacional, cuantitativo, realizado en tres Instituciones de Larga Permanencia para Ancianos en el municipio de Belém, de los dos géneros, evaluados por medio del Índice de Katz y del Índice de Tinetti. Para análisis fue utilizado el test de Qui-quadrado de Pearson, adoptando un nivel de significado de p-valor < 0.05. Y la correlación de los datos fue realizada por el test de correlación de Pearson, con significado de 5% ( $p < 0,05$ ). **Resultados:** Participaron 48 ancianos. La mayoría fue clasificada como funcionalmente independiente (89,6%) y con bajo riesgo de caídas (58,3%). Hube correlación moderada entre la independencia funcional y bajo riesgo de caídas. **Conclusión:** Cuanto más independientes son los ancianos, menor es lo riesgo de caídas. Entonces, es necesario hacer un planeamiento de cuidados individualizados, considerando sus peculiaridades y limitaciones, para que el anciano pueda preservar por más tiempo su independencia funcional.

## DESCRIPTORES

Anciano; Hogares para Ancianos; Accidentes por Caídas; Actividades Cotidianas; Enfermería Geriátrica.

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