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ORIGINAL

Prevention of falls in older adults: analysis of effective interventions

Prevención de caídas en adultos mayores: análisis de intervenciones efectivas

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ABSTRACT

Introduction: accidental falls in older adults represent a phenomenon of recurrence and considerable severity since they affect the loss of independence and reduce the person's mobility capabilities, which contributes to premature admission of older adults to nursing homes in the short or long term. long term. It is imperative to study the effective prevention of these events to improve the quality of life of this population. The objective is to analyze effective interventions to prevent accidental falls and their physical consequences to improve the quality of life of older adults and sociodemographically identify samples of collected studies, determine influential risk factors in accidental falls, characterize types of preventive interventions and specify effectiveness. of these interventions.
Method: the methodology applied was a systematic review of the bibliography, retrospective, prospective and qualitative, carried out using a data registration form obtained from academic articles published from 2019 to 2024 according to inclusion criteria. The material used was 11 studies or systematic reviews related to the stated inclusion criteria.
Results: the influencing risk factors are internal, such as cognitive and neuronal conditions mostly, which affects both men and women over 60 years of age. The most effective preventive interventions are multicomponent ones (exercise+cognitive therapy+professional education+technology) and comprehensive physical exercise, with a high level of fall reduction and noticeable physical improvement in the individual. Other interventions generate relative effects conditioned by time of application, age or preferences of the older adult.
Conclusion: the effectiveness of preventive interventions for falls in older adults in association with the risk factors that influence these accidents should be further explored.

Keywords: Elderly; Accidental Falls/Prevention and Control; Risk Factors; Treatment Effectiveness; Quality of Life; Quality of Life.

RESUMEN

Introducción: las caídas accidentales en adultos mayores representan un fenómeno de recurrencia y de gravedad considerable puesto que afectan en la pérdida de la independencia y reducen las capacidades de movilidad de la persona lo cual contribuye a un ingreso prematura de los adultos mayores en asilos en el corto o largo plazo. Resulta imperativo el estudio de la prevención eficaz de estos eventos para mejorar la calidad de vida de esta población. Se plantea como objetivo analizar intervenciones efectivas de prevención de caídas accidentales y sus consecuencias físicas para mejorar calidad de vida de adultos mayores e identificar sociodemográficamente a muestras de estudios recopilados, determinar factores de riesgo influyentes en caídas accidentales, caracterizar tipos de intervenciones preventivas y precisar eficacia de dichas intervenciones.

Método: la metodología aplicada fue una revisión sistemática de la bibliografía, retrospectiva, prospectiva y cualitativa, llevada a cabo mediante planilla de registro de datos obtenidos de artículos académicos publicados desde 2019 a 2024 acorde a criterios de inclusión. El material utilizado fueron 11 estudios o revisiones sistemáticas relativos a los criterios de inclusión expresados.
Resultados: los factores de riesgo de influencia son internos, como las condiciones cognitivas y neuronales mayormente, lo que afecta tanto a hombres como mujeres mayores a 60 años. Las intervenciones preventivas mas efectivas son las de multicomponentes (ejercicio+terapia cognitiva+educacion profesional+tecnología) y las de ejercicio físico integral, con nivel alto de disminución de caída y mejora fisica notoria en el individuo. Otras intervenciones generan efectos relativos y condicionados por tiempo de aplicación, edades o preferencias del adulto mayor.
Conclusión: debe profundizarse en relación con la eficacia de las intervenciones preventivaas de caídas de adultos mayores en asociacion a los factores de riesgo que influyen estos accidentes.

Palabras clave: Personas Mayores; Caídas Accidentales/Prevención y Control; Factores de Riesgo; Eficacia del Tratamiento; Calidad de Vida.

INTRODUCTION

Older adults are considered members of a global population whose preservation depends on longevity and care aimed at achieving it. Generally, a person is considered older when they are 60 or older.[1] Care to prolong the life of these individuals is associated with fall prevention, which is one of the most prevalent risk factors in this population.[2]

It should be noted that accidental falls in older adults are a recurring and serious phenomenon. They affect independence and reduce mobility, contributing to the premature admission of older adults to nursing homes in the short or long term.[3,4,5] As individuals age, the risk of accidental falls increases.[5]

At least one accidental fall is recorded per year among the global population of adults aged 80 years or older, which means that people's quality of life deteriorates as they suffer accidents.[5] Thus, quality of life is affected by the injuries caused by falls, such as fractures, contusions, sprains, and strains.[5,6] More serious effects of falls can include death.[5,6]

In Argentina, adults over 60 have a 30 % chance of suffering independent or self-inflicted falls, while this percentage increases to 35 % in those over 75 and 50 % in those aged 80 and over.[7]

Given the reality of this phenomenon, the possibility of preventing these adverse circumstances in older adults to optimize their quality of life and reduce the risk of accidental falls is being questioned. Some research has indicated that a dietary intervention with vitamin D and protein provides good protection and strengthens the physical condition of older adults.[2,8,9] However, most of these studies refer to nursing home populations or hospitalized patients with osteoporosis.

