

## Protocol of exercises for home management of the hemiplegic patient

Protocolo de exercícios para manejo domiciliar do paciente hemiplégico

Protocolo de ejercicios para el tratamiento domiciliario de pacientes hemipléjicos

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#### ARTICLE INFORMATION

##### Science-Metrix Classification (Domain):

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##### Main topic:

Home exercise protocol for hemiplegic patients

##### Main practical implications:

The exercise protocol enables caregivers to effectively manage hemiplegic patients at home, reducing spasticity and fall risk, ultimately improving patients' mobility and safety.

##### Originality/value:

This study introduces a structured home exercise protocol specifically for hemiplegic patients, demonstrating significant improvements in reducing spasticity and fall risk, filling a gap in caregiver guidelines.

#### ABSTRACT

**Background:** Stroke represents the second cause of death and the first cause of disability in adults worldwide. Hemiplegia is the main sequel of ischemic stroke. It presents muscular alterations such as spasticity and lack of coordination. It also produces abnormalities in balance and gait, increasing the rate of falls. Physical rehabilitation through exercises is essential. There is not enough information for the caregiver to perform the exercises. **Objective:** to implement an exercise protocol to improve the home management of the hemiplegic patient that favors the reduction of spasticity and the risk of falls. **Methods:** It is a longitudinal, analytical study with a quantitative approach. It was developed in 15 people with hemiplegia by the Home Care Project for People with Disabilities of Palora Canton, Ecuador. The ages were from 20 to 64 years. The intervention was performed 3 times a week in each home. The Tinetti test and the Ashworth test were used for the initial evaluation. For the final evaluation, the Wilcoxon method was used. **Results:** a predominance was evidenced in the female gender 53.3% and the age range between 27 to 63 years 86.7% in the hypothesis testing of the Tinetti test (risk of falls) and Ashworth test (spasticity) where the results the value  $p < 0.001$  (asymptotic significance) With this data, the null hypothesis is rejected. **Conclusions:** It was determined that the exercise protocol for home management of the hemiplegic patient decreases the risk of falls and spasticity.

**Keywords:** hemiplegia; balance; spasticity; gait; home care.

#### RESUMO

**Introdução:** O AVC representa a segunda causa de morte e a primeira causa de incapacidade em adultos em todo o mundo. A hemiplegia é a principal sequela do AVC isquêmico. Apresenta alterações musculares como espasticidade e falta de coordenação. Também produz anormalidades no equilíbrio e na marcha, aumentando a taxa de quedas. A reabilitação física através de exercícios é essencial. Não há informações suficientes para o cuidador realizar os exercícios. **Objetivo:** implementar um protocolo de exercícios para melhorar o manejo domiciliar do paciente hemipléjico que favoreça a redução da espasticidade e do risco de quedas. **Métodos:** Trata-se de um estudo longitudinal, analítico com abordagem quantitativa. Foi desenvolvido em 15 pessoas com hemiplegia do Projeto de Atenção Domiciliar para Pessoas com Deficiência do Cantão de Palora, Equador. As idades variaram de 20 a 64 anos. A intervenção foi realizada 3 vezes por semana em cada casa. O teste de Tinetti e o teste de Ashworth foram utilizados para a avaliação inicial. E para avaliação final foi utilizado o método de Wilcoxon. Resultados: constatou-se predominância no gênero feminino 53,3% e na faixa etária entre 27 a 63 anos 86,7% no teste de hipótese do teste de Tinetti (risco de quedas) e teste de Ashworth (espasticidade) onde os resultados o valor  $p < 0,001$  (significância assintótica) Com esses dados, a hipótese nula é rejeitada. **Conclusões:** Foi determinado que o protocolo de exercícios para o manejo domiciliar do paciente hemipléjico diminui o risco de quedas e espasticidade.

