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EFFECT OF PROPRIOCEPTIVE TRAINING TO PREVENT FALL RISK IN OLDER ADULTS

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Summary. Introduction: Falls are considered one of the most important geriatric syndromes due to their high incidence in adults over 65 years of age. Falls can generate diverse and important physical and/or psychological consequences, functional deterioration, dependence and even death. Objective: To determine the effectiveness of proprioceptive training to prevent the risk of falls in older adults aged 65 years old living in a nursing home at km 1 via Dapa, Valle del Cauca. Methodology: A quasi-experimental cross-sectional research was conducted, with a non-probabilistic sample consisting of 12 women and 3 men over 65 years of age residing in a nursing home, voluntarily participating in a 6-week proprioceptive training, twice a week during the months of March and April 2021. The feasibility of the proprioceptive exercises proposal was validated using the nominal group research technique. The results included the Short Physical Performance Battery (SPPB) and Timed up and go (TUG) tests evaluated pre- and post-intervention. Results: There were significant differences in the level of functionality pre post intervention, ($p<0.05$), the two variables (level of fall risk and level of functionality) correlate inversely ($p<0.05$). Conclusions: Proprioceptive training is effective in improving static/dynamic balance, gait speed, and lower extremity strength in nursing home-dwelling adults 65 years of age and older.

Key words: Prevention; Prevention; Fall; Proprioception; Older adults; Rehabilitation.

EFECTO DE UN ENTRENAMIENTO PROPIOCEPTIVO PARA PREVENIR EL RIESGO DE CAÍDA EN ADULTOS MAYORES

Resumen. Introducción: Las caídas se consideran como uno de los síndromes geriátricos más importantes por su alta incidencia en los adultos mayores de 65 años. Las caídas pueden generar diversas e importantes consecuencias físicas y/o psicológicas, deterioro funcional, dependencia e incluso la muerte. Objetivo: Determinar la efectividad del entrenamiento propioceptivo para prevenir el riesgo de caídas en el adulto mayor de 65 años residente en un hogar de reposo en el km 1 vía a Dapa, Valle del Cauca. Metodología: Se realizó una investigación cuasiexperimental de corte transversal, con muestra no probabilística constituida por 12 mujeres y 3 hombres adultos mayores de 65 años residentes en un hogar de reposo, participando de manera voluntaria en un entrenamiento propioceptivo de 6 semanas, dos veces a la semana durante los meses de marzo y abril de 2021. La factibilidad de la propuesta de ejercicios propioceptivos se validó a partir de la técnica de investigación grupo nominal. Los resultados incluyeron las pruebas Short Physical Performance Battery (SPPB) y Timed up and go (TUG) evaluadas pre y post intervención. Resultados: Hubo diferencias significativas en el nivel de funcionalidad pre- post intervención, ($p<0,05$), las dos variables (nivel de riesgo de caída y nivel de funcionalidad) se correlacionan en sentido inverso ($p<0,05$). Conclusiones: El entrenamiento propioceptivo es efectivo para mejorar el equilibrio estático/dinámico, la velocidad de la marcha y fuerza de extremidades inferiores en los adultos mayores de 65 años que residen en un hogar de reposo.

Palabras clave: Prevención; Caída; Propiocepción; Adultos mayores; Rehabilitación.

Introduction

Aging is a universal, irreversible and individual process that causes physiological changes in the different systems of the human being, among them: the musculoskeletal system, central nervous system and sensory systems; in addition, it has been demonstrated that as we age the risk of presenting various types of pathologies and medical alterations increases, all this causes a greater risk of presenting falls, being a public health problem, and one of the great geriatric syndromes, due to the high costs in the health system and functional complications that they represent in the elderly; unfortunately all these aspects constitute one of the main causes of morbidity and disability in this population.

This chapter aims to put into context this problem in this group of people, starting from the identification of the situation at the national level, the research that evidences the complications due to the aging process, the strategies to prevent and/or avoid further complications and the importance of the implementation of proprioceptive exercises as a strategy to promote the prevention of the risk of falling in older adults.

