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## EQUILÍBRIO E MARCHA DE PESSOAS IDOSAS: AVALIAÇÃO COM RECURSO A TECNOLOGIA

*BALANCE AND GAIT OF ELDERLY PEOPLE: EVALUATION USING TECHNOLOGY*

*EQUILIBRIO Y MARCHA DE PERSONAS MAYORES: EVALUACIÓN MEDIANTE TECNOLOGÍA*

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## RESUMO

**Introdução:** As pessoas idosas sofrem múltiplas alterações no equilíbrio relacionadas com a diminuição da força muscular, alterações multissensoriais e cognitivas que contribuem para ocorrência de quedas, podendo resultar em comprometimento das capacidades funcionais e até a morte. A avaliação do equilíbrio é complexa e envolve causas multifatoriais, na qual o enfermeiro especialista em enfermagem de reabilitação desempenha um papel fundamental, com vista a desenvolver estratégias e intervenções que favoreçam a autonomia e independência dos idosos. Neste seguimento, este estudo tem por objetivo avaliar o equilíbrio e, posteriormente, a marcha de pessoas idosas com recurso a uma tecnologia construída com base no Índice de Tinetti.

**Metodologia:** Realizou-se um estudo quantitativo, do tipo transversal, descritivo e exploratório. Com recurso a técnica de amostragem não probabilística por conveniência, participaram no estudo 119 pessoas idosas de dois lares e um centro de dia do distrito de Braga. A colheita de dados ocorreu no período de janeiro a março de 2018, recorrendo a um questionário para caracterização sociodemográfica e condição de saúde e recurso a uma tecnologia (tapete) para avaliação do equilíbrio e marcha.

**Resultados:** Foram avaliados 119 idosos. A utilização da tecnologia contribuiu para melhorar os movimentos realizados pelos idosos, facilitando a avaliação e interpretação dos resultados em relação ao equilíbrio e marcha pelo enfermeiro especialista em enfermagem de reabilitação. Na avaliação global da marcha com e sem o tapete, o uso do tapete contribuiu para movimentos mais eficazes e com associação estatisticamente significativa ( $p < 0,05$ ), com exceção do movimento pé ante pé.

**Conclusão:** Além de facilitar a avaliação do equilíbrio estático e dinâmico, o uso da tecnologia contribuiu para aperfeiçoar a habilidade da marcha nas pessoas idosas. Ainda que seja necessária a realização de mais estudos, recomenda-se a avaliação do equilíbrio e marcha com recurso a tecnologia.

**Descritores:** Equilíbrio Postural, Enfermagem em Reabilitação, Idoso, Análise da Marcha.

## ABSTRACT

**Introduction:** Elderly people suffer multiple changes in balance related to decreased muscle strength, multisensory and cognitive changes that contribute to the occurrence of falls, which may result in impairment of functional capacities and even death. Balance assessment is complex and involves multifactorial causes, in which the specialist nurse in rehabilitation nursing plays a fundamental role, with a view to developing strategies and interventions that favor the autonomy and independence of the elderly people. In this follow-up, this study aims to evaluate the balance and, subsequently, the gait of elderly people using a technology built based on the Tinetti Index.

**Methodology:** A quantitative, cross-sectional, descriptive and exploratory study was carried out. Using a non-probabilistic convenience sampling technique, 119 elderly people from two homes and a Braga district day center participated in the study. Data collection took place from January to March 2018, using a questionnaire for sociodemographic characterization and health condition, and using technology (mat) to assess balance and gait.

**Results:** 119 elderly people were evaluated. The use of technology contributed to improving the movements performed by the elderly, facilitating the evaluation and interpretation of results in relation to balance and gait by the nurse specialist in rehabilitation nursing. In the global gait assessment with and without the mat, the use of the mat contributed to more effective movements and with a statistically significant association ( $p < 0.05$ ), with the exception of foot-to-toe movement.