On the other hand, the effectiveness of interventions associated with physical exercise and multifactorial methods in older adults was studied, indicating a decrease in annual falls among participants in primary care settings.[5,10,11] From a community perspective, other findings established the effectiveness of fall prevention in older adults in more controlled environments, such as their own homes.[12,13]

However, to estimate the effectiveness of prevention, it is important to take into account the particular circumstances of older adults, i.e., it is necessary to determine which risk factors trigger falls and the resulting injuries on an individual basis. Some recognized factors relate to chronic diseases, loss of musculoskeletal mass, general frailty, and bone fragility.[14]

Given that falls are defined as a situation or event that occurs outside the individual, as established by the ICD-10, and can occur from different heights and in different ways (accidental, repeated, or prolonged), the etiology of these events, i.e., their causes, must also be considered. In this sense, intrinsic causes are recognized, including diseases, but also the aging process, being female, a history of falls, loss of balance, and polypharmacy, as highlighted by some studies.[15,16,17]

Extrinsic causes include floor conditions, such as slippery or uneven floors, lack of handrails, loose household items, pets, tall furniture, or shoes that are unsuitable for moving around the environment.[15,18]

Although intrinsic and extrinsic risk factors or causes have been identified, some conclusive results have been contradictory or ambiguous, as it has been noted that females may be predisposed to frequent falls during the aging process. At the same time, other studies have found that older adults who fell were predominantly male.[19,20]

Due to their increasing vulnerability, older adults are predisposed to falls and the resulting injuries, altering their quality of life.[21] However, quality of life is subjective, although, in general terms, a life of health, comfort, enjoyment, and leisure is expected even in old age.

Both social and psychophysical aspects must be taken care of in older adults since isolation, the increasing

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possibility of dependence on others for care, disabilities, and mental deterioration are detrimental to quality of life and health.[21]

So, how can falls in older adults be effectively prevented to ensure an adequate quality of life? This depends on the characteristics of the older adult and their context, as prevention will not be the same in hospitals, the homes of the individuals concerned, or nursing homes. It is, therefore, essential that medical professionals, caregivers, and/or family members pay attention to these aspects in order to establish care that is appropriate for the individual in their unique situation.[21]

Local or national studies have not sufficiently explored the multiplicity of ways in which these interventions can be planned, which affects the recognition of the problem among the older adult population and leads to a pause in effective practical methods to prevent and counteract the effects of falls. Special attention to the issue from the clinical, care and psycho-emotional spheres is relevant for an accurate contribution.

It is possible to identify fall prevention tools and techniques appropriate for the elderly, but it is imperative to identify the current interventions applied in order to compare their effectiveness. This reduces the risk of errors and possible harm in their application to the population.

In this way, a systematic review of the subject will allow for the comparison of results according to effectiveness levels, consistency with each case's characteristics, and theoretical perspectives that duly support professional actions aimed at improving the quality of life of older adults.

In older adults with a history of falls, are preventive interventions (exercise, education, environmental modifications) compared to pharmacological treatments effective in reducing the frequency of falls, minimizing their physical consequences, and improving quality of life?

Objective

To analyze effective interventions for preventing accidental falls and their physical consequences to improve the quality of life of older adults.

METHOD

The method used to conduct this research was a systematic literature review. A systematic review allows for research focused on a well-defined problem to identify, select, evaluate, and synthesize the relevant results found. In addition, systematic literature reviews follow a rigorous construction process, allowing them to be reproduced by other researchers.

This study aims to systematically review the literature from the last 5 years (2019-2024). To achieve this purpose, scientific articles were searched using the following descriptors: Aged/older adults; Accidental falls/prevention & control; Risk factors; Treatment Efficacy; Life Quality.

These are available in the following databases: Scielo (Scientific Electronic Library Online), PubMed, Google Scholar, Redalyc, and LILACS.

A total of 11 articles that met all the inclusion criteria were selected.

Study Design

This is a systematic, retrospective, prospective, and qualitative literature review. The systematic literature review is presented in the report, which recommends the following steps: 1) Preparation of a problematic question that concludes; 2) How to select the sources of studies in the research; 3) Analysis of the content of the selected articles by abstracts and keywords; 4) Conference of information, by the proposed objectives; 5) Relative interpretation of thematic axes related to objectives; 6) Updating of the topic, in order to provide new criticisms/suggestions, thus contributing to further studies. (24)

A keyword search will be carried out to select the works used. If repetitive articles appear in the electronic search, they will be cataloged only once. The articles will be selected, and the Thematic Content Analysis Method will be applied to categorize the works and give meaning to the sample collected. They will be grouped according to their similarity, noting convergences and divergences between them.

Initially, the content of the articles' titles and/or phrases will be analyzed. Abstracts and quotations in the text will also be considered in the analysis. An initial reading of the articles will be carried out, followed by an in-depth reading to understand the specificities of the content in each category of analysis.