In Colombia, according to figures from the Ministry of Health and Social Protection (Cubillos, Matamoros, & Perea, 2020), eight out of ten older adults suffer more than one disease; example of this, diseases in the nervous and musculoskeletal system that can cause alterations in gait and, predispose a fall, according to data from research conducted by (Jaramillo-Losada, Gómez-Ramírez, & Calvo-Soto, 2020), the total prevalence of falls of the elderly during the last year was 31.9%; among adults who had already had falls in the last year, approximately, according to them, half were recurrent, increased in women and with age, In addition to this, locomotion capacity tends to decrease progressively and the alteration of gait and balance capacity in older adults is a

predictor not only of functional impairment but also of frailty and restrictions in social participation.

It has been proven that aging leads to a natural biological degeneration in terms of strength, muscle mass and neurological functions. Likewise, it is evidenced that the fear of presenting a fall can change the gait parameters compared to people who do not fear falling, as exposed (Romano- Durán, Rodríguez -Camarero, & Martínez-Esparza, 2017) as well as it is also evidenced that those adults older than 65 years who perform some type of activity combined with all types of exercise (aerobic, muscle strengthening, balance training) have proven to be effective in preventing falls. (Bull, Al-Ansari, & al., 2020).

The changes brought about by the aging process have negative effects in terms of mobility, strength and autonomy in the older adult. As mentioned by (Garatachea & Torres, 2021), complications in the musculoskeletal system are generated due to various factors such as: central nervous system, muscle tissue, hormonal levels and lifestyle, this last aspect can be modifiable if 150-300 minutes of aerobic physical activity of moderate or vigorous intensity per week are performed, as mentioned by (Bull, Al-Ansari, & al., 2020), guidelines that can be added to activities aimed at strengthening balance, coordination and muscle strengthening; in that same research, these authors ensure that there is "high evidence showing that functional and balance exercises reduce the rate of falls"; research that resembles those conducted by (Cando-Macas & Fiallos-Holguín, 2019); (Anzatuña- Romero & Figueroa- Figueroa, 2016); (Huerta- Villar, 2018) and (Cabrera -Rivadeneyra & Rios, 2021), who conclude that there is a statistically significant difference between the risk of falling before and after performing proprioceptive training so older adults improve their independence in performing activities of daily living, proprioceptive exercises stimulate the muscle spindle, helping the perception and execution of body movements, contributing to improve balance and therefore, favor the prevention of falls in this group of people.

Prevention is the most efficient and least costly measure to prevent any event affecting a person's health status. Balance as a modifiable factor through a proprioceptive exercise program is a key aspect in the prevention of this adverse event.

Although the factors associated with falls in the elderly are multifactorial in nature (some may be more preventable than others), there is a need to apply practical interventions that are approached from a preventive context and, if necessary, minimize the risk of adverse events that lead to loss of functionality and reduce the quality of life of the elderly.

Therefore, the aim of this study was to investigate the effects of proprioceptive training on the level of fall risk and level of functionality assessed with the TUG and SPPB tests (respectively) pre- and post-intervention in 15 older adults aged 65 years and older residing in a nursing home.

Method

As mentioned above, this study was categorized as a quantitative methodology research, quasi-experimental subcategory and cross-sectional. The research was conducted during the months of March and April 2021.

Design

The nominal group technique was developed, in charge of 10 professionals, to determine the relevance of the exercises to be included in the proprioceptive training, taking into account that the exercises would not be performed with any type of external implement (hoops, cones, balls, among others), this in order to generate greater ease of learning the exercises in older adults and to be included in a regular physical exercise session. After each member presented the exercises, a socialization was carried out with their respective qualification, being 1 a low complexity qualification and 5 as very high complexity, to obtain the authorization and execute the intervention proposal. Older adults were invited to participate in such training after discussion and approval of the exercises; each participant was shown a visual support material of the tests and provided with written informed consent to participate voluntarily. Each participant was assigned a number according to the order of arrival at the time of evaluation.