**Palavras-chave:** hemiplegia; equilíbrio; espasticidade; maneira de andar, cuidado domiciliar.

#### RESUMEN

**Antecedentes:** El ictus representa la segunda causa de muerte y la primera de discapacidad en adultos en todo el mundo. La hemiplejia es la principal secuela del ictus isquémico. Presenta alteraciones musculares como espasticidad y falta de coordinación. También produce anomalías en el equilibrio y la marcha, aumentando la tasa de caídas. La rehabilitación física mediante ejercicios es esencial. No existe suficiente información para que el cuidador realice los ejercicios. **Objetivo:** implementar un protocolo de ejercicios para mejorar el manejo domiciliario del paciente hemipléjico que favorezca la reducción de la espasticidad y el riesgo de caídas. **Métodos:** Se trata de un estudio longitudinal, analítico y con enfoque cuantitativo. Se desarrolló en 15 personas con hemiplejia del Proyecto de Atención Domiciliar a Personas con Discapacidad del Cantón Palora, Ecuador. Las edades fueron de 20 a 64 años. La intervención se realizó 3 veces por semana en cada hogar. Para la evaluación inicial se utilizó el test de Tinetti y el test de Ashworth. Y para la evaluación final se utilizó el método de Wilcoxon. **Resultados:** se evidenció un predominio en el sexo femenino 53,3% y en el rango de edad entre 27 a 63 años 86,7% en la prueba de hipótesis del test de Tinetti (riesgo de caídas) y test de Ashworth (espasticidad) donde los resultados el valor  $p < 0,001$  (significación asintótica) Con estos datos, se rechaza la hipótesis nula. **Conclusiones:** Se determinó que el protocolo de ejercicios para el manejo domiciliario del paciente hemipléjico disminuye el riesgo de caídas y espasticidad

**Palabras clave:** cuidados en el hogar; adultos mayores; osteoartritis; miembros inferiores; programa de intervención; protocolo

## INTRODUCTION

A stroke is the second cause of death and the first cause of disability, with 11% worldwide, and 6.70% in Ecuador. This figure has remained the same for the last 25 years, becoming the fourth cause of death in the country. Stroke is caused by the interruption of blood supply to an area of the brain, resulting in brain damage due to lack of oxygen. 70% of strokes occur due to hypertension. There are two types of strokes. Most of them are ischemic due to the obstruction of an artery and hemorrhagic due to the total rupture of the artery. It can cause brain death in the patient. Hemiplegia is a common sign of ischemic stroke, as a consequence of damage to the internal capsule or motor cortex of the hemisphere, characterized by paralysis of half of the body (Desiderio-Moreira et al., 2022) (Donoso-Noroña et al., 2021) (Alrashid et al., 2019). Hemiplegia presents a decrease in motor function, joint amplitude, coordination, balance and gait, with unfavorable repercussions with a high degree of difficulty in the execution of motor actions and activities of daily living. Therefore, functional reeducation is essential (Gutiérrez-Sosa et al., 2022).

From the point of view of rehabilitation, stroke is a major generator of disability, both physical and cognitive. The most frequent sequela is hemiplegia with spasticity, and lack of coordination. It results in balance and gait abnormalities, increasing the rate of falls. In addition to functional limitations, spasticity, when it is inappropriately treated, leads to reduced quality of life. It increases pain and muscle contractures in the affected area. Spasticity is a clinical sign, which may vary according to the location of the brain damage. It may occur in the first week or after one year of the stroke, 24% during the first week, 19% at 3 months, 43% at 4 and 6 months and 38% at 12 months. Between 15% and 30% of people who suffer ischemic stroke present long-term functional deterioration, which leads to dependence on third parties. For this reason, the physiotherapist must establish a treatment at the affected level, and from the functional point of view (Arlette-Doussoulin et al., 2019) (Gutiérrez de los Santos et al., 2020). The frequency of stroke increases with age. The main risk factors are arterial hypertension, diabetes mellitus, obesity, and sedentary life (Sánchez Pando et al., 2020). Hemiplegia also presents the affectation of manual function related to the difficulty of performing selective patterns of individual and bilateral movement. With physiotherapeutic treatment through exercises, functional performance and independence of the patient with hemiplegia of the affected area improve (Sebastiao-Bastos et al., 2021) (Valencia-Buitrago, et al., 2018).

Rehabilitation through exercises for the person with hemiplegia becomes a challenge for the patient, their relatives and the physiotherapist. All efforts are oriented to results that improve their quality of life. It is important to mention that housework is essential for the affected person. It is of great importance to perform the exercises with the help of a caregiver. As mentioned, the caregiver plays a leading role, becoming an active entity in the rehabilitation of his family member. The development of this research is fundamental, since its objective was to implement an exercise protocol to improve the home management of the hemiplegic patient that favors the reduction of spasticity and the risk of falls.

In the research by Baumhardt-Guidoti et al. (2021), it is mentioned that 50% to 75% of individuals with hemiplegia have motor consequences that hinder their autonomy. Therefore, rehabilitation is essential in conjunction with the family. Sedentary lifestyle is common, because the patient returns home with functional limitations. Likewise, the physiotherapist is the most requested health professional in the intervention for the hemiplegic population in hospitals and in home care. The implementation of rehabilitation at home increases recovery.

Also Sebastiao-Bastos et al. (2021), in their article, point out that people with hemiplegia have a sedentary lifestyle, despite the recommendations to reduce physical inactivity. In their research, they determined that exercises such as walking, and muscle training are the most selected. This information helps to improve the care given by health personnel. The progression and number of repetitions of the exercises are performed according to the conditions of each individual, to achieve autonomy in activities of daily living (Lima et al., 2020).