**Conclusion:** In addition to facilitating the assessment of static and dynamic balance, the use of technology contributed to improving the gait ability of elderly people. Although further studies are needed, it is recommended that balance and gait be assessed using technology.

**Descriptors:** Postural Balance, Rehabilitation Nursing, Aged, Gait Analysis.

## RESUMEN

**Introducción:** Los adultos mayores sufren múltiples cambios en el equilibrio relacionados con la disminución de la fuerza muscular, cambios multisensoriales y cognitivos que contribuyen a la ocurrencia de caídas, que pueden resultar en deterioro de las capacidades funcionales y muerte. La evaluación del equilibrio es compleja e involucra causas multifactoriales, en las que la enfermera especialista en enfermería rehabilitadora juega un papel fundamental, con miras a desarrollar estrategias e intervenciones que favorezcan la autonomía e independencia del anciano. En ese seguimiento, este estudio tiene como objetivo evaluar el equilibrio y, posteriormente, la marcha de personas mayores utilizando una tecnología construida con base en el Índice de Tinetti.

**Metodología:** Se realizó un estudio cuantitativo, transversal, descriptivo y exploratorio. Utilizando una técnica de muestreo no probabilístico por conveniencia, participaron en el estudio 119 personas mayores de dos residencias y un centro de día del distrito de Braga. La recolección de datos se realizó de enero a marzo de 2018, mediante cuestionario de caracterización sociodemográfica y del estado de salud y uso de tecnología (tapete) para evaluar el equilibrio y la marcha.

**Resultados:** Se evaluaron 119 personas mayores. El uso de la tecnología contribuyó para mejorar los movimientos realizados por los ancianos, facilitando la evaluación e interpretación de resultados en relación al equilibrio y la marcha por parte del enfermero especialista en enfermería de rehabilitación. En la evaluación global de la marcha con y sin colchoneta, el uso de la colchoneta contribuyó a movimientos más efectivos y con una asociación estadísticamente significativa ( $p < 0,05$ ), con excepción del movimiento pie-dedo.

**Conclusión:** Además de facilitar la evaluación del equilibrio estático y dinámico, el uso de la tecnología ha contribuido a mejorar la capacidad de caminar de las personas mayores. Aunque se necesitan más estudios, se recomienda evaluar el equilibrio y la marcha utilizando la tecnología.

**Descriptor:** Equilibrio Postural, Enfermería en Rehabilitación, Anciano, Análisis de la Marcha.

## INTRODUCTION

People are living longer, and the phenomenon of population aging has become the subject of major discussions. In the coming decades, the proportion of elderly people in the European Union population will increase significantly, estimated to reach 129.8 million in 2050. In the same period, it is estimated that people aged 55 and over will represent more than 45% of the population of Portugal. Increasing demographic aging has implications for people at the individual level, but also for social and governmental structures, such as health and social assistance systems, labor markets, public finances and social security rights<sup>(1-2)</sup>.

At an individual level, changes in physiological processes common to aging affect the elderly person's ability to balance<sup>(3-4)</sup>. Elderly people suffer multiple changes in balance related to decreased muscle strength, multisensory changes and cognitive changes. There is a consensus that these changes lead directly to functional loss, such as the inability to walk safely, climb stairs and carry out different self-care tasks independently<sup>(5-6)</sup>.

Impaired balance is a complex diagnosis as the causes are often multifactorial, and generally related to disturbances not only in balance, but also in gait. These disorders contribute to the occurrence of falls, which can result in compromised functional capabilities and even death. In addition to the physical consequences, falls can also result in fear of falling again, insecurity, self-limitation and social isolation, leading to an increased risk of further falls and a potential reduction in the elderly's quality of life<sup>(4)</sup>.