After the analysis at the end of the study, the older adults received an individualized report in plain language detailing the results of each test (TUG /SPPB), their level of functionality and possible fall risks based on those results. Thus, a proprioceptive exercise intervention was carried out for 6 weeks to older adults aged 65 years who would reside in a nursing home at Km1 via Dapa (Valle del Cauca-Colombia). Data collection was performed at two points in time: before and after proprioceptive training, in order to compare and evaluate the changes recorded pre/post intervention.

Participants

Men and women over 65 years of age residing in a nursing home were recruited, followed by an analysis and observation of possible participants, with the staff of the institution, taking into account the inclusion and exclusion criteria, so this study was considered as a non-probabilistic sample.

Inclusion criteria were: (1) Men and women over 65 years of age, (2) older adults oriented in their three mental spheres (space, place, time) and the exclusion criteria were: (1) adults with any type of recent pathology (last 6 months) that contraindicates exercise and (2) older adults with any type of disability (hearing, visual and/or physical). The final research sample size was 15 older adults, 12 women and 3 men; all of them agreed to participate voluntarily by signing the corresponding informed consent form.

Intervention

The 6-week proprioceptive training protocol was designed to prevent fall risk in the older adult. Participants assigned to the intervention were asked to complete two sessions per week. In weeks 1 and 2, with a difficulty level of 1 and 2 according to the nominal technique, the following exercises were performed:

- Bipodal support (legs at shoulder height), upper limb support and eyes open.
- Bipodal support (legs in semi-tandem position) upper limb support and eyes open.
- Bipodal support (feet together) upper limb support and eyes open.
- Bipodal support (legs at shoulder height), upper limb support and eyes closed.
- Bipodal support (legs in semi-tandem position) upper limb support and eyes closed.
- Bipodal support (feet together) upper limb support and eyes closed.
- Bipodal support, left upper limb support, flexion and extension movement of the right upper limb and eyes closed.
- Bipodal support, right upper limb support, flexion and extension movement of the left upper limb and eyes closed.

- Bipodal support, left upper limb support, right upper limb abduction movement and eyes closed.
- Bipodal support, left upper limb support, right upper limb abduction movement and eyes closed.

Training volume: 1 set and 8 repetitions of each exercise; frequency: 2 days a week. march 2,4,9 and 11. Intensity: Modified Borg scale. Execution time of the exercises: 20 minutes *Methodological orientations: Guidance was given on the importance of unloading the weight of the body on both lower extremities. The older adult was advised that until he/she felt confident in the exercise position, he/she should not perform the upper extremity movement.

In week 3, with a difficulty level of 3, according to the nominal technique, the following exercises were performed:

- Full support of the left foot, support only with the forefoot (toes) of the contralateral limb, support of the right upper limb and eyes open.
- Full support of the right foot, support only with the forefoot (toes) of the contralateral limb, support of the left upper limb and eyes open.
- Full support of the left foot, support only with rearfoot (heel) of the contralateral limb, support of the right upper limb and eyes open.
- Full support of the right foot, support only with rearfoot (heel) of the contralateral limb, support of the left upper limb and eyes open.
- Full support of the left foot, support only with the forefoot (toes) of the contralateral limb, support of the right upper limb and eyes closed.
- Full support of the right foot, support only with the forefoot (toes) of the contralateral limb, support of the left upper limb and eyes closed.
- Full support of the left foot, support only with the rearfoot (heel) of the contralateral limb, support of the right upper limb and eyes closed.
- Full support of the right foot, support only with the rearfoot (heel) of the contralateral limb, support of the left upper limb and eyes closed.

Training volume: 1 set of each lower/upper limb, 10 repetitions of each exercise. Frequency: 2 days a week: march 16 and 18. Intensity: Modified Borg scale, Time of execution of the exercises: 18 minutes *Methodological guidelines: Guidance was given on the importance of unloading the weight of the body on both extremities, and then closing the eyes.

