

**OPIICS 2019****International Conference of Psychology, Sociology, Education, and Social Sciences****BIBLIOGRAPHIC REVIEW PHYSICAL ACTIVITY  
PROGRAMS IN OLDER ADULTS: BALANCE, PREVENTION  
OF FALLS**

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***Abstract***

The objective has been to collect, compare and elaborate a reference with scientific evidence, about the effectiveness of physical activity programs that help prevent falls in healthy older adults. The methodology chosen was a literature review based on the databases: PubMed, Scielo, Science Direct, Web of Science and Scopus. After filtering based on the inclusion and exclusion criteria designed ad hoc for the study, a total of 23 scientific articles were rescued. Thus, the validity of numerous protocols for the prevention of falls for elderly people has been proven, mainly constituted through exercise programs, seeking the improvement, mainly, of strength, balance, functionality and, indirectly, of the quality of life of the patient. All this, acts in a synergistic manner decreasing the appearance of accidental falls. However, it has also been possible to see the existence of numerous activities such as Pilates, Yoga, adapted Judo, exercises carried out in aquatic means or even Contemporary Dance, which have benefits in terms of prevention of falls, also having the incentive to be very easy to improve adherence to the program, being able to be inserted without too many difficulties in its day to day, attending, at all times, to the characteristics and needs of the elderly.

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**Keywords:** Aging, elderly people, prevention of falls, balance, physical exercise.

## **1. Introduction**

The Spanish population ages as time passes and this fact is causing a profound modification in the population pyramid of our country. The assessment is that the world population is aging at tremendous rates, which specialized sources define as alarming. The real result is that society is undergoing an aging process, both in relative and absolute values. This silent revolution, this modification of the population structure, will bring changes in life habits in a few years, which will affect socio-geography, socio-economic conditions, business and even values of society as they are known today. The WHO estimates that between 2000 and 2050, the world population of people aged 60 years or older will double from 11% to 22%, which means in absolute terms that this population will go from 605 million to 2000 million inhabitants over the course of half a century. In addition, the number of people aged 80 years or older will increase almost four times to reach 395 million (WHO, 2015). Spain is one of the countries with the highest proportion of the oldest population in the European economic environment. According to data from the United Nations (2014), Spain is one of the countries with the oldest population on the planet. The causes of ageing show positive data, for example that Spain has one of the highest life expectancy rates, which is 83 years old. However, other aspects are not as favorable, such a low birth rate. As it can be seen in the literature in this regard, falls are the leading cause of death and injury in the elderly. Around 33% of the elderly fall at least once a year, and these falls represent a large part of emergency hospital visits (Gama & Gómez-Conesa, 2008). Health can be a determining risk factor related to falls, but it is not the sole contributor under any circumstances, so knowing the multiple factors behind falls can make it easier to avoid them. According to the WHO report (2007) on prevention of falls among the elderly, falls have a multifactor component. In addition, the main risk factors reflect the multitude of health determinants that directly or indirectly effect well-being. Risk factors can be classified as intrinsic and extrinsic, or more specifically as biological, socioeconomic, behavioral and environmental, according to (Rubenstein & Josephson, 2006; Terra et al., 2014; WHO, 2007).

## **2. Objective**

The objective is to conduct a literature review focused on research for physical activity programs aimed at preventing falls in older adults without remarkable musculoskeletal disorders, mainly through balance training and specific physical activity to prevent falls and develop a reference based on the scientific evidence found in the PubMed, Scielo, Science Direct, Web of Science and Scopus databases, which correlates the articles related to physical activity in healthy older adults and falls, focusing on those physical activity programs that study the improvement of strength, balance and prevention of falls in older adults.

## **3. Material and Methods**

### **3.1. PICO Question**

The methodology chosen for the study presented here is that of a bibliographic review. For this, the scientific search engines PubMed, Science Direct, Scielo, Web of Science and Scopus and the search engine of the HONselect organization will be used (to detect the MeSH terms that will be used in the PubMed

search). Once the databases are chosen from which the necessary bibliographic information will be extracted, the search strategy will be implemented. This strategy will find the most appropriate published studies for the objectives pursued in this study.

The PICO question asked for this research is the following:

P (patients): Healthy older adults.

I (intervention): Supervised exercise programs that improve muscle strength, balance, ability to walk and reduce the risk of falls.