In this sense, to evaluate postural balance it is necessary to perceive the elderly people as a complex system of interaction mechanisms. Added to this, it is considered that the phenomenon of balance in the elderly population is multifactorial<sup>(7)</sup>, and therefore, it is possible to see that no isolated balance test can suggest a rehabilitation exercise plan for an elderly person. Furthermore, it will not only be necessary to perform therapeutic exercises to improve balance. Nor is it possible to assume that the same type of exercises will be beneficial for all people with the same type of balance disorder<sup>(8)</sup>.

In this area, the intervention of the Rehabilitation Nursing (RN) is essential to plan appropriate interventions for elderly people with balance changes and assess the integrity of each individual's physiology and the available compensatory strategies<sup>(9)</sup>. Simplified measures to improve or restore balance are insufficient, as they are not capable of looking at the person's individuality, predicting the situations in which they will lose body stability. It is, therefore, necessary to personalize rehabilitation, individualizing the processes to intervene in balance, individually specifying which sensory and motor mechanisms each elderly person has altered, adapting interventions to their needs<sup>(4,9)</sup>.

Therefore, this assessment must be carried out by a specialized expert, such as the RN, who has the ability to look at the individual in a holistic way, systematically evaluating their changes and the strategies underlying the functional performance of postural balance<sup>(9)</sup>. RN's play a fundamental role in this scenario and should develop skills related to maximizing the physical and intellectual capabilities of the elderly people, with a view to preparing them for an aging process with greater autonomy and quality of life. It is believed that only in this way will it be possible to evaluate, diagnose and intervene effectively in the rehabilitation process of the elderly population.

Based on the above, the aim is to find a complementary alternative for assessing postural balance in a systematic and conscientious way focused on the person's uniqueness. Although the Tinetti Index presents itself as an instrument for assessing dynamic and static balance, the aim was to understand whether this, in conjunction with a physical instrument, would bring benefits in the assessment of the elders. Additionally, the question arises: does the use of a device improve the balance and gait of elderly people? In this context, this study aims to evaluate the balance and, subsequently, the gait of elderly people using a technology built based on the Tinetti index.

## METHODOLOGY

A quantitative, cross-sectional, descriptive and exploratory study was carried out.

The study setting was two homes and a day center in the Braga district, invited to participate through a meeting with the site coordinators to present the project aims. The choice of research locations was intentional, considering ease of access for the researcher and based on the interest of the location coordinators.

To select the sample, the non-probabilistic convenience sampling technique was used. The following were included: all people over 65 years-old in the places where the study took place; who had preserved gait, with or without a walking aid; and who agreed to participate in the study. Elderly people who were blind and did not have the ability to walk were excluded. The sample consisted of 119 elderly people.

The data collection instrument was divided into two parts. The first part consists of sociodemographic variables (age; sex; marital status; education), clinical variables (history; medication; signs/symptoms), body mass index, number of falls in the last year and length of institutionalization. The second part contained the Tinetti Index to record the assessment of balance and gait<sup>(5-6,10)</sup>.

Although the use of the Tinetti Index does not require sophisticated equipment and allows the assessment and detection of significant changes in balance and gait<sup>(11)</sup>, the balance/gait assessment mat, built by researchers from the Escola Superior de Enfermagem do Porto, was also used as a resource. Porto and which is under patent registration, at the National Institute of National Property, with number x 2020100044373.

Data collection took place from January to March 2018, in a large room in the institutions where the study took place. At all times of data collection there was the main researcher and at least two experts in the area of Rehabilitation Nursing, and the result to be recorded in the instrument was taken by consensus.

To process the data, the Statistical Package for the Social Sciences (SPSS) version 27 was used. Descriptive statistics were used to characterize the sample in relation to sociodemographic variables, clinical variables, body mass index, number of falls in the last year, at the time of institutionalization, as well as, regarding balance and gait.

In order to analyze the differences in gait assessment with and without using technology (mat), Pearson's Chi-square test was used. The significance level adopted was  $p < 0.05$ .

In the data analysis process, a detailed approach was adopted. The use of descriptive statistics provided a clear and concrete view of the variables under study, enabling a more precise interpretation.