In week 4, with a difficulty level of 4, according to the nominal technique, the following exercises were performed:

- Left lower limb support, right knee flexed, eyes open and right upper limb support.
- Right lower limb support, left knee flexed, eyes open and left upper limb support.
- Left lower limb support, right hip flexed, eyes open and right upper limb support.
- Right lower limb support, left hip flexed, eyes open and left upper limb support.
- Left lower limb support, right knee flexed, eyes closed and right upper limb support.
- Right lower limb support, left knee flexed, eyes closed and left upper limb support.
- Left lower limb support, right hip extended without touching the floor, eyes closed and right upper limb support.
- Right lower limb support, left hip extended without touching the floor, eyes closed and left upper limb support.

Training volume: 2 sets, 10 repetitions of each exercise. Frequency: 2 days a week: march 23,25. Intensity: Modified Borg scale. *Execution time of the exercises: 20 minutes *Methodological orientations: The importance of fully supporting the foot (toe-heel) of the lower extremity that is fixed was emphasized. It was ensured that older adults (at the time of performing hip extension) the knee was in full extension.

In week 5, with a difficulty level of 5, according to the nominal technique, the following exercises were performed:

- Left lower limb support, right knee flexion/extension movement, upper limb support and eyes closed.
- Left lower limb support, left knee flexion/extension movement, upper limb support and eyes closed.
- Right lower limb support, left hip flexion/extension movement, upper limb support and eyes open.
- Left lower limb support, right hip flexion/extension movement, upper limb support and eyes closed.
- Left lower limb support, right knee and hip flexion movement, upper limb support and eyes closed.
- Left lower limb support, left knee and hip flexion movement, upper limb support and eyes closed.
- Left lower limb support, right hip abduction movement, upper limb support and eyes closed.
- Left lower limb support, left hip abduction movement, upper limb support and eyes closed.
- Left lower limb support, right hip external rotation movement, upper limb support and eyes closed.
- Left lower limb support, left hip external rotation movement, upper limb support and eyes closed.

Training volume: 2 sets and 10 repetitions of each exercise. Frequency: 2 days a week: april 30 and 1. Intensity: Modified Borg scale. Execution time of the exercises: 20 minutes *Methodological guidelines: Guidance was given on the importance of fully supporting the foot (toes-heel) before performing any movement. They were reminded of the importance of feeling secure in position to perform the exercise.

In the last week, with all levels of difficulty (from 1 to 5), according to the nominal technique, the following exercises were performed:

- Bipodal support, right upper limb support, flexion and extension movement of the left upper limb and eyes closed.
- Bipodal support, left upper limb support, right upper limb abduction movement and eyes closed.
- Full support of the left foot, support only with the rearfoot (heel) of the contralateral limb, support of the right upper limb and eyes closed.
- Full support of the right foot, support only with the rearfoot (heel) of the contralateral limb, support of the left upper limb and eyes closed.
- Left lower limb support, right hip extended without touching the floor, eyes closed and right upper limb support.
- Right lower limb support, left hip extended without touching the floor, eyes closed and left upper limb support.

- Left lower limb support, right hip external rotation movement, upper limb support and eyes closed.
- Left lower limb support, left hip external rotation movement, upper limb support and eyes closed.

Training volume: 2 sets, 12 repetitions of each exercise. Frequency: 2 days a week: april 6 and 8. Intensity: Modified Borg scale. Execution time of the exercises: 18 minutes.

Methodological guidelines: They were reminded about the importance of fully supporting the limb(s) before performing any movement. - Guidance was given on the importance of keeping the foot fixed and without ipsilateral knee flexion. They were reminded of the importance of feeling secure in position to perform the exercise.

In all 12 sessions of proprioceptive training, participants were supervised. Exercise progressions were only implemented when a given exercise was no longer challenging enough and/or when all older adults had learned the exercise and were performing it without methodological guidance. The duration of each session depended on the physical condition of the older adults and was modified according to individual considerations (physical condition, age, external assistance for walking).