C (comparison): To a lifestyle lacking this type of practice or physical activity protocols.

O (results sought): Improvement of functional ability through these programs in the selected profile.

### 3.2. Keywords

The keywords and MeSH terms chosen (see Table 01) to do the different searches in the previously mentioned databases are the ones shown below:

**Table 01.** MeSH keywords and terms used

<b>Keywords</b>	<b>Term MeSH</b>
Ejercicio	Exercise
Fuerza muscular	Muscle strength
Equilibrio	Balance
Funcionalidad	Functionality
Caídas	Accidental falls
Prevención	Prevention
Adultos mayores	Aged, Older, elderly

Source: Own elaboration 2019.

### 3.3. Inclusion and exclusion criteria

To facilitate the work of filtering the search results and to extract the ones that best suit the research objectives, the following criteria have been set:

#### 3.3.1. Inclusion criteria

Articles published in the last five years. Articles in Spanish or English. Articles focused on the human species. Articles on healthy elderly subjects aged 60 years and older. Articles corresponding to clinical trials.

#### 3.3.2. Exclusion criteria

Subjects with additional medical complications. Subjects with remarkable musculoskeletal disorders. Articles that are not limited to the objectives formulated in this study. Articles that do not show objective results or that employ methodologies that introduce great possibilities of bias.

## 4. Results

Below are a series of tables with the results obtained in each of the databases used, describing the search strategies used, and taking into account the inclusion and exclusion criteria set out above.

The data presented in table 02, correspond to the Scopus.

**Table 02.** Results obtained in Scopus

Keywords/Inclusion criteria	“falls” AND “prevention” AND “exercise”	“falls” AND “prevention” AND “muscular strength”	"falls" AND "exercise" AND "balance"
Results	2539 results	43 results	2599 results
Published in last 5 years	899 results	19 results	1124 results
Review and investigation	788 results	17 results	995 results
Language (Spanish or English)	754 results	11 results	958 results
Category Aged	533 results	11 results	660 results
Open access	200 results	5 results	206 results
Title or Summary	46 results	2 results	2 results

The data presented in table 03, correspond to the PubMed.

**Table 03.** Results obtained in PubMed

	("accidental Falls"[Mesh]) AND "accident prevention" [Mesh]	("accidental falls"[Mesh]) AND "primary prevention" [Mesh]	("accidental falls"[Mesh] AND "exercise" [Mesh])	("aged" [Mesh]) AND "accidental falls" [Mesh] AND prevention
Results	1.472 results	128 results	1955 results	6.755 results
Published in last 5 years	349 results	29 results	750 results	1.953 results
Language (Spanish or English)	340 results	29 results	726 results	1.844 results
Human species	336 results	29 results	725 results	1.844 results
Clinical trials	19 results	6 results	143 results	354 results
Title or summary	3 results	2 results	3 results	3 results

The data presented in table 04, correspond to the Science Direct.

**Table 04.** Results obtained in Science Direct

	falls AND prevention AND aged AND exercise	accidental Falls AND prevention AND aged AND muscular strength	accidental Falls AND prevention AND aged AND balance	accidental Falls AND prevention AND aged AND functionality
Results	16.428 results	687 results	2.751 results	2.737 results
Published in last 5 years	3.879 results	125 results	580 results	595 results
Review and investigation	1.558 results	29 results	202 results	195 results
Title or Summary	2 results	2 results	3 results	2 results

The data presented in table 05, correspond to the Scielo.

**Table 05.** Results obtained in Scielo

Keywords/Inclusion criteria	"falls" And "prevention" AND "exercise"	"falls" AND "prevention" AND "muscular strength"	"falls" And "prevention" AND "aged"	"falls" AND "exercise" AND "older"
Results	16 results	7 results	63 results	26 results
Published in last 5 years	7 results	5 results	25 results	11 results
Review and investigation	7 results	5 results	25 results	11 results
Language (Spanish or English)	5 results	4 results	22 results	9 results
Title or Summary	2 results	1 result	1 result	2 results

The data presented in table 06, correspond to the Web of Science.