To present the results in an organized and accessible way, tables were created that summarized the information, making it visually explicit for readers. These tables are designed to highlight the most relevant data, providing a concise and comprehensive summary of the data.

All procedures were carried out in accordance with strict ethical conduct, with a favorable opinion from the Health Ethics Committee of the Regional Health Administration of the North and authorization from the institutions where the study took place. All participants were informed in detail about the objectives of the investigation, procedures adopted for data collection and the guarantee of anonymity and confidentiality.

## RESULTS

Regarding the characterization of the participants, the majority are women (79=66.4%), aged between 65 and 98 years old, with an average of 79.13 years old. When grouped by classes, the largest representation is in the 75 to 84 years old class (44=37.0%), followed by 65 to 74 years old (40=33.6%). The elderly people are mostly widowed (70=58.8%), followed by the separated condition (30=25.2%). Regarding education, we found that the majority know how to read (95=79.8%) and write (94=79%), having only completed the first cycle of basic education (76=63.9%).

Elderly people with more than five years of institutionalization are the group with the highest representation (37=31.1%), followed by those with four years (26=21.8%). Regarding the use of medications, the majority of elderly people take five medications (38=31.9%). The most common disease is hypertension (89=74.8%), followed by ophthalmic disease (48=56.3%) and osteoporosis (41=34.5%).

Among the manifestations of signs and/or symptoms noticed in the last week, instability in walking (75=63.0%), imbalance (74=62.2%) and gait deviations (67=56.3%) predominate, followed by dizziness (23=19.3%), vertigo (8=6.7%) and nausea (4=3.4%) to a lesser extent. Regarding the number of falls in the last year, participants had at least one fall/year (42=35.3%), followed by those who did not have any falls/year (39=32.8%). In relation to the body mass index of the elderly, the data demonstrate values of pre-obesity (44=37%), weight within normal values (29=24.4%) and weight less than desirable (6=5.0%).

Regarding the participants' postural balance, the results presented consist of the evaluation of the 19 dimensions contained in the Tinetti Index (Tables 1 and 2).

TABLE 1 - ASSESSMENT OF BALANCE DIMENSIONS ACCORDING TO THE TINETTI INDEX

| Tinetti Index Dimensions  | n  | %    |
|---|----|------|
| <b>Balance sitting on a chair</b>   |    |      |
| leans or slides in the chair  | 2  | 1.7  |
| leans over slightly or increases the distance from the buttocks to the back of the chair                      | 37 | 31.1 |
| stable, safe  | 80 | 67.2 |
| <b>Getting up</b>   |    |      |
| unable without help or loses balance  | 3  | 2.5  |
| capable, but uses arms to help or flexes the trunk excessively or fails on the first attempt                  | 54 | 45.4 |
| able on the 1st try without using arms  | 62 | 52.1 |
| <b>Immediate balance (first 5 seconds)</b>  |    |      |
| unstable (staggering, moving feet, marked trunk oscillations, trying to grab something to support themselves) | 9  | 7.6  |
| stable, but uses a walking aid to support himself/herself.  | 41 | 34.5 |
| stable without any type of aid  | 69 | 58   |
| <b>Balance while standing with feet parallel</b>  |    |      |
| unstable  | 2  | 1.7  |
| stable, but widening the base of support  | 62 | 52.1 |
| feet close together and without aids  | 55 | 46.2 |
| <b>Small imbalances in the same position</b>  |    |      |
| wobbly, clings, but stabilizes  | 61 | 51.3 |
| stable  | 58 | 48.7 |
| <b>Close the eyes in the same position</b>  |    |      |
| unstable  | 32 | 26.9 |
| stable  | 87 | 73.1 |

| Tinetti Index Dimensions                                    | n  | %    |
|---|----|------|
| <b>360 degree turn (2 times)</b>                            |    |      |
| unstable (clings, falters)                                  | 10 | 8.4  |
| stable, but takes discontinuous steps                       | 81 | 68.1 |
| stable and continuous steps                                 | 28 | 23.5 |
| <b>Single-leg support (holds at least 5 seconds stably)</b> |    |      |
| cannot or tries to hold on to any object                    | 66 | 55.5 |
| holds 5 seconds stably                                      | 53 | 44.5 |
| <b>Sitting down</b>   |    |      |
| unsafe or fall into the chair or misjudge the distance      | 17 | 14.3 |
| uses arms or non-harmonious movement                        | 50 | 42   |
| safe, harmonious movement                                   | 52 | 43.7 |