Instruments

Prior to the start of each test, participants received written and verbal instructions and were allowed a practice run of each subtest. The instruments used were as follows:

Timed up and go test: used to assess the level of fall risk in older adults. Each participant was asked to get up from a chair, walk three meters, pass around a cone and return to the chair as quickly as possible. The indicators to determine if the older adult was at a low risk of falling were if the test execution time was less than 10 seconds, a time between 10 seconds and 20 seconds was categorized as a moderate risk of falling, and if the participant took more than 20 seconds to execute the test, he/she was categorized as a high risk of falling.

Guralnik Test/Physical Performance Battery: it was used to assess the level of functionality; the results of this instrument allowed the detection of frailty and the risk of disability in which the older adults were found. This battery made it possible to assess the older adults from three points of view: balance, gait speed and lower limb resistance. The balance test was evaluated in three positions: side by side (feet together), semi-tandem (toe of one foot at half the height of the other) and tandem (one foot in front of the other, touching the heel of one foot with the toe of the other). To assess balance, each participant was asked to perform (according to his or her condition) the three positions described above; to assess lower extremity endurance, each participant was asked to stand up and sit down from a chair (for 5 times) as quickly as possible ; if the older adult scored between 0 and 3 points he or she was categorized as having major limitations, with 4 to 6 points he or she was categorized as having a moderate limitation (frailty), 7 to 9 points as having a mild limitation (pre-frailty) and with a total score of 10-12 points the older adult was categorized as having no limitations.

Data analysis

Data collection was done through direct observation, and data were collected as the adults performed the tests; all analyses were coded using SPSS v.g. statistical software. A bivariate analysis was performed by applying means and standard deviations, categories and groups were described by frequency and percentages. The SPPB results

were coded in the virtual calculator of the (Sociedad Española de Endocrinología y Nutrición., 2018) and subsequently the information was appended to the SPSS program for its respective analysis;

Since there were only 15 data, the Shapiro Wilk test was performed to determine whether the distribution of the data for the variables of the level of risk of falling and the level of functionality presented a normal distribution.

To compare the results of the evaluations before and after applying the proprioceptive training, a statistical analysis was performed with non-parametric tests, in this case, a Wilcoxon signed-rank test. Finally, Spearman's correlation coefficient was used to analyze the correlation between the variables proprioceptive training and the total score of the variables of level of risk of falling and level of functionality. An alpha level of 0.05 was adopted for all statistical tests.

Results

In total, 50 older adults reside in the nursing home, of whom 30 were chosen (according to the inclusion and exclusion criteria) to participate in the study. Finally, 15 adults over 65 years of age voluntarily agreed to participate in the study and performed 12 sessions of proprioceptive training, twice a week, during the months of March and April 2021. No serious adverse events occurred during the 6-week intervention period. Regarding the results of the Timed up and go test, the time of ambulation was not statistically significant, the before/after measure was not different (P>0.05); only 1 older adult modified the level of fall risk, going from high fall risk to moderate fall risk, so it was concluded that the total score of the level of fall risk of older adults over 65 years old after proprioceptive training is equal to the initial one.

Table 1 shows the results of the participants' fall risk level before and after the proprioceptive exercise intervention.

Table 1
Level of fall risk. TUG

Pre-intervention	Frequency	Percentage	Post-intervention	Frequency	Percentage
Fall risk level			Fall risk level		
>10-20 seconds: moderate fall risk	3	20,0%	>10-20 seconds: moderate fall risk	26,7%	4
> 20 seconds: High risk of falling	12	80,0%	> 20 seconds: High risk of falling	73,3%	11
Total	15	100,0%		100,0%	15

Note: Taken from pre- and post-intervention test results (2021)

With respect to the results of the Guralnik test (SPPB), the results show, specifically, the scores of the three subassessments that are part of the test. For the balance test, in the case of the side by side position, it was evident that at the beginning of the test 11 older adults found it difficult to perform more positions, after the proprioceptive exercises the participants were able to move from the first position, being 9 adults in total; likewise, only 2 of 15 participants performed the tandem position, after performing the proprioceptive exercises 6 of 15 adults performed this position.

Table 2 shows the score of the balance test, in its three positions, before and after the proprioceptive exercise intervention.