Jisheng-Wang (2021) in his study mentions that it is very important for stroke patients with hemiplegic sequelae to perform physical exercise, but physical dysfunction restricts the performance of these activities. To explore the efficacy of physical exercise to recover limb function in these patients, the authors selected a population, which after rehabilitation they concluded that low-intensity exercise helps patients with hemiplegia to recover their basic ability to live.

On the other hand, Hyun-Seung et al. (2021) point out in their research that hemiplegia due to ischemic stroke induces an imbalance in the affected area of the body, with limitations in sitting, standing and walking due to motor impairment. Re-education of balance control and motor impairment increases the rate of falls due to loss of function of the upper and lower extremities, making independence difficult. Patients consider walking as a complex activity due to the restricted mobility they undergo. Also, the authors mention that it was evidenced that through exercise it was possible to improve the movement of the body weight and the positional sense of the foot obtaining positive results in balance.

Diéguez-Ruíz, et al., (2021) in their article establish the benefits of a battery of exercises for joint deformities reduction in stroke patients with hemiplegia sequelae. The battery of exercises determined 4 stages with activities such as

passive, active assisted, active and resisted mobilizations. Gait corrections were also performed. Each stage with objectives to be met. The results of the investigation of the battery of exercises were satisfactory. They contributed to the decrease of the deformity in each of the participants. It allowed the patients to reach a greater articular amplitude, a harmonic and functional gait, and a decrease in risk of falls. Also, Taro et al. (2018) conducted a literature review, where the results obtained were quantitatively and qualitatively assessed. They established, in their article, a strategy consisting of 4 stages. Each of the stages has its objective and its actions that allowed to endorse the relevance of the research. The application of the strategy demonstrated, from the fulfillment of the objectives of the applied stages and the existing evaluations of the process, that the results of this research constitute a viable proposal.

Secorún-Enjuanes, et al. (2022) carried out an investigation with the aim of evaluating the results obtained after the implementation of an exercise program to treat balance in patients with a history of stroke, 2 years ago and in a chronic phase. The results show an improvement in balance after the exercise program. The physiotherapy treatment is transcendental for recovery. The research mentions that balance is the human being's ability to maintain a sitting or standing posture. It allows to know their orientation in space and position.

On the other hand, Pinzón-Bernal M, et al.,(2020) in their study, proposed to establish the effect of an intervention program based on motor relearning on postural control in adults with hemiparesis. The selected population were male and female adults. The physiotherapy sessions were performed 3 times a week. The authors concluded that their study has effective results in improving antigravity postural control and the quality of selective lower limb patterns, compared to a conventional physiotherapy program. It is important to mention that in the instrumental sample analysis it was evidenced that it produces significant changes in stability during gait, antigravity postural control, balance, sensory organization and in the quality of hand, lower limb, seated-kneeling, bipedal, gait, bipedal and global movement patterns in adults with hemiparesis.

In addition, it is important to mention that spontaneous recovery occurs in the first month, followed by an assisted recovery during the next 6 months and slow recovery during the following months. Recovery in the chronic stage is possible thanks to brain plasticity and sensory learning related to motor control. Home rehabilitation programs for the recovery of the hemiplegic patient significantly improve independence. Patients at home face challenges of independence in daily life. Thus, it is encouraged to improve functional interventions and reduce the deterioration of the affected limbs through the exercise therapy program performed at home (Gonzalez-Santos et al., 2020).

Borrero-Gonzalez (2019) states that exercise is essential for the recovery of hemiplegic people. He establishes a program of 3 stages, in which he mentions several exercises with series and repetitions, in different postures. After the rehabilitation sessions, the results contributed to improve the patient's daily errands. They helped perform activities with the affected side with the support of the healthy side, such as turning over in bed, and removing some clothes. In the analysis of an individual with hemiplegia, great satisfaction with the exercise treatment performed was found. The care of a patient with ischemic stroke, and with sequela of hemiplegia, focuses on recovering the fundamental functions to have an autonomous life. Physical exercise improves performance in basic motor skills. Exercise programs increase the psychosocial reintegration of the beneficiary in the community (Alrashid et al., 2019).

Exercise improves muscle tone, joint mobility and balance in the medium or long term in the human body, when physical activity is performed in an appropriate manner by health personnel and family support in home rehabilitation. The International Center for Neurological Restoration (CIREN) in Cuba executed a rehabilitation program, where it was evidenced that essential exercises were not performed to solve the problem. Therefore, a set of exercises was elaborated to improve strength and balance in patients with ischemic stroke. It consists of 3 phases, each exercise was performed in 3 series of 10 repetitions, during a time of 45 minutes to 1 hour for 4 consecutive weeks. Balance and strengthening of muscle tone were considered. The results showed an increase in muscle strength, decreased spasticity and increased balance as evidenced by the Tinetti scale. It improved the patients' quality of life and increased their autonomy (Dutill-Macurán et al., 2020).