Study population

The population refers to all academic articles that respond to the search terms and meet the inclusion criteria indicated below, i.e., adult patients of both sexes who have experienced accidental falls.

Inclusion criteria

- Clinical studies of patients with falls
- Clinical studies of patients with injuries caused by falls
- Clinical studies of patients with diseases that predispose them to falls

- Clinical studies of patients who have suffered falls and are undergoing treatment or preventive intervention
- Clinical studies of patients who have suffered falls in English, Spanish, and Portuguese.

Exclusion criteria

- Clinical studies of patients diagnosed with psychiatric disorders
- Clinical studies of patients with substance addiction
- Clinical studies of patients diagnosed with motor disorders
- Clinical studies of patients who have suffered falls with incomplete information and/or in languages other than those indicated.

Sample Selection and Size

As this is a systematic review of previously published articles, no sample selection or sizing is performed.

Scope of the study

The scope of the study will be university-based, as this is a systematic review of the literature.

VARIABLES	DEFINICIONES	TIPO	ESCALA	INDICADORES
EDAD	Tiempo de vida medido en años.	Cuantitativa	Todas las edades	
SEXO	Características fenotípicas que posee la persona del estudio	Cualitativa nominal	Femenino Masculino	
CAÍDAS ACCI-DENTA-LES	Situación o evento que le ocurre al individuo por la pérdida de estabilidad corporal desde diferentes alturas y modalidades, sea por factores internos al sujeto (enfermedades) o externos (condiciones del entorno)	Cualitativa nominal	Desde alturas: Baja, media o alta. Modalidades: Accidental, de repetición o prolongada Factores internos: Enfermedades, pero también al proceso de envejecimiento, ser de sexo femenino, antecedente de caídas, perdida de equilibrio y polifarmacia Factores externos: Pisos resbaladizos o irregulares, ausencia de barra de apoyo, elementos domésticos sueltos, animales domésticos, muebles altos o uso de zapatos inadecuados para trasladarse por el entorno	Efectos asociados a las caídas, como lesiones, daño neurológico, fragilidad corporal posterior, entre otras manifestaciones. Recurrencia de caídas accidentales
PRE-VEN-CIÓN DE CAÍ-DAS	Acciones e intervenciones realizadas por	Cualitativa nominal	Diagnóstico	Ausencia de alteraciones clínicas

Figure 1. Operationalization of research variables

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Proposed intervention and data collection tool(s)

The data collection technique will be:

- Document review or systematic review of documents: The data collection tool will be a data recording spreadsheet consisting of a table with columns corresponding to the aspects to be noted in the selected academic articles, namely:
  - Year and place of research or study or systematic review
  - Authors of the research or systematic review.
  - Type of population/sample: sex and age of participants.
  - Sociodemographic characteristics of the sample
  - Clinical history of the sample (diseases, among other data)
  - Number of falls per month or year
  - Type of falls
  - Factors associated with falls
  - Type of fall prevention
  - Effectiveness of fall prevention

Data Analysis Plan

Data analysis will be performed using descriptive statistics to indicate the average and frequency of variables such as age and gender. At the same time, a correlational biostatistical study will be implemented as a chi-square test to associate variables such as the frequency of accidental falls and the presence of disease.

These analytical tests will be carried out using the Microsoft Excel statistical package, and the results will be presented in bar, pie, and distribution charts.

Necessary resources

The following will be necessary to carry out this project:

- Computer and internet connection to access data search engines and edit the work.
- A journal-type notebook records the articles found for comparison with the record sheet.
- Microsoft Excel software or a suitable statistical package for creating graphs.
- Printer and materials for the printed presentation of the work.
- Average financial resources (the work does not involve high implementation costs

Table 1. Estimated schedule of activities

Activities	START	END	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
1: Initial planning	28/10/2024	01/11/2024	X					
2: Bibliographic search strategy	05/11/2024	20/11/2024		X				
3: Data extraction and analysis	05/11/2024	05/12/2024		X	X			
4: Thesis writing	10/12/2024	22/12/2024			X			
5: Necessary updates and adjustments	05/02/2025	01/03/2025					X	X
6: Final conclusions	14/03/2025	16/03/2025						X
7: Pre-delivery (protocol)	17/03/2025	20/03/2025						X
8: Thesis submission	24/03/2025	26/03/2025						

RESULTS

The results obtained from the systematic review were first organized according to sociodemographic characteristics.

Thirty-six articles related to the topic were collected, of which 11 were selected because they referred to most or all of the criteria and provided the information needed to meet the objectives. They also responded accurately to the specificity of the search terms.

Sociodemographic aspects of older adults according to the systematic review

The sociodemographic aspects collected from the studies were the age and sex of the selected studies.