Table 2
Scoring of the balance test. SPPB

Pre-intervention	Frequency	Percentage	Post-intervention	Frequency	Percentage
Side by side	11	73,3%	Side by side	*	*
Semi tandem	2	13,3%	Semi tandem	9	60,0%
Tandem	2	13,3%	Tandem	6	40,0%
Total	15	100,0%	Total	15	100,0%

Note: Taken from pre- and post-intervention test results (2021)

For the ambulation subtest, at the time of the initial evaluation, only 1 of 15 adults took between 10-15 seconds to ambulate the distance, after the proprioceptive training 4 of 15 adults performed the test in that time; 3 of 15 adults performed the test between 15-20 seconds and after the exercises only 1 participant performed the test in that time. In the case of performing the test with more than 30 seconds, 6 out of 15 older adults obtained this result in the initial evaluation and, in the final evaluation, 4 out of 15 were located in that period.

Table 3 shows the ambulation test score before and after the proprioceptive exercise intervention.

Table 3
Scoring of the walking speed test. SPPB

Pre-intervention	Frequency	Percentage	Post-intervention	Frequency	Percentage
>10-15 seconds	1	6,7%	>10-15 seconds	4	26,7%
>15-20 seconds	3	20,0%	>15-20 seconds	1	6,7%
>20-30 seconds	5	33,3%	>20-30 seconds	6	40,0%
>30 seconds	6	40,0%	>30 seconds	4	26,7%
Total	15	100,0%	Total	15	100,0%

Note: Taken from pre- and post-intervention test results (2021)

The results of the subtest to get up and sit down from a chair, to evaluate the resistance of the lower extremities, showed that in the initial evaluation no participant was able to perform the test in less than 15 seconds, however, after performing the proprioceptive training, the results show that in the final evaluation 4 out of 15 adults were able to perform the test in less than that time; Similarly, it was shown that in the initial evaluation, 6 out of 15 participants were able to perform the test within 25 to 35 seconds, at the time of the final evaluation, 3 out of 15 of them performed the test in that time.

Table 4 shows the score of the standing and sitting up from a chair test before and after the proprioceptive exercise intervention.

Table 4
Lower extremity endurance test score. SPPB

Pre-intervention	Frequency	Percentage	Post-intervention	Frequency	Percentage
0-15 seconds	*	*	0-15 seconds	4	26,7%
>15-25 seconds	7	46,7%	>15-25 seconds	7	46,7%
>25-35 seconds	6	40,0%	>25-35 seconds	3	20,0%
>35 seconds	2	13,3%	>35 seconds	1	6,7%
Total	15	100,0%	Total	15	100,0%

Note: Taken from pre- and post-intervention test results (2021)

Table 5 shows, in a general way, the total score of the SPPB test before and after proprioceptive exercises. The results show that in the initial evaluation 9 out of 15 participants were at a level with major limitations and, in the final evaluation, 2 out of 15 participants were at this level. Likewise, it was shown that in the initial evaluation no older adult achieved a level of mild limitation, however, in the final evaluation, after performing the proprioceptive exercises, it was shown that 3 out of 15 older adults were located in a level of (pre-fragility) mild limitation.

Table 5
Total score of the level of functionality. SPPB

Pre-intervention	Frequency	Percentage	Post-intervention	Frequency	Percentage
0-3 points: major limitations	9	60,0%	0-3 points: major limitations	2	13,3%
4-6 points: moderate limitation (fragility)	6	40,0%	4-6 points: moderate limitation (fragility)	10	66,7%
7-9 points: mild limitation (pre-fragility)	*	*	7-9 points: mild limitation (pre-fragility)	3	20,0%
Total	15	100,0%	Total	15	100,0%

Note: Taken from pre- and post-intervention test results (2021)

Finally, Table 6 shows the comparison of the results between the two evaluations: TUG & SPPB before and after a 6-week proprioceptive training; in this table it can be observed that, in the level of fall risk, there were no significant changes in the sample, since only 1/15 adults managed to modify the level from high to moderate fall risk, a condition that could be due to intrinsic/extrinsic factors of the older adults and not for reasons inherent to the intervention; on the contrary, significant changes related to balance, walking speed and resistance in the lower extremities were generated, results that are reflected in the progress of the functionality of the older adults and, with it, a decrease in the rating of the frailty syndrome; a situation that favors the prevention of falls, dependence, disability and even death.