## METHODOLOGY

A descriptive study with a quantitative approach was conducted. Data were collected to numerically verify the results of the study. The research was conducted at Project for People with Disabilities Home Care in Palora canton through an agreement signed with the Palora' Municipal Government and the Ministry of Inclusion and Solidarity Economy in the Province of Morona Santiago. In this place 30 people with physical, intellectual and visual disabilities (MIES 2022) are beneficiaries. We worked with a sample of 15 people with hemiplegia who meet the following inclusion criteria: individuals with an age range from 20 to 64 years, subjects presenting acquired spastic hemiplegia not less than 3 years, with their caregiver available for the execution, patients who sign the informed consent. The exclusion criteria were: individuals with lower and upper limb amputations, people undergoing private physiotherapeutic care, subjects with visual problems and

severe cognitive impairments proven and the indigenous population that does not master the Spanish language.

Two evaluations were carried out at the beginning and at the end of the study. The Tinetti test is composed of 9 balance items and 7 gait items. The answers are scored 0 when the person does not achieve or maintain stability in the changes of position or has an inappropriate gait pattern. According to the parameters described in the scale, this is considered as abnormal. Score 1, means that he/she achieves the changes and it is called as adaptive. Finally, Score 2, is that person of position or gait patterns with postural compensations. This condition without difficulties to execute the different tasks of the scale is considered as normal. The maximum score of balance is 16 and gait 12, with a total score of 28. Through this test the risk of falls is determined. It is considered high risk of falls between 0 to 18, risk of falls between 19 to 23 and low or mild risk of falls from 24 to 28 (Carballo-Rodríguez et al., 2018). Cronbach's scale validity of 0.95 and a variance of 13.89 were obtained. The scale has proven to be a valid and reliable tool for the assessment of mobility ( $r$  0.74-0.93). In addition, it has a high inter-(0.95) observer reliability (Guevara-Rodríguez et al., 2012).

Ashworth test, which assesses the level of spasticity and muscle tone of the subject, consists of 5 items. The test score are: 0 (normal muscle tone, no spasticity), 1 (slight increase in muscle tone, minimal resistance at the end of the joint arc when passively stretching the muscle group considered), 1+ (slight increase in tone, resistance to elongation in less than half of the joint arc), 2 (major increase in tone, resistance to elongation in less than half of the joint arc), 3 (considerable increase in tone, passive mobilization of the limb is difficult), and 4 (hypertonia of the limbs in flexion or extension, abduction, adduction, etc. ). The reliability of the scale is good since it has a Cronbach's alpha greater than 80% (Agredo et al., 2009).

The present exercise protocol for home management of the hemiplegic patient was based on the research of Dutil-Macurán et al. (2020) and validated by experts. The exercises were established in 3 phases, with similarity in the number of repetitions, execution time and the results were positive for the reduction of spasticity and the rate of falls. The exercise protocol was executed in 16 weeks, and was directed to the caregiver or relative. It is evidenced that they are able to contribute in the rehabilitation of the hemiplegic patient. The research was carried out in 3 phases, which are detailed below:

#### **PHASE 1:** Current situation of the patient with hemiplegia.

In week 1, we began with the socialization of the exercise protocol to the caregiver. In the description, technical language was not used. It was written in a simple way for the caregiver to use the protocol with the disabled person. The signature of the informed consent was requested. The clinical history was validated by the Ministry of Public Health (MSP) of Ecuador (2009) and it was applied to 15 people with hemiplegia.

#### **PHASE 2:** Application of the exercise protocol

From the second to the fifteenth week, the exercise protocol was executed. It was subdivided into four stages:

*Stage 1:* passive and active assisted movements in upper and lower limb were performed through 2 series of 10 repetitions in the second and third week.