Age

The age of the participants in the studies is shown in the following graph:

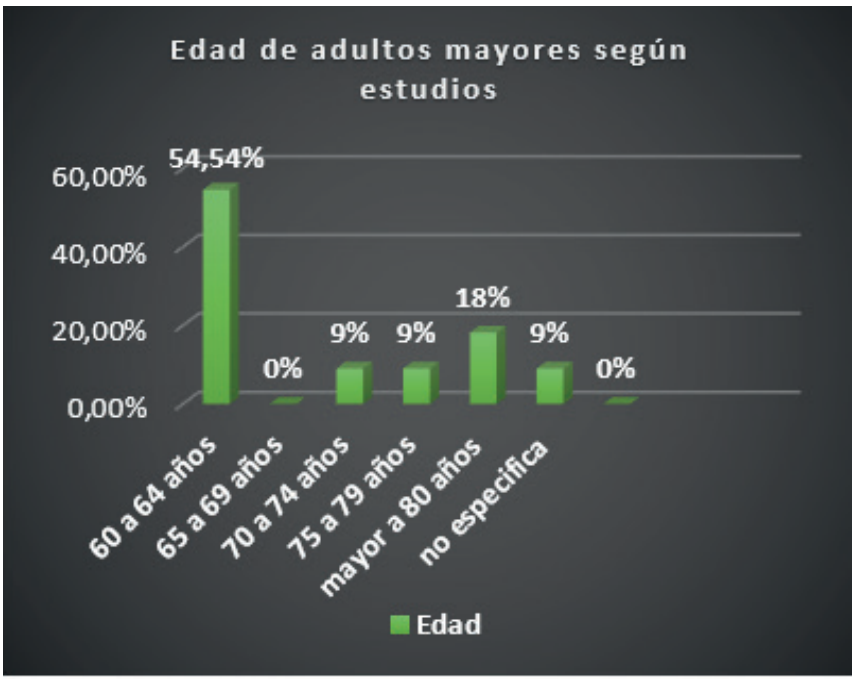

Figure 2. Age of older adults according to studies

Most of the studies reviewed (six articles) stated that the participants were older adults over 60, while only two studies indicated samples over 80. The remaining two studies indicated that the sample was between 70 and 74 years old and 75 and 79 years old on average (one study each).

Gender

The gender of the older adults participating in the studies reviewed is as follows:

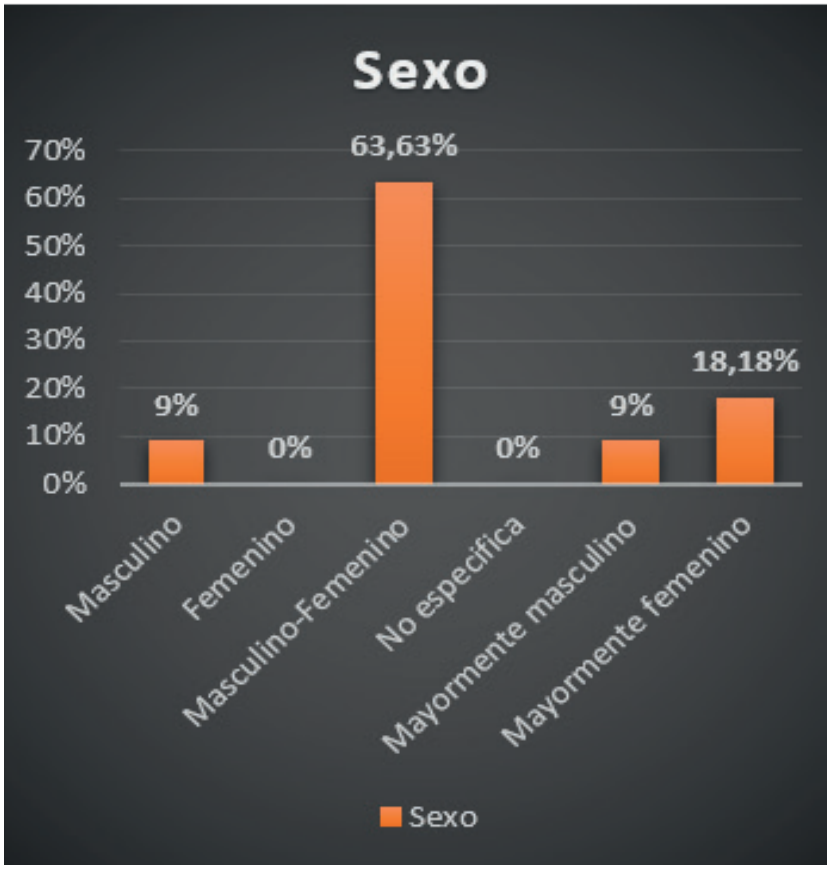

Figure 3. Gender of older adult participants according to studies

Seven of the articles' samples or groups of older adults participating in the studies investigated revealed

that they were mostly of both sexes (male and female). Two studies indicated that they studied a sample mostly of older women, and the rest of the studies (two minority studies) established that the sample was male or mostly male (one study for each option).