As for Figure 1, the correlation results showed a statistically significant value ($p<0.05$) and a relationship coefficient: -0.732, which indicates that the two variables are inversely correlated, therefore, it can be affirmed that as adults over 65 years of age (residing in a nursing home) progressively increase the level of functionality, the level of risk of falling will also decrease and vice versa.

Table 6
Comparison of results between the two evaluations: TUG & SPPB

Fall risk level		Level of functionality	
Pre-intervention	Post-Intervention	Pre-intervention	Post-intervention
20.0% of older adults were at moderate risk of falling.	Of the participants, 26.7% had a moderate fall risk rating.	Prior to initiating proprioceptive training, 60.0% of the total number of participants scored with major limitations	After 6 weeks of proprioceptive training the percentage was reduced to a total of 13.3% of participants with a rating of major limitations
80.0% of the participants were found to be at high risk of falling.	After a 6-week proprioceptive training intervention, 73.3% of the total participants obtained a moderate risk rating.	40.0% of the participants were found to have the frailty syndrome, generating a rating in adults with moderate limitation.	With proprioceptive training, 66.7% of the participants obtained a rating of moderate limitation.
		Before starting the proprioceptive training sessions, no older adult was able to obtain a mild limitation rating.	After the intervention of proprioceptive exercises, 20.0% of the total number of participants obtained a rating of mild limitation.

Note: Taken from pre- and post-intervention test results (2021)

			Puntuación total SPPB post - intervención	Puntuación total TUG post - intervención
Rho de Spearman	Puntuación total SPPB post- intervención	Coeficiente de correlación	1,000	-,732**
		Sig. (bilateral)	.	,002
		N	15	15
	Puntuación total TUG post- intervención	Coeficiente de correlación	-,732**	1,000
		Sig. (bilateral)	,002	.
		N	15	15

Figure 1. Correlation of the two post-intervention evaluations: TUG & SPPB
Note: This figure shows the results of the Spearman correlation between the two dependent variables. Taken from pre- and post-intervention test results (2021)

Discussion and conclusions

The aim of this study was to investigate the effectiveness of a six-week proprioceptive exercise intervention on the variables of fall risk level and level of functionality in nursing home residents to promote fall risk prevention in the elderly. The main findings of this analysis were that an intervention of 12 sessions of proprioceptive training, twice a week with a duration of 15-20 minutes each session, did not improve the level of fall risk in older adults, but it did generate significant changes in the level of functionality, in relation to the balance, ambulation and lower extremity resistance tests.

The finding that there was no effect of the proprioceptive exercise intervention on the level of fall risk is similar to the results of other research that found no significant changes when using this test, as in the studies of (Pérez- Ruíz, Ventura- Hernández, & Valverde- Grandal, 2015; Alfieri, Marcelo, & al, 2012), in the case of Pérez and Barry & al, these state that the results are due to inconsistencies with the characteristics of the test but not by the participants, the authors noted that this test does not allow to adequately cover the multiple intrinsic and extrinsic factors that depend falls, and also does not allow to detect small changes in this variable. In the case of Alferi, factors such as intervention time and comorbidities of the participants interfere directly and negatively in the results of the test but not because of the characteristics of the test. Although this study showed that the older adults improved their walking speed, this item was not enough to generate significant changes in the risk levels in which the test is classified and, therefore, only 1 of 15 participants modified the high level of fall risk to a moderate level.

Some of the reasons that may explain the lack of efficacy of the proprioceptive exercise intervention on the level of fall risk include the age of the participants (11 of 15 participants are over 80 years old) and lifestyle, factors that may increase the risk of having a fall, and with it, dependency in activities of daily living.