Regarding balance, the majority of elderly people had stable balance sitting in the chair, were able to get up on the first attempt without using their arms and maintained balance without any type of help in the first 5 seconds, as well as when they were asked to close their eyes. On the other hand, the elderly showed greater difficulty in maintaining balance when asked to perform a 360-degree turn, single-leg support for at least 5 seconds and to remain standing with feet parallel.

**TABLE 2 - ASSESSMENT OF GAIT DIMENSIONS ACCORDING TO THE TINETTI INDEX**

| Tinetti Index Dimensions                               | n  | %    |
|--|----|------|
| <b>Gait beginning</b>                                  |    |      |
| hesitation or multiple attempts to start               | 30 | 25.2 |
| without hesitation                                     | 89 | 74.8 |
| <b>Step width (right foot)</b>                         |    |      |
| It does not go beyond the front of the supporting foot | 38 | 31.9 |
| It overtakes the left foot in support                  | 81 | 68.1 |



| Tinetti Index Dimensions   | n  | %    |
|--|----|------|
| <b>Step height (right foot)</b>  |    |      |
| the right foot does not completely lose contact with the ground  | 38 | 31.9 |
| the right foot is completely lifted off the ground   | 81 | 68.1 |
| <b>Step width (left foot)</b>  |    |      |
| It does not go beyond the front of the supporting foot   | 35 | 29.4 |
| It exceeds the right foot in support   | 84 | 70.6 |
| <b>Step height (left foot)</b>   |    |      |
| the left foot does not completely lose contact with the ground   | 36 | 30.3 |
| the left foot is completely lifted off the ground  | 83 | 69.7 |
| <b>Step Symmetry</b>   |    |      |
| apparently asymmetrical step length  | 51 | 42.9 |
| apparently symmetrical step length   | 68 | 57.1 |
| <b>Step continuity</b>   |    |      |
| stops or takes discontinuous steps   | 43 | 36.1 |
| continuous steps   | 76 | 63.9 |
| <b>3 meters route</b>  |    |      |
| deviates from the marked line  | 10 | 8.4  |
| deviates slightly or uses a walking aid  | 76 | 63.9 |
| without deviations and without aids  | 33 | 27.7 |
| <b>Trunk stability</b>   |    |      |
| clear oscillation or uses a walking aid  | 35 | 29.4 |
| without swaying, but with bending of the knees or spine or moving the arms away from the trunk while walking | 32 | 26.9 |
| no oscillation, no flexion, no use of arms or walking aids   | 52 | 43.7 |

| Tinetti Index Dimensions          | n  | %    |
|-----------------------------------|----|------|
| <b>Support base while walking</b> |    |      |
| heels too far apart               | 27 | 22.7 |
| heels close, almost touching      | 92 | 77.3 |

Regarding gait, the majority of elderly people started walking without hesitation, with adequate width, height and continuity of steps. On the other hand, they demonstrated more difficulty in maintaining the symmetry of the step and trunk stability, as well as completing a 3-meter distance without deviations/assistance.

When repeating the assessment using assisted technology (treadmill), the researchers noted that it was easier to identify changes, as well as more significant adherence from participants, showing interesting results in relation to walking ability (Table 3).