Risk factors influencing accidental falls in older adults according to the systematic review

Regarding the risk factors associated with the occurrence of falls in the older adult population, the findings indicated that:

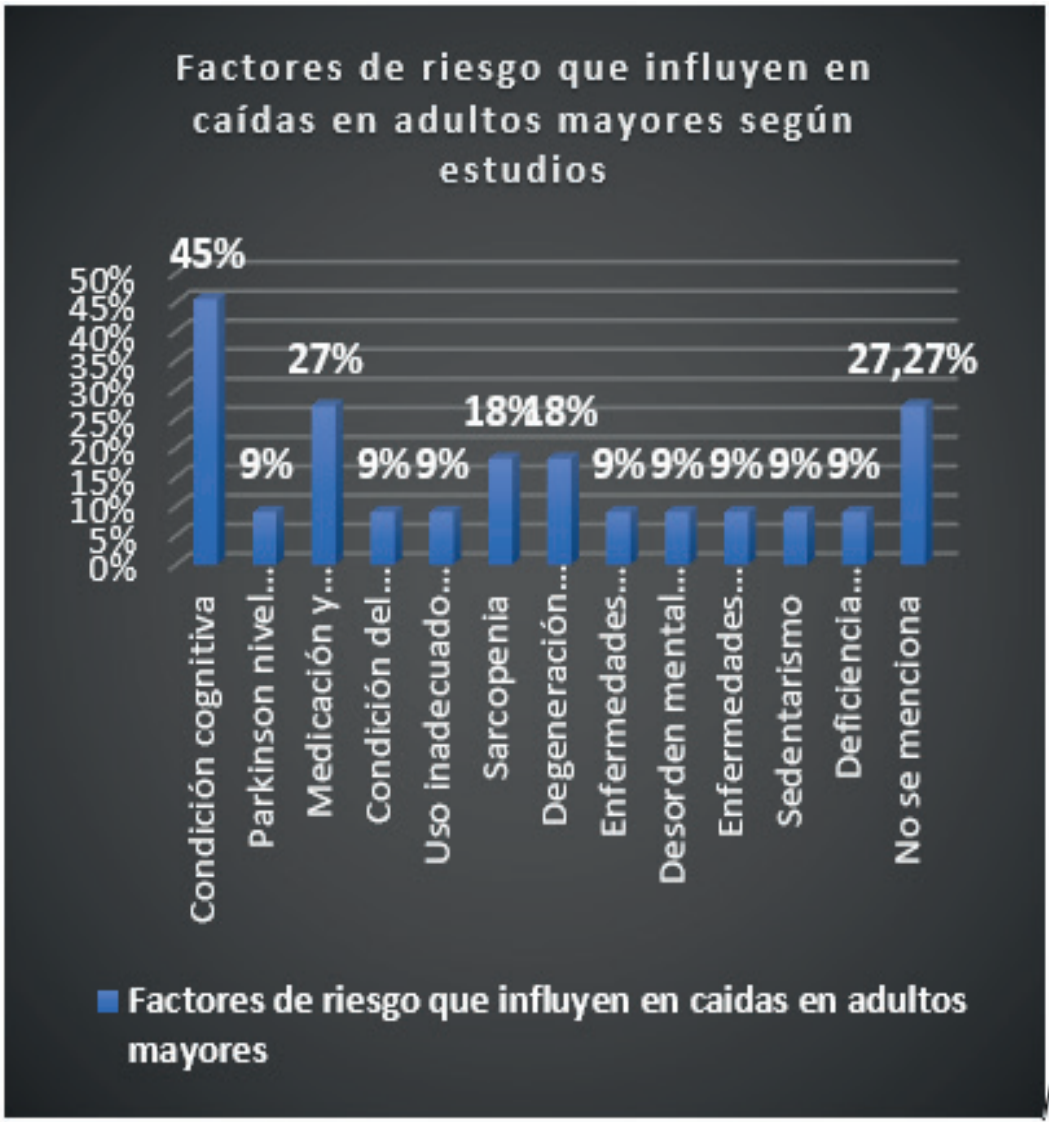

Figure 4. Risk factors influencing falls in older adults according to studies

Cognitive status was found to be the most frequently mentioned risk factor in studies related to falls in older adults (5 articles). In contrast, medication and unspecified risk factors were the next most commonly cited (in 3 studies each). Neuronal degeneration and sarcopenia were indicated as factors in 2 studies, and the remaining factors in figure 4 were observed in 1 study each.

Research indicated that the type of preventive intervention for falls in older adults is comprehensive physical exercise (aerobic + resistance + balance), as mentioned in four articles, followed by professional education and training, assessment, and modification of the living environment in three studies. Each intervention, aerobic exercise alone, resistance exercise alone, and balance exercise alone, obtained the next highest percentage (18 %) when mentioned in two studies each, as did the use of assistive technology.

As one study mentioned, the other interventions (e.g., occupational therapy, Tai Chi, Ba Duan Jin, and use of bed rails) obtained lower percentages.