**Shoulder:** Shoulder flexion and extension: the caregiver takes the affected arm forward and backward. Shoulder abduction and adduction: the caregiver takes the affected arm extended outward and inward. Shoulder external and internal rotation: the caregiver positions the affected arm in 90° elbow flexion, palm up, brings the arm outward and inward. **Elbow:** Elbow flexion and extension: the caregiver bends the affected arm upward and extends it downward. Elbow pronation and supination: the caregiver positions the arm extended, brings the palm of the hand upwards and downwards. **Wrist:** Wrist flexion and extension: the caregiver positions the arm in 90°, elbow flexion with the palm upwards, from there the caregiver holds the affected wrist and brings it upwards and downwards. Radial and ulnar wrist deviation: the caregiver positions the arm in 90°, elbow flexion with the palm facing upwards, holds the affected wrist with the fingers extended and performs lateral movements to the left and to the right. **Fingers:** Finger flexion and extension: the caregiver positions the arm in 90°, elbow flexion with the palm up, bends and extends the fingers of the affected hand. Finger abduction and adduction: the caregiver positions the arm in 90°, elbow flexion with the palm facing upwards, separates and brings the fingers of the hand closer together. **Trunk:** Trunk flexion and extension: the caregiver holds the disabled person by the hands and bends up and down. **Hip:** Hip flexion and extension: flexion the caregiver brings the extended leg up and down, extension the caregiver brings the extended leg back and down. **Hip abduction;** caregiver separates and brings the affected leg extended closer to the healthy leg. **Knee:** Knee flexion and extension; the caregiver bends and extends the affected leg. **Foot:** Plantiflexion and dorsiflexion of the foot: the caregiver brings the foot up and down.

*Stage 2:* free movements, postural care in upper and lower limb, 3 series of 15 repetitions in sedentary position, from the fourth to the seventh week.

**Arm:** Elevation of the affected arm with the healthy arm: the subject interlaces the fingers of the hand, with the arms extended, and performs elevations of the arms above the head, taking into account the tolerance of each one. **Elbow:** Flexion and extension of the **elbow:** the subject flexes and extends the arm without any support. **Trunk:** Left and right trunk tilt: the

person is positioned with hands interlocked above the head. From there he/she leans to the right and left side. **Knee:** Knee extension and flexion: sitting with the legs bent, he/she places the affected leg over the healthy one and bring the leg up and down. **Foot:** Plantiflexion and dorsiflexion of the foot: the subject is positioned with the legs in flexion. He/she performs heel and toe movements. Posture correction: the subject is positioned in a chair, facing the mirror, from there the caregiver corrects the alignment of shoulders, trunk, hips, knees and feet.

*Stage 3:* movements were performed with resistance. The caregiver observes, verifies the resistance to be used and then corrects the execution of the exercises. 4 series of 10 repetitions are performed.

**Arm:** Elevation of the affected arm: the subject holds a 1-pound sand weight with the affected arm and performs up and down movements. **Elbow:** Elbow flexion and extension: the subject holds a 1-pound sand weight in the hand with the affected arm and flexes and extends the elbow. **Trunk:** Lateral tilts: the subject holds a 1-pound sand weight in the hand with the affected arm, and bends to the right and left side. **Hip:** Hip flexion and extension: the subject with a 1-pound sand weight on the ankle and with the knee flexed brings the leg forward and backward. **Knee:** Knee flexion and extension: the subject with a 1-pound sand weight on the ankle, bends and extends the knee. **Foot:** Plantiflexion and **dorsiflexion:** the subject with a 1-pound sand weight on the ankle, rests on the toes and heels alternately.

*Stage 4:* gait correction from the eleventh to the fifteenth week. 3 series of 15 repetitions were performed in a standing position.

**Weight offloading:** the subject will lean on the back of a chair. From there, the caregiver takes the affected leg forward to make contact with the heel and backward to make contact with the toe. **Lateral gait:** the subject performs side steps with the affected leg and with the healthy leg alternately. **Posture correction during gait:** the subject walks 3 to 5 meters, and the caregiver performs posture correction (shoulders aligned, forward gaze, correct gait). **Walking:** the subject walks 5 meters, and the caregiver observes correct heel toe and correct postures when moving.

Each stage was carried out 3 times a week. Each beneficiary had an established schedule. The sessions were executed in each home. It is important to mention that to advance to the next stage they must master the previous one. This was done according to the characteristics of the hemiplegic person.

**PHASE 3:** on week 16, the final evaluation was carried out through the Tinetti test and the Ashworth test. It aimed to identify the evolution after the application of the protocol in the study population.

**Statistical Analysis**

The SPSS program version 29.0 was used. The results were expressed in tables with frequencies and percentages. The statistical normality test was performed to certify the normality of the variables, so the Shapiro-Wilk test was used. It corresponds to small samples of less than 30. The Wilcoxon test was selected, a non-parametric test for quantitative variables that do not have a normal distribution, to compare related samples before and after. The asymptotic significance should be  $p < 0.05$  with this result, so the null hypothesis was rejected.

**Bioethical considerations**

The current project has the approval of the "Bioethics Committee for Research in Human Beings of the Faculty of Health Sciences, Technical University of Ambato", with code 39-CEISH-UTA-2023. This research is approved and complies with the ethical, methodological and legal requirements. The methodology was socialized and the informed consent, where the research process is detailed, was signed.