**TABLE 3 - DISTRIBUTION OF APPRECIATION OF WALKING WITH AND WITHOUT A MAT, FOLLOWING THE DOMAINS OF THE TINETTI INDEX (N=119)**

| Movement      | Execution of the movement by the participant | With mat |      | Without mat |      | P-value (Pearson Chi-square) |
|---------------|--|----------|------|-------------|------|------------------------------|
|               |  | n        | %    | n           | %    |                              |
| Foot to foot  | No   | 72       | 60.5 | 5           | 4,2  | 0.065                        |
|               | Yes  | 47       | 39.5 | 114         | 95.8 |                              |
| Tips          | No   | 80       | 67.2 | 49          | 41.2 | 0.000                        |
|               | Yes  | 39       | 32.8 | 70          | 58.8 |                              |
| Backwards     | No   | 38       | 31.9 | 15          | 12.6 | 0,000                        |
|               | Yes  | 81       | 68.1 | 104         | 87.4 |                              |
| Heel          | No   | 85       | 71.4 | 60          | 50.4 | 0.000                        |
|               | Yes  | 34       | 28.6 | 59          | 49.6 |                              |
| Right support | No   | 68       | 57.1 | 57          | 47.9 | 0.000                        |
|               | Yes  | 51       | 42.9 | 62          | 52.1 |                              |
| Left support  | No   | 70       | 58.8 | 60          | 50.4 | 0.000                        |
|               | Yes  | 49       | 41.2 | 59          | 49.6 |                              |

| Movement | Execution of the movement by the participant | With mat |      | Without mat |      | P-value (Pearson Chi-square) |
|----------|--|----------|------|-------------|------|------------------------------|
|          |  | n        | %    | n           | %    |                              |
| Side     | No   | 42       | 35.3 | 3           | 2.5  | 0.018                        |
|          | Yes  | 77       | 64.7 | 116         | 97.5 |                              |

There is a positive assessment in all movements when performed with the mat, confirming a statistically significant association between the variables having and not having a mat ( $p < 0.05$ ), in all movements with the exception of the forefoot.

## DISCUSSION

In addition to the sociodemographic and clinical characterization of elderly people, this study focused particularly on the domains of balance and gait. The results indicate challenges related to the older population's health, highlighting the importance of strategies that allow them to design and provide care adjusted to their real needs.

The participants in this study are mostly women, have an average age close to 80 years old, have been institutionalized for more than 5 years and have low education. The data is in line with the literature regarding the growing number of elderly people who become dependent on the help of other people due to the decline in physical and/or mental health during aging<sup>(1-2,12)</sup>. Furthermore, it is known that the physical and social environments experienced by these people throughout their lives, such as the opportunities to study and maintain healthy habits, can affect the way their health condition presents itself in old age<sup>(13-14)</sup>.

The high use of medicines by the majority of elderly people generally results from the multiple pathologies associated with unhealthy aging, many of them characterized as chronic diseases, which show an increase in chronic-degenerative diseases and a reduction in acute infectious diseases in the elderly population<sup>(13)</sup>. Furthermore, ineffective promotion and prevention actions have implications for the health of the population and, consequently, for illness during aging, reinforcing the importance of comprehensive health strategies throughout all life cycles<sup>(14)</sup>.

Low education is reflected in greater difficulty in recognizing one's own health needs and adhering to guidelines and treatments, increasing the chances of multimorbidity in the elderly by 64%<sup>(15)</sup>. Studies indicate that the higher prevalence of hypertension and diabetes mellitus in the elderly was also associated with low education<sup>(13,16)</sup>. Notoriously, sociodemographic determinants are relevant to understanding the health-disease process of the elders<sup>(13)</sup>, with a focus on social determinants and health promotion<sup>(14)</sup>.

Regarding functional changes resulting from aging and pathological processes, these trigger changes in posture, balance and gait impairment<sup>(7,17)</sup>. Maintaining postural balance is a complex task that involves multiple mechanisms, such as interaction with the environment, responses from the central nervous system, efficient motor posture and biomechanical support<sup>(4)</sup>, constituting a fruitful scenario for carrying out this study on balance and gait in the elderly population.