**Table 06.** Results obtained in Web of Science

Keywords/Inclusion criteria	"falls" And "prevention" AND "exercise"	"falls" AND "prevention" AND "muscular strength"	"falls" And "prevention" AND "aged"	"falls" AND "exercise" AND "balance"
Results	1970 results	26 results	1743 results	2041 results
Published in last 5 years	758 results	11 results	802 results	992 results
Review and investigation	711 results	11 results	783 results	959 results
Language (Spanish or English)	686 results	11 results	757 results	931 results
Sport Science Category	89 results	11 results	11 results	157 results
Title or Summary	10 results	2 results	1 result	2 result

## 5. Discussion

Two large research groups have been observed: those that focus on the prevention of falls through fitness exercises that are integrated into a strategic program of fall prevention and those that focus on assessing the potential of different physical activities, when it comes to fall prevention. With respect to the former, it has been observed that, these fitness programs significantly improve strength and balance in participants (Arkkukangas Sundler, Soderlund, Eriksson, & Johansson, 2017; Bjerck, Brovold, Skelton, & Bergland, 2017; Hawley-Haghue, Roden, & Abbott, 2017; Papa, Foreman, & Dibble, 2015), which results in a general decrease in the risk of falling. Some of them also focus on patient functionality, which significantly improve, through these exercise plans (Bjerck et al., 2017; Hawley-Haghue et al., 2017). We also found studies that talked about carrying out exercise programs as a weapon to fight against the appearance of falls in the elderly, paying special attention to individualization, meaning that each patient characteristics and particularities are taken into account, because what works well for one patient is not necessarily the best for another because, each person has their own specific needs, strengths and weaknesses (Aliaga, Cuba, & Meza, 2016; Arkkukangas et al., 2017).

It is often observed in different studies, that it is necessary to integrate these fitness programs in the day-to-day life of patients, which in one way or another will lead to healthy aging (Aliaga et al., 2016; Arkkukangas et al., 2017). The role of the professional in charge of carrying out the physical activity programs is highlighted in several studies, having been able to verify that, together with the figure of the medical specialist, they are key in the process of improving adherence to treatment, which in this type of program and according to the benefit sought, stands as a key variable (Arkkukangas et al., 2017; Hawley-Haghighi et al., 2017). In relation to the latter, Lacroix et al. (2016), carried out an intervention a 12-week intervention for balance and strength training (BST) among older adults, who were divided into two groups. One group implemented the program with the supervision of a professional and the other group without supervision. Physical improvements in balance and muscle power were found in both groups; however, the supervised BST was more effective. Therefore, they concluded that the supervised application of BST programs for older adults can counteract the intrinsic risk factors of falling. It was possible to observe a study where the authors affirmed that they could not categorically conclude that this type of fall prevention protocols based on physical exercises will be successful in 100% of the patients. Precisely, only one third of the programs evaluated showed significant differences in terms of decreased risk of falls (Hawley-Haghighi et al., 2017). The study carried out by Papa et al. (2015) obtained a key result, since it could verify that muscular fatigue had a significant influence on the risk of falling, a risk that decreased after 15 minutes of rest after the onset of fatigue. Thus, it could be concluded that both fatigue and stride shortening were two of the main risk factors in older patients in relation to the occurrence of involuntary falls. On the other hand, we have been able to observe different studies that focused on a specific activity instead of general fitness programs. Orenes and Carrasco (2016) evaluated the effectiveness of Pilates, having found positive results in the increase of isometric strength in the participants' hips, as well as an improvement in balance, which evidenced a significant increase in physical ability, reducing the risk of falling. At the same time, in this study, a clear relationship could not be demonstrated between the variables: strength, balance and risk of falling. These results coincide with those found by Pucci, Neves and Saavedra, (2019). They carried out a systematic review on the effectiveness of the Pilates method in which they analyzed 41 studies and, from which they extracted as relevant data that the interventions studied varied between 4-24 weeks, 1-3 sessions /week and the most investigated variable was balance. In addition to the improvement of balance and muscle strength, they found improvements in flexibility, functional autonomy, muscular endurance, body composition and aerobic resistance. We have also found several studies that have evaluated the effect of Yoga on falls, observing small improvements in participants' balance, and medium improvements in physical mobility, which led, in one way or another, to a reduction in the risk of suffering a fall, (Hamrick, Mross, Christopher, & Smith, 2017; Youkhana, Dean, Wolff, Sherrington, & Tiedemann, 2016). Others have evaluated the effect that training in some martial arts such as Ving Tsun (TV) or TaiChi-Chuan can have on balance. One study determined that TV could be a potential exercise in preventing falls, with benefits in improving balance and confidence among the elderly. Regarding training through Tai Chi Chuan, no improvements were seen in any functional abilities or variables of balance, except in the components of LOS (stability limits) that tended to increase. These results contrast with others found in the scientific literature, where the potential of Tai Chi in the improvement of balance has been reflected (Lip, Fong, Ng, Liu, & Guo, 2015; Rahal et al., 2015; Takeshima et al., 2017).