**RESULTS AND DISCUSSION**

Once the intervention had been carried out and the final data from the applied tests had been collected, the results obtained were as follows:

**Table 1.** Sociodemographic characteristics of the beneficiaries of the project "Home Care for People with Disabilities".

	Variable	Frequency	Percentage (%)
<b>Age</b>	20-26	2	13.3
	27-63	13	86.7
<b>Total</b>		15	100.0

<b>Sex</b>	Female	8	53.3
	Male	7	46.7
<b>Total</b>		15	100.0

**Note.** Own elaboration with the research data (2023)

The study was carried out with 15 people where it was found that 86.7% corresponded to ages between 27 and 63 years. 13.3% corresponded to an age range between 20 and 26 years. According to female gender, 53.3% corresponds to 8 women and 46.67% to 7 men (Table 1).

**The Tinetti test** is a quantitative evaluation, assessing balance, gait and risk of falling.

In the initial assessment, 9 people evaluated (60%) obtained a score of 10, while 6 people (40%) obtained a score of 11. After the intervention, 6 people (40%) obtained a score of 14, while 5 people (33.3%) obtained a score of 13. And 4 people (26.7%) obtained a score of 12. When comparing the initial and final assessment, in balance, score 10 corresponds to 60% and 11 to 40%. These data are not visualized at the end because after the intervention there is an advance in score 12 for 26.7%, followed by a score of 13 for 33.3% and finally a score of 14 for 40% (Table 2).

**Table 2.** Assessment of balance through the Tinetti test in hemiplegic patients

Tinetti test score	Assessment of initial balance		Evaluation of final balance	
	Frequency	Percentage (%)	Frequency	Percentage (%)
10	9	60.0		
11	6	40.0		
12			4	26.7
13			5	33.3
14			6	40.0
<b>Total</b>	15	100.0	15	100.0

**Note.** Own elaboration with the research data (2023)

The Shapiro-Wilk test was used. It corresponds to small samples, considering that the result in balance in the initial assessment  $p=0.00$  and in the final assessment  $p=0.04$ . The values do not exceed the significance  $p>0.05$ . That is to say that the data do not correspond to a normal distribution. The nonparametric Wilcoxon test was selected.

**Table 3.** Hypothesis testing: Tinetti test in balance

Test Statistics	
	Evaluation of initial balance - Evaluation of final balance -
Z	-3.578
Asymptotic sig (bilateral)	.000

- a. Wilcoxon signed-rank Wilcoxon test
- b. It is based on negative ranges.

**Note.** Own elaboration with the research data (2023)

In the balance test, the Wilcoxon test was run, obtaining a result  $p<0.05$  (asymptotic significance) in the initial and final assessment. Thus, the null hypothesis is rejected. It means that the exercise protocol was effective in improving balance in people with hemiplegia (Table 3).

**Tinetti test in gait.**

In the area of gait, an assessment was carried out before the intervention. 40% had a score of 10 corresponding to 6 participants, 33.3% with a score of 9 corresponding to 5 participants and 26.7% with a score of 8 corresponding to 4 participants. After the intervention 73.3% showed a score of 12 corresponding to 11 participants and 26.7% with a value of 11 corresponding to 4 participants. When comparing the initial and final assessment, a score of 8 corresponds to 26.7%, followed by a score of 9 which corresponds to 33.3% and a score of 10 to 40.0%. After the intervention no scores of 8, 9 or 10 were observed. This demonstrates progress with a final score of 11 for 26.7% and a score of 12 for 73.3% (Table 4).

**Table 4.** Gait evaluation through the Tinetti test in hemiplegic patients

Tinetti test score	Assessment of initial gait		Assessment of final gait	
	Frequency	Percentage (%)	Frequency	Percentage (%)
8	4	26.7		
9	5	33.3		
10	6	40.0		
11			4	26.7
12			11	73.3
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>

**Note.** Own elaboration with the research data (2023)

The Shapiro-Wilk was used. It corresponds to small samples. The results in initial gait was  $p=0.04$  and the final was  $p=0.00$ . The values do not exceed the significance  $p>0.05$ . It means that the data do not correlate to normal distribution. The non-parametric Wilcoxon test is selected.

**Table 5** Gait evaluation through the Tinetti test in hemiplegic patients.

Test statistics	
	Initial gait evaluation - Final gait evaluation
Z	-3.520b
Asymptotic sig. (bilateral)	.000

a. Wilcoxon signed-rank test  
b. It is based on negative ranges.

**Note.** Own elaboration with the research data (2023)

In the gait test, the Wilcoxon test was run, obtaining a result  $p<0.05$  (asymptotic significance) in the initial and final assessment, Thus the null hypothesis is rejected. Therefore, the exercise protocol was effective in improving gait in people with hemiplegia (Table 5).