In the case of the level of functionality, the results of this research resemble those found by (Sierra-Silvestre & E, 2011; Mesquita, de Carvalho, & Freire, 2015; Almeida, Rodrigues, & Teixeira, 2017; Drummond, Cardoso, & Losada, 2018), the results of these studies showed that older adults increased walking speed and stride length after a balance exercise intervention. Likewise, in this study it was possible to obtain significant changes in the subtest of getting up and sitting down from a chair, an item that allowed improving the resistance of the limbs of older adults, which "allows the identification of both progressive and catastrophic onset of disability" in older adults according to (Tápanes, González, Cascudo, & al, 2016).

An unexpected observation of the present study was the trend toward improved confidence in performing the exercises. This could explain why more participants did not complete the ambulation test in less than 20 seconds. The 4 of 15 participants who used some type of ambulation aid performed the second evaluation without any type of technical aid, as they reported "feeling more confident" to perform basic activities of daily living after the 6 weeks of proprioceptive training. This finding is related to what was previously mentioned about the research of (Olmos & Pérez-Jara, 2010), these authors state that the same insecurity to move around produces a decrease to perform other activities and, thus, promote the appearance of other complications in this population.

The results of this study show that 9 of 15 participants obtained an initial rating of major limitations, while in the final evaluation 2 of 15 participants obtained the same rating after performing the proprioceptive training, these findings found in this research indicate that the functionality of people decreases as age advances, a situation that

resembles what was stated by a research conducted in the Ministry of Health by (Gómez-Pavón, Martín, & al. 2007), ensuring that there is a linear and close relationship between fragility and functionality. As well as that mentioned by (Navalón-Alcañiz & Ignacio, 2020), who state that there is a positive association between the time of regular physical activity and a lower functional deterioration (p.580).

Finally, with the results obtained in this study, it is concluded that a proprioceptive exercise intervention is related to the level of functionality of older adults and, therefore, promote the prevention of fall risk, findings that are in line with the guidelines made by (Proske, 2012) assuring that "exercises that really challenge standing stability" are important to achieve a reduction in the incidence of falls in older adults; as mentioned by Bull & al (2020) who assert that there is "high evidence demonstrating that functional and balance exercises reduce the rate of falls" (p.1455).

Studies by (Bellew, Fenter, Chelette, & Moore, 2005;Sagastume, 2013), stating that proprioceptive exercises help to decrease the risk of falls which are of great benefit for older adults and what found by (Cando & Fiallos, 2019; Anzatuña & Figueroa, 2016; Huerta, 2018 and Mascaró, 2019) who conclude that there is a statistically significant difference between the risk of falling before and after performing proprioceptive training so older adults improve their independence in performing activities of daily living.

The strengths of this study include that proprioceptive training for 6 weeks is effective in improving static/dynamic balance, gait speed and lower extremity strength in older adults aged 65 years and, the unexpected finding, proprioceptive exercises promote confidence in the older adult to perform activities of daily living and, therefore, reduce the fear of a fall in older adults aged 65 years residing in a nursing home at Km1 via Dapa-Valle del Cauca.

The nominal group allowed to determine the relevance and feasibility of the proposal of a proprioceptive training in adults over 65 years of age residing in a nursing home at Km1 on the road to Dapa-Valle del Cauca. This proposed intervention is a viable option and can be included among the key strategies to promote fall risk prevention.

The limitations of the study, firstly, due to the health emergency caused by covid-19, the intervention time was too short to find more positive changes in the results and, perhaps, better results in the TUG test; secondly, the nursing home does not have professionals for an adequate prescription of exercise to promote physical activity in the elderly, since only 3 physiotherapists who were part of the nominal group were present.

Future research that seeks to promote the prevention of fall risk in adults over 65 years of age residing in a nursing home should ensure that the intervention is prescribed and supervised by professionals in the area, indicating the exact intervention program (time, frequency, training volume), a strategy that can facilitate adherence to physical training in older adults and, with this, include proprioceptive exercises in such sessions.

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