In this study, the elderly people maintained their balance when sitting in the chair and did not need any type of help when getting up. It is believed that these data represent that elderly people maintain minimum balance conditions to carry out some activities independently. Maintaining the elders' ability to balance is essential to prevent falls and, essentially, maintain independence in carrying out activities of daily living, reinforcing the need for strategies focused on muscle strengthening and postural balance<sup>(8-9,18)</sup>.

The postural oscillations that occur during aging result in the degradation of postural balance, requiring greater muscle recruitment in older people during activities that require balance when compared to younger people<sup>(3,7,19)</sup>. The data from the global balance assessment in this study are in line with the literature, showing that the elderly had greater difficulty maintaining balance after performing a 360-degree turn and sitting in a chair, indicating that falls can occur as a result of imbalance when perform movements with greater complexity and that involve more than one concomitant task (turning around and sitting down)<sup>(3,10)</sup>.

The study identified greater difficulty for elderly people when supporting themselves with just one foot (single-leg support) for at least 5 seconds and remaining standing with their feet parallel. The findings indicate changes in balance control mechanisms in the elders and reduced mobility, which are frequent causes of falls, hospitalizations and even deaths<sup>(18,20-21)</sup>. Balance problems represent one of the main risk factors for falls and recurrence of falls and actions aimed at preventing these critical events should be the target of interventions by health professionals, and particularly by RN<sup>(9)</sup>.

Regarding falls, most elderly people suffered an episode of falls in the year before the assessment, corroborating studies that indicate that people over 65 years old fall at least once every year<sup>(18,20)</sup>. A study on mortality rates from falls among elderly people in Brazil identified that balance problems were more frequent in women, around 31.2% elderly people  $\geq$  60 years old died as a result of falls, with falls from the same level being the most common. frequent (53.8%)<sup>(18)</sup>.

Regarding the assessment of the elderly people's gait without a mat, the majority of participants started without hesitation and showed adequate width, height and continuity of steps. In the assessment with a carpet, the elderly, for the most part, demonstrated better performance and greater movements during walking. Changes in the spatial-temporal parameters of gait increase the risk of falling in the elderly population and, in general, elderly people with a history of falls have a longer support phase, with an increase in the double support phase during gait<sup>(17)</sup>.

Furthermore, a study with elderly people in Korea identified that people who fell had shorter steps compared to those who did not fall, with an influence on gait speed. A more conservative and cautious gait can be a strategy for the elderly to maintain dynamic balance and avoid falls<sup>(22)</sup>.

On the other hand, the elderly people had greater difficulty in maintaining the symmetry of the step and the stability of the trunk during walking, as well as walking a distance of 3 meters without deviations or aids during the assessment without the mat. In the assessment with the mat, the elderly performed better ( $p < 0.05$ ), with emphasis on the movements of walking on tiptoe, backwards, with support under the heels, right and left single-leg support and lateral walking. In relation to gait stability, elderly people at risk of falling, due to

inefficient gait control, tend to increase the period of double support in order to guarantee greater stabilization<sup>(22)</sup>.

In the context presented, balance is a problem with great representation in the elderly and age-related changes in the way of walking can induce changes in dynamic stability. This reinforces the relevance of understanding compensatory gait strategies based on their assessment, using a physical resource (mat) as a complementary instrument to the Tinetti Index. Interventions to improve gait and prevent falls become more effective when the behavior of each elderly person is known through a systematic and more complete assessment.

In general, the evaluation of walking with the mat was positive in all movements, with the exception of toe-toe ( $p > 0.05$ ). This fact reveals that the use of assisted technology can contribute to improving the quality of gait assessment using the RN, as well as helping the elderly to better perform movements during the assessment, as they are visually guided through each step to be performed during gait.