Another type of martial arts with a positive effect in reducing the fear of falling syndrome (FOF) is the adapted utilitarian Judo (JUA). Toronjo-Hornillo et al. (2018) carried out a study in which they observed a decrease of 11.9% in the fear of falling, being even greater in those older adults who had a greater fear of falling before the intervention.

A very popular activity among the population of our study is social dance. Merom et al. (2016) conducted a study to determine if social dance was effective in reducing the number of falls and improving physical and cognitive risk factors related to the falls. An intervention was carried out in 23 villages. They concluded that social dance did not prevent falls or their associated risk factors. On the other hand, contemporary dance, has showed obvious improvements for female gender and can be considered a valid activity to do in the field of fall prevention (Britten, Addington, & Astill, 2017).

## 6. Conclusion

The truth is that falls make up a high percentage of the total fractures and even lethal accidents among older people. This is the main reason why it is necessary to develop effective protocols in the fight against unwanted falls. There are a large number of activities that offer numerous advantages in terms of preventing falls, mainly through the increase of strength in general and, of the lower body and, the improvement of balance and of functionality. That is why a qualified doctor should recommend to each patient, taking into account individualization, the activities that best suit their needs. The aim is to incorporate the activities into the patient's day-to-day and therefore achieve good adherence to the protocol. Some activities that have proven their validity in the field of fall prevention are Taichi, Pilates, Yoga, Judo, Dance and to a lesser extent, aquatic activities. It is necessary to publish in detail the protocols or exercise programs that have given positive results in the different RCTs performed, as it is something that in very few studies is done and is a fact of great value when it comes to transferring all this to clinical practice.

## References

- Aliaga, E., Cuba, S., & Meza, M. (2016). Promoción de la salud y prevención de las enfermedades para un envejecimiento activo y con calidad de vida [Health promotion and disease prevention for active ageing and quality of life]. *Revista Peruana Médica de Salud Pública*, 33(2). <https://doi.org/10.17843/rpmesp.2016.332.2143>
- Arkkukangas, M., Sundler, A., Soderlund, A., Eriksson, S., & Johansson, A. (2017). Older person's experiences of a home-based exercise program with behavioral change support. *Physiotherapy: Theory and practice*, 33(12), 905-913. <https://doi.org/10.1080/09593985.2017.1359869>
- Bjerk, M., Brovold, T., Skelton, D., & Bergland, A. (2017). A falls prevention program to improve quality of life, physical function and falls efficacy in older people receiving home help services: study protocol for a randomized controlled trial. *BMC Health Serv Res.*, 17(1), 559-567. <https://doi.org/10.1186/s12913-017-2516-5>
- Britten, L., Addington, C., & Astill, S. (2017). Dancing in time: feasibility and acceptability of a contemporary dance programme to modify risk factors for falling in community dwelling older adults. *BMC geriatrics*, 17(1), 83-95. <https://doi.org/10.1186/s12877-017-0476-6>
- Gama, Z. A. D. S., & Gómez-Conesa, A. (2008). Factores de riesgo de caídas en ancianos: revisión sistemática [Risk factors for falls in the elderly: systematic review]. *Revista de Saúde Pública*, 42, 946-956. <https://doi.org/10.1590/S0034-89102008000500022>
- Hamrick, I., Mross, P., Christopher, N., & Smith, P. D. (2017). Yoga's effect on falls in rural, older adults. *Complementary therapies in medicine*, 35, 57-63. <https://doi.org/10.1016/j.ctim.2017.09.007>