**Tinetti test for risk of falls**

In obtaining initial data with the Tinetti test, it is observed that 73.3% have a risk of falls corresponding to 11 beneficiaries, while 26.7% have a high risk of falls involving 4 beneficiaries, Therefore, most beneficiaries have a high risk of falls. In the final evaluation, 73.3% had a low or slight risk of falling, which involved 11 people, and 26.7%, which corresponded to 4 beneficiaries. At the beginning there was a high risk of falls, but at the end it is no longer observed. This score advanced to another level called risk of falls, which corresponds to 26.7% and most of them progressed to a low or slight risk of falls with 73.3% (Table 6).

**Table 6:** Assessment of fall risk by Tinetti test in hemiplegic patients.

Tinetti test score	Initial fall risk score		Final fall risk score	
	Frequency	Percentage (%)	Frequency	Percentage (%)
High risk of falls	4	26.7		
Low or slight risk of falls	11	73.3	4	26.7
Low or slight risk of falls			11	73.3
<b>Total</b>	<b>15</b>	<b>100.0</b>	<b>15</b>	<b>100.0</b>

**Note.** Own elaboration with the research data (2023)

The Shapiro-Wilk test was performed. It corresponds to small samples. The result in the initial risk of falls was  $p=0.00$  and in the final risk of falls  $p=0.00$ . The values do not exceed the significance  $p>0.05$ , that is to say that the data do not correspond to a normal distribution. The nonparametric Wilcoxon test was selected.

**Table 7:** Hypothesis testing: Tinetti test for risk of falls interpretation.

Test Statistics	
	Evaluation of Initial Risk of Falls – Evaluation of Final Risk of Falls
Z	-3.873b
Asymptotic sig. (bilateral)	.000

a. Wilcoxon signed-rank test  
b. Based on negative ranges

**Note.** Own elaboration with the research data (2023)

The Wilcoxon test was run on the risk of falls, obtaining a result of  $p < 0.05$  (asymptotic significance). Thus, the null hypothesis is rejected. Therefore, the exercise protocol was effective in people with hemiplegia, reducing the rate of falls.

**Ashworth test to evaluate the degree of spasticity.**

The results of the Ashworth test applied in the initial evaluation were 73.3% with a grade of +1 corresponding to 11 persons and 26.7% with an evaluation of 2 corresponding to 4 persons evaluated. In the final evaluation there was 73.3% with a grade of 1 corresponding to 11 persons and 26.7% with a grade of +1 corresponding to 4 persons evaluated. When comparing the 2 evaluations, there is evidence of progress. In grade 2 no percentages are observed. In the final evaluation, a percentage of 73.3% in grade 1 is verified (Table 8).

**Table 8:** Evaluation of the degree of spasticity through the Ashworth test in hemiplegic patients

Degree of spasticity		Ashworth's initial assessment		Ashworth final assessment	
		Frequency	Percentage (%)	Frequency	Percentage (%)
0	Normal muscle tone, no spasticity.				
1	Slight increase in tone, minimal resistance at the end of the joint range.			11	73.3
1+	Slight increase in muscle tone, resistance at less than half of joint range.	11	73.3	4	26.7
2	Major increase in tone, resistance at less than half of joint range.	4	26.7		
3	Considerable increase in tone, difficult passive mobilization of the limb.				
4	Considerable increase in tone, difficult passive mobilization of the limb.				
<b>TOTAL</b>		15	100.0	15	100.0

**Note.** Own elaboration with the research data (2023)

The Shapiro-Wilk test was performed, which corresponds to small samples. The result in the Ashworth test of the initial  $p=0.00$  and final  $p=0.00$  values do not exceed the significance  $p > 0.05$ . That is to say that the data do not correspond to a normal distribution, the nonparametric Wilcoxon test was selected.

Test statistics	
	Initial Ashworth rating – Final Ashworth rating
Z	-3.742b
Asymptotic sig. (bilateral)	.000

a. Wilcoxon signed-rank test  
b. It is based on positive ranges.

**Note.** Own elaboration with the research data (2023)

In the Ashworth test, the Wilcoxon test was performed, obtaining a result  $p < 0.05$ . Thus, the null hypothesis is rejected. That is to say that the exercise protocol was effective in people with hemiplegia by decreasing the degree of spasticity.