Types of preventive interventions for falls in older adults from a systematic review

The results on the type of preventive intervention for falls in older adults reflected the following data:

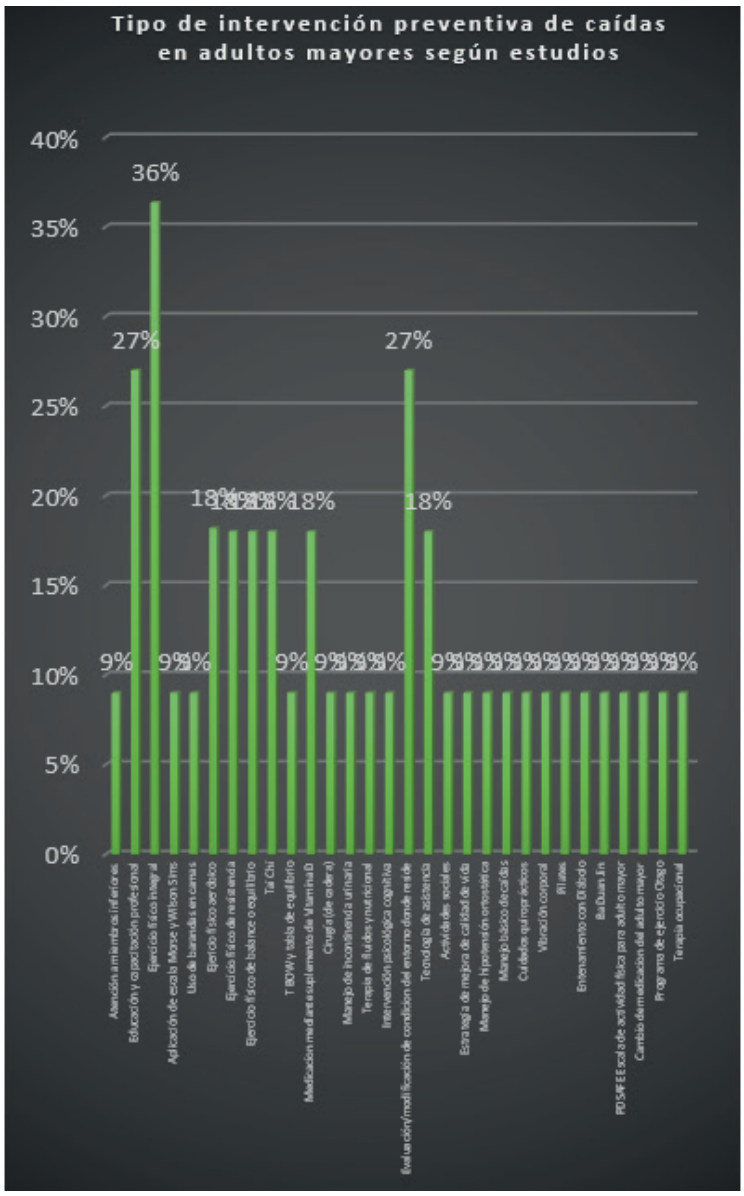

Figure 5. Types of preventive interventions for falls in older adults from the systematic review

Consequences or effects of the application of fall prevention interventions: The effects or consequences of the interventions were also investigated to complement the review. This yielded the following data:

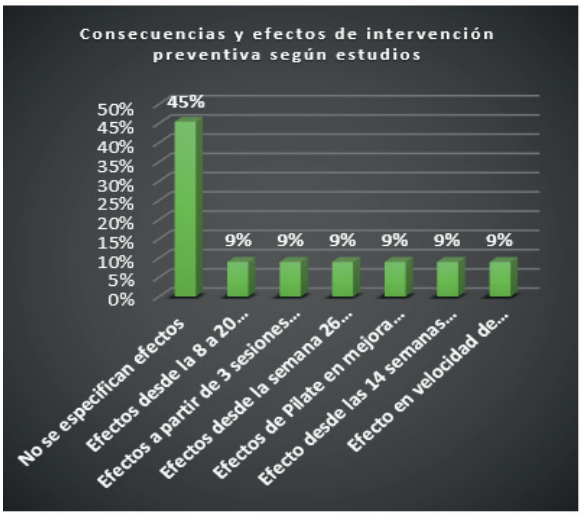

Figure 6. Effects and consequences of preventive intervention for falls in older adults with myorexia, according to a systematic review

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Most studies did not specify the effects and consequences of the interventions, although effects specified according to the duration of application were mentioned in one study for each option.