- Hawley-Hague, H., Roden, A., & Abbott, J. (2017). Evaluation of a strength and balance exercise program for the prevention of falls in community primary care. *Physical therapy theory and practice*, 33(8), 611-621.
- Lacroix, A., Kressig, R. W., Muehlbauer, T., Gschwind, Y. J., Pfenninger, B., Bruegger, O., & Granacher, U. (2016). Effects of a supervised versus an unsupervised combined balance and strength training program on balance and muscle power in healthy older adults: a randomized controlled trial. *Gerontology*, 62(3), 275-288. <https://doi.org/10.1159/000442087>
- Lip, R. W., Fong, S. S., Ng, S. S., Liu, K. P., & Guo, X. (2015). Effects of Ving Tsun Chinese martial art training on musculoskeletal health, balance performance, and self-efficacy in community-dwelling older adults. *Journal of physical therapy science*, 27(3), 667-672. <https://doi.org/10.1589/jpts.27.667>
- Merom, D., Mathieu, E., Cerin, E., Morton, R. L., Simpson, J. M., Rissel, C., & Cumming, R. G. (2016). Social dancing and incidence of falls in older adults: a cluster randomised controlled trial. *PLoS medicine*, 13(8), 1-19. <https://doi.org/10.1371/journal.pmed.1002112>
- Orenes, D., & Carrasco, M. (2016). Aportaciones sobre la eficacia del método Pilates en la fuerza, el equilibrio y el riesgo de caídas de personas mayores [Contributions on the effectiveness of the Pilates method on strength, balance and the risk of falls of older people]. *Revista Andaluza de Medicina del Deporte*, 9(2), 85-90. <https://doi.org/10.1016/j.ram.2015.09.001>
- Papa, E., Foreman, K., & Dibble, L. (2015). Effects of age and acute muscle fatigue on reactive postural control in healthy adults. *Clin Biomech*, 30(10), 1108-1113. <https://doi.org/10.1016/j.clinbiomech.2015.08.017>
- Pucci, G. C. M. F., Neves, E. B., & Saavedra, F. J. F. (2019). Effect of Pilates method on physical fitness related to health in the elderly: a systematic review. *Revista Brasileira de Medicina do Esporte*, 25(1), 76-87. <https://doi.org/10.1590/1517-869220192501193516>
- Rahal, M. A., Alonso, A. C., Andrusaitis, F. R., Rodrigues, T. S., Speciali, D. S., Greve, J. M. D., & Leme, L. E. G. (2015). Analysis of static and dynamic balance in healthy elderly practitioners of Tai Chi Chuan versus ballroom dancing. *Clinics*, 70(3), 157-161. [https://doi.org/10.6061/clinics/2015\(03\)01](https://doi.org/10.6061/clinics/2015(03)01)
- Rubenstein, L. Z., & Josephson, K. R. (2006). Falls and their prevention in older people: what does the evidence show? *Medical Clinics*, 90(5), 807-824.
- Takehima, N., Islam, M., Kato, Y., Koizumi, D., Narita, M., Rogers, N., & Rogers, M. (2017). Effects of 12 weeks of Tai Chi Chuan training on balance and functional fitness in older Japanese adults. *Sports*, 5(2), 32. <https://doi.org/10.3390/sports5020032>
- Terra, L., Diniz, V., Inácio, K., Mendes, M., Silva, M. A., Vitor, J., & Ribeiro, M. (2014). Evaluación del riesgo de caídas en las personas mayores: ¿cómo hacerlo? [Assessing the risk of falls in the elderly: how to do it?] *Gerokomos*, 25(1), 13-16. <https://doi.org/10.4321/S1134-928X2014000100004>
- Toronjo-Hornillo, L., Castañeda-Vázquez, C., Campos-Mesa, M., González-Campos, G., Corral-Pernía, J., Chacón-Borrego, F., & DelCastillo-Andrés, Ó. (2018). Effects of the Application of a Program of Adapted Utilitarian Judo (JUA) on the Fear of Falling Syndrome (FOF) for the Health Sustainability of the Elderly Population. *International journal of environmental research and public health*, 15(11), 2526. <https://doi.org/10.3390/ijerph15112526>
- World Health Organization (2015). *World Report on Ageing and Health*. Retrieved from <https://www.who.int/ageing/publications/world-report-2015/es/>
- World Health Organization (WHO) (2007). Global report on falls prevention in older age. Geneva (Switzerland).
- Youkhana, S., Dean, C. M., Wolff, M., Sherrington, C., & Tiedemann, A. (2016). Yoga-based exercise improves balance and mobility in people aged 60 and over: a systematic review and meta-analysis. *Age and ageing*, 45(1), 21-29. <https://doi.org/10.1093/ageing/afv175>