It should also be considered that the use of poly-pharmaceuticals, having cardiovascular diseases and diabetes mellitus impair speed, alter the base of support and gait cadence in the elders<sup>(17,23)</sup>. In this sense, designing and implementing rehabilitation programs for the elderly population focused on balance and gait results in the attenuation, or at least the preservation, of walking and balancing abilities<sup>(9,11,24)</sup>.

RN, within the scope of their specific competencies, have a fundamental role in caring for people with limited activity and/or restricted participation for the reintegration and exercise of citizenship, in order to maximize functionality by developing the person's capabilities<sup>(25)</sup>. These professionals take a leading role in adopting attitudes to promote a rigorous and systematic assessment of balance, optimizing the functional potential of the elderly population, promoting their independence and autonomy, and promoting a better quality of life through individual awareness of their physical capacity. and intellectual<sup>(9,11,26)</sup>.

Considering the specific skills of nurses specializing in rehabilitation nursing, it is absolutely essential that these professionals focus on areas sensitive to their intervention, examples of which are balance and gait. However, for the RN to scientifically support their diagnoses and interventions regarding balance and gait in the elderly, they need instruments capable of evaluating certain areas, from a more objective point of view. The combination of the use of the mat and the Tinetti Index proved to be useful for assessing balance and gait, facilitating the clinical decision-making process for RN. In this context, the study carried out, in addition to making it possible to evaluate the problem of balance and gait in the elders, highlights the relevance of using technologies to support traditional measures, which, in addition to providing objective assessment, will ensure greater involvement of people in the process. rehabilitation, as well as in their recovery.

Furthermore, it is essential to train RNs to build and use new technologies in the area of rehabilitation nursing, with a view to contributing to the implementation of intervention strategies, especially in more vulnerable populations, such as institutionalized elderly people and those with balance disorders. It is noteworthy that technologies must be tested in order to demonstrate, whether based on evidence or the results of fieldwork, their usefulness for clinical practice, which reinforces the relevance of this study and encourages the carrying out of others with greater scientific robustness.

The limitation of the study consists of the multifactorial aspects of balance, which have not been fully studied, which is why we suggest that, in the future, replicate the study in other spaces where the RN operates and study changes in balance and gait in greater depth. in the elderly population.

## CONCLUSION

The balance/gait assessment mat constitutes a strategy for systematizing the assessment carried out by the RN. The assessment of balance with and without the mat demonstrates significant differences, with emphasis on the effectiveness of static and dynamic balance performance, the improvement in mobility and the improvement in walking ability with the use of technology.

The use of the mat to assess balance/gait is also positive for the RN, allowing the development of skills related to the precision of clinical assessment and rehabilitation of the elderly with more efficiency, certainty and effectiveness. It was demonstrated that RNs can act as experts, through a multidimensional approach to balance, focusing on the implementation of strategies that minimize discrepancy and subjectivity in the assessment, through the implementation of assisted technologies.

By highlighting the relevance of assessing balance/gait using physical technologies, this study reinforces the need to train health professionals and, particularly, RNs to use innovative technologies that qualify their clinical decision-making. , in addition to favoring future investigations to advance clinical practice and, consequently, the quality of life of the elderly.

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## ETHICAL DISCLOSURES

Contribution of the author(s):

Conceptualization: PCFAO, MMM, OMPLR;

Data treatment: PCFAO, MMM, OMPLR;

Formal analysis: PCFAO, MMM, OMPLR;

Investigation: PCFAO, MMM, OMPLR, BPG;

Methodology: PCFAO, MMM, OMPLR;

Project administration: PCFAO, MMM, OMPLR;

Resources: PCFAO, MMM, OMPLR;

Software: PCFAO, MMM, OMPLR;

Supervision: MMM, OMPLR;

Validation: PCFAO, MMM, OMPLR;

Visualization: PCFAO, MMM, OMPLR, BPG, MM;

Original draft writing: PCFAO, MMM, OMPLR, BPG, MM, LV;

Writing - review and editing: PCFAO, MMM, OMPLR, BPG, MM, LV.

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