Effectiveness of types of fall prevention interventions in older adults from a systematic review

According to the systematic review, the following levels of effectiveness were reported in the selected studies:

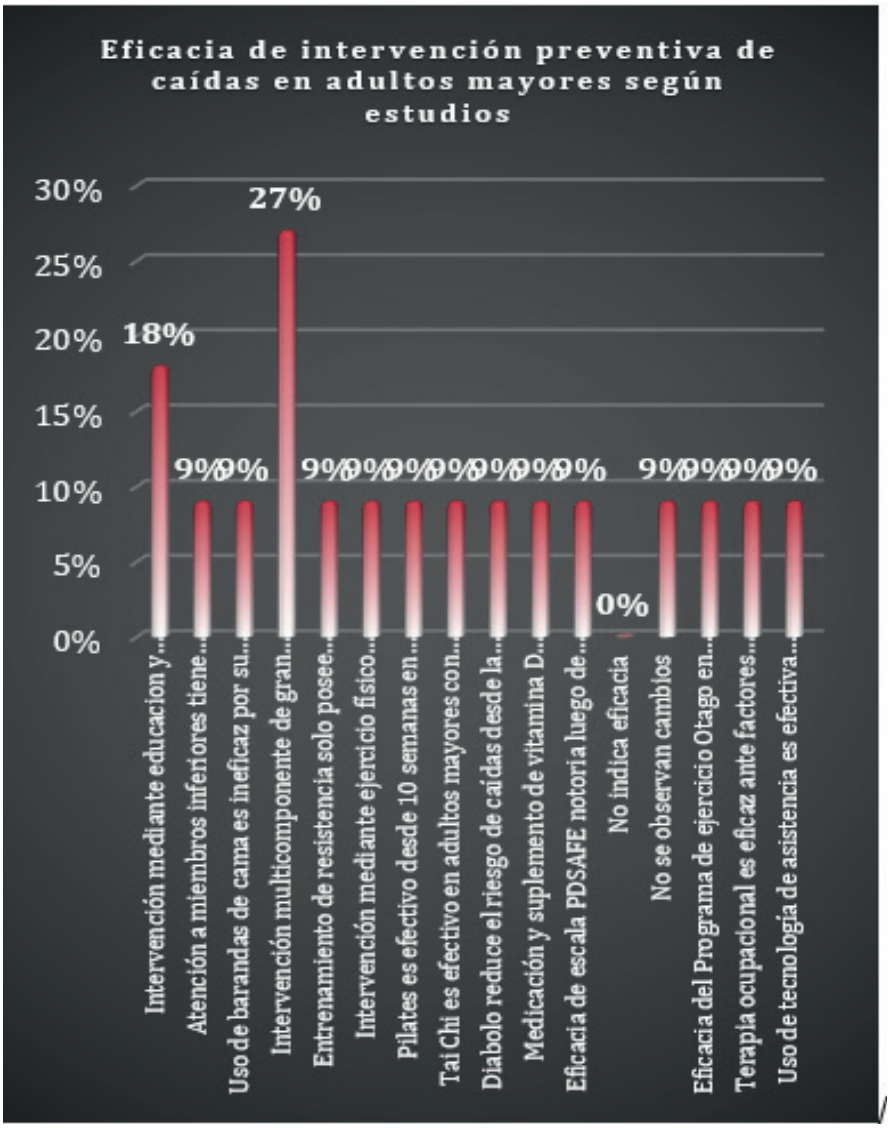

Figure 7. Effectiveness of preventive interventions for falls in older adults according to studies

Three studies indicated that multi-component interventions, i.e., those integrating physical exercise, environmental modification, cognitive assistance, and professional education, effectively reduce falls. In comparison, two studies mentioned professional education and training as effective interventions. The other interventions demonstrated efficacy (one survey for each option). However, some of them estimated a relative level of effectiveness (e.g., medication and vitamin D supplementation according to the older adult's preferred diet, Pilates effective from age 65).

Correlations between risk factors and fall prevention interventions in older adults according to studies

For correlation calculations, the Chi-square test was applied, categorizing the effectiveness and risk factors variables into three nominal categories.

Each effectiveness option (relative, unspecified, and absolute) was assigned one point according to the risk factor mentioned (internal, external, or combined). The results observed in the 11 studies compiled yielded the following figure of observed data:

		OBSERVADOS			
		FACTORES DE RIESGO			
		COMBINADOS	INTERNOS	EXTERNOS	TOTAL
EFICACIA	RELATIVA	3	3	0	6
	ABSOLUTA	2	2	0	4
	INESPECIFICA	1	0	0	1
	TOTAL	6	5	0	11
		55%	45%	0%	

Figure 8. Observed data on the correlation between effectiveness and risk factors for falls in older adults

The percentages obtained are shown below, which were subsequently used to calculate the expected data, as shown in the following figure:

		ESPERADOS			
		FACTORES DE RIESGO			
		COMBINADOS	INTERNOS	EXTERNOS	TOTAL
EFICACIA	RELATIVA	3,272727273	2,72727273	0	
	ABSOLUTA	2,181818182	1,81818182	0	
	INESPECIFICA	0,545454545	0,45454545	0	
	TOTAL				

Figure 9. Expected data on the correlation between effectiveness and risk factors for falls in older adults

Finally, the formula for calculated chi and chi from the figure was applied to these expected data, which yielded the following data according to the categories of Effectiveness and Risk Factors.