The current study was carried out with 15 people with hemiplegia from the project "Home Care for People with Disabilities". The ages ranged from 20 to 63 with a prevalent range from 27 to 63 years (86.7%). The selected population were men and women, with a predominance of the female gender with 53.3%. The average age is similar to the research conducted by Gutiérrez de los Santos et al. (2020) with an age range between 22 and 67 years. Similarly, the study conducted by Desiderio-Moreira et al.(2022) and Dutill-Macurán et al. (2020) carried out populations of both genders, in people with hemiplegia, with the difference that there was a higher prevalence in the male gender.

The Tinetti test was used in the area of balance. Initially the score 10 corresponds to 60% and 11 to 40%. These data are not displayed at the end, because after the intervention there is an advance in the score 12, 26.7%, followed by a score of



13, 33.3% and finally a score of 14 corresponding to 40%. As for walking, a score of 8 represents 26.7%, followed by a score of 9 corresponding to 33.3% and a score of 10 corresponding to 40.0%. After the intervention, there are no scores of 8, 9 or 10. This shows progress with a final score of 11 26.7% and a score of 12 73.3%. In relation to the risk of falls it was high representing 73.3%, which at the end is no longer observed This shows progress to another level called risk of falls, which corresponds to 26.7% and mostly progress to a low or slight risk of falls with 73.3%. In the results of the Ashworth test applied in the initial evaluation, 73.3% with grade +1 and 26.7% with an evaluation of 2. In the final evaluation there is evidence of progress, in grade 2 no percentages are observed. In the final evaluation a percentage of 73.3% in grade 1 is verified. With the results obtained there is evidence of progress in the selected population. Baumhardt-Guidoti et al, (2021) in their article mention that after rehabilitation in patients with hemiplegia following an ischemic stroke, significant changes were evidenced when using the Tinetti and Ashworth test. They verified progress in participants with hemiplegia demonstrating the importance of rehabilitation in this population. Morales-Barrietos (2019), mentions that after the intervention, one of the results obtained in his research is the reduction of spasticity assessed by the Ashworth test. It achieved several postural changes in the hemiplegic patient. Rehabilitation at home is an important tool. Adequate training of family members will contribute to the patient's recovery (Valencia-Herrera et al., 2021).

As for the current project, the exercise protocol was performed 3 times a week, during 16 weeks, in a time range of 45 minutes to one hour in each home. Each person with hemiplegia performed the exercises with their respective caregiver. Progressive exercises in different postures were performed such as supine, prone, seated, and standing. There was also gait correction. The intervention of the protocol was carried out in 4 phases. In each phase, passive and active assisted exercises and active free exercises were executed. Flexion, extension, abduction, and adduction of the different areas of the body were performed. They were socialized without technical terms so that the caregiver could develop them without any inconvenience.

Pérez-Reyes et al, (2021) in their article mention adapted and necessary exercises for the rehabilitation of patients with ischemic stroke, with sequela of hemiplegia. They elaborated an exercise guide directed to a family member. The time is of 1 hour, in several phases, 3 times a week. The exercises consisted of passive mobilizations, active assisted, free, postural exercises, exercises for muscle strength and walking. Positive results were obtained since the person with hemiplegia, evaluated in the intervention time, did not suffer any fall. This increased their mobility at home. This correlates with our research, since the author mentions the importance of exercise and the beneficial contribution to people with hemiplegia who are not able to continue their rehabilitation in their physiotherapy centers.

Therefore, it can be emphasized that home rehabilitation, through simple exercises performed correctly, helps this population to improve their quality of life and independence. This was evidenced in this study after the results obtained from the tests applied. There was decrease in the degree of spasticity and the risk of falls. Pratz-Andrade (2022) in their study mentioned that rehabilitation is essential for the recovery of hemiplegic persons. Also individualized home care is important, where the family is involved in their rehabilitation. It helps with the reincorporation of the patient in their daily life. Guerra-Sánchez et al. (2021) also corroborates in their article that home rehabilitation improves neurological status, spasticity and autonomy in activities of daily living in hemiplegic stroke patients.

## CONCLUSIONS

The exercise protocol for the home management of the hemiplegic patient, for beneficiaries of the project "Home Care for People with Disabilities", had a positive influence on the improvement of gait and balance. It helped decrease the risk of falling and improve the degree of spasticity and autonomy significantly.

According to the results obtained in the different tests applied at the beginning and at the end, the effectiveness of the research was evidenced. It is concluded that the protocol of exercises for the home management of the hemiplegic patient favors their recovery. The exercises are simple and were performed by the caregiver without any inconvenience. Favorable changes for hemiplegic people were observed. Home rehabilitation performed by the caregiver assures that progress is obtained in the hemiplegic patient, when there is a guide with simple language, series, repetitions and indications, executed correctly. Therefore, it helps to improve the patient's conditions.

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**Contribution of each author to the manuscript:**

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B. data research and statistical analysis:	50%	15%	15%	10%	10%
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