	-0,022	0,028	0
	-0,014	0,019	0
	0,39	-0,45	0
CHI CAL	-0,049		
CHI TABLA	9,48772904		

Figure 10. Data on calculated chi and chi from the table

According to the study, the Chi of the figure was higher than the calculated Chi, so there is no relationship between the effectiveness of preventive intervention and risk factors for falls in older adults.

DISCUSSION

The systematic review revealed that the concept of older adults is oriented toward ages 60 and older.[21,24,25,26,27,28,29,30,31] All studies also indicate that the likelihood of accidental falls increases with age.[17,21,22,23,24,25,26,27,28,29,30,31]

Among the studies reviewed, it should be noted that most of them conducted research or tests on samples of older adults of both sexes. Still, according to previous findings, the number of accidental falls was higher among men.[19,20]

Furthermore, not all studies referred to participants with a history of falls before the test; therefore, specific results showed limitations.[24,25,26] At least one study only studied healthy older adults.[25] In contrast, two studies indicated that they implemented tests on older adults with Parkinson's disease and another with diagnosed osteoporosis.[17,28]

The studies reviewed were conducted in various settings, as they were not restricted to older adults in

nursing homes or care facilities but also included home settings with family members.[29,31]

It should be noted that the risk factors indicated in the background, such as the use of inappropriate footwear and bone fragility,[15,18] have not been the focus of systematic studies reviewed in the selected period (2019 to 2024). However, the importance of internal or intrinsic factors in the history and repetition of accidental falls in the older population was noted.

Some notable intrinsic risk factors referred to chronic diseases, neuronal degeneration, and cognitive impairment.[24,25,26,27,28,29,30]

However, despite the importance given to cognitive impairment as a factor influencing falls, there was no marked focus on cognitive psychological preventive interventions, as only one study reported such an application.[27]

It is agreed that a combination of internal and external risk factors influence the likelihood of accidents in older adults; however, internal factors are prioritized.

It is interesting to note that, given the prior admission of the influence of internal factors on falls, the most commonly implemented type of intervention is comprehensive physical exercise.[25,26,27,28,29,30,31]

Physical exercise, in particular, cannot be carried out by caregivers of older adults in a home environment, so physical activity requires the adult to be transferred to an institution where such activity can be carried out by professionals. It is, therefore, understandable that professional education and training is the second most frequently mentioned preventive intervention, considering that many studies have been conducted in hospitals and nursing homes.[24,27,29,31]

Although the conditions of the environment in which older adults live directly influence their daily lives, interventions involving modifications to furniture, footwear and its use, schedules, and other organizational elements have not been sufficiently considered as preventive actions but rather as part of general or basic care. Even bed rails were deemed ineffective because they restrict the movement of older adults at rest and can be an obstacle in specific emergencies.[24]

Another detail of interest involved the notion that self-confidence and the absence of fear of falling may be relevant to improving the quality of life of older adults and, in fact, preventing specific falls. However, these variables have not been addressed directly through interventions but rather observed as subsequent effects.[24]

As a risk factor, the background information indicated that a diet rich in vitamin D could effectively prevent falls due to notable nutritional deficiencies, mainly in hospital settings. However, the systematic review stated that a diet supplemented with this vitamin faced numerous limitations due to the consumption preferences of older adults, including those with lactose intolerance.[17,21]

It should be noted that the effectiveness of preventive interventions varies and that the level of positive effect in fall prevention depends mainly on the appropriate combination of resources. Thus, a higher level of effectiveness in reducing and preventing falls in older adults was found in multi-component interventions (physical exercise + cognitive therapy + professional education + use of technology) or comprehensive physical exercise interventions (aerobics + resistance + balance).[25,26,27,28]

This led to the question of the relationship between risk factors and fall prevention interventions and their effectiveness, which showed that there is no direct relationship. The effectiveness and success of preventive actions are independent of any type of factor that affects or predisposes older adults to accidental falls in any context.

This statement allows us to conclude that the systematic review's contributions are concrete and in line with the research and objectives proposed, reflecting both theoretical and practical advances in possible more in-depth experiences on the subject.

CONCLUSIONS

Fall prevention in older adults is a multifactorial challenge that requires a comprehensive approach. This systematic review shows that the most influential risk factors, such as neuronal degeneration and cognitive impairment, are intrinsic, although environmental conditions also play a relevant role.

The most effective preventive interventions are multi-component, integrating physical exercise, cognitive therapy, environmental modifications, and professional education. These strategies have demonstrated a significant reduction in the frequency of falls and improved the quality of life of older adults. However, the lack of correlation between risk factors and the effectiveness of interventions suggests the need for greater personalization in their application.

Given that this study is based on a systematic review with a limited sample of articles, controlled clinical trials with greater population representativeness are recommended.

Future research should also focus on identifying specific profiles of older adults so that more accurate and effective preventive strategies can be implemented.

In conclusion, fall prevention in older adults should be approached from an interdisciplinary perspective, using available resources and improving this population's autonomy and quality of life

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CONFLICT OF INTEREST

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