

Physical Activity of Older People Based on Exercises in Various Forms of Combat Sports as a Prevention of Unintentional Falls

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ABSTRACT

Falls are one of the most serious health risks in the elderly population and are a significant public health problem. One of the best-documented strategies for preventing falls is regular physical activity in the form of planned and structured exercise. Exercise programmes have a beneficial effect on key risk factors for falls, such as muscle strength, balance control and gait quality. A characteristic feature of many forms of hand-to-hand combat is the integration of motor and cognitive components, which makes them particularly valuable in preventing falls, which often occur in situations requiring simultaneous information processing, posture control and motor adaptation to changing environmental conditions. Mastering the appropriate motor techniques, including elements of safe falling, enables a more conscious response even in conditions of sudden loss of balance. The aim of this publication is to present the importance of introducing physical activity through martial arts as a multidimensional strategy for preventing falls in older people. Appropriately modified elements of combat sports and hand-to-hand combat systems – without competition and injury – are a tool that supports primary and secondary fall prevention. However, the effectiveness of such programmes depends on their competent implementation and individual adaptation to the participants' abilities.

Keywords: Aged, Combat sports, Functional status, Physical fitness, Postural balance

INTRODUCTION

Falls are one of the most serious health risks in the elderly population and are a significant public health problem. It is estimated that at least one third of people over 65 living in the community experience a fall at least once a year (Campbell et al., 1990; Tinetti et al., 1988), and the incidence of fall-related injuries increases with age (Peel, 2002). The consequences of falls include both serious somatic injuries, such as fractures and head injuries (Peel, 2002), and less serious soft tissue injuries, which can nevertheless lead to pain, functional impairment and increased healthcare costs (Burns et al., 2016). Approximately 10% of falls result in fractures (Campbell et al., 1990; Tinetti et al., 1988), and fall-related fractures are a major cause of morbidity and mortality in the elderly population (Burns et al., 2016).

They are also associated with a significant reduction in the quality of life of older people (Stenhagen et al., 2014) and have serious psychological consequences. The most commonly described consequences include fear of another fall, reduced self-efficacy and loss of mobility, which can lead to reduced physical activity, decreased social contact and further deterioration of motor functions (Yardley et al., 2002). Paradoxically, reduced physical activity contributes to the exacerbation of strength and balance deficits, thereby increasing the risk of further falls. Both traumatic and non-traumatic falls can cause such negative psychophysical effects.

Despite attempts to develop a uniform definition of the term ‘fall’ (Anonymous, 1987), there are still many interpretations of it in the literature on the subject. For research purposes, it is particularly important to use a clear and unambiguous definition. An international expert statement defines a fall as ‘an unexpected event in which a person ends up on the ground, floor or other lower level’ (Lamb et al., 2005). This definition also covers situations in which a person loses their balance as a result of slipping or tripping and ends up on a surface lower than their starting position.

In addition to health consequences, falls generate significant economic costs, placing a burden on older people and their families, as well as on health and social care systems (Burns et al., 2016). Falls have been shown to be an independent predictor of admission to institutional long-term care (Tinetti et al., 1997). In the context of an ageing population, the issue of fall prevention is becoming particularly important.

One of the best-documented strategies for fall prevention is regular physical activity in the form of planned and structured exercise (Caspersen et al., 1985). Exercise programmes have a beneficial effect on key risk factors for falls, such as muscle strength, balance control and gait quality (Tinetti et al., 1988). People with reduced lower limb extensor strength have a significantly higher risk of falls in the home environment compared to those with better strength (Menant et al., 2017). In addition, gait disturbances double the risk of falling (Deandrea et al., 2010), and functional tests such as the Berg Balance Scale, Timed Up and Go, or the five-time chair rise test can identify individuals at increased risk of future falls (Lusardi et al., 2017).

Systematic reviews of studies have shown that physical exercise improves muscle strength (Liu et al., 2010), balance (Howe et al., 2011) and reduces fear of falling (Kendrick et al., 2014), which translates into a reduced risk of falls. Cochrane reviews confirm that exercise is one of the most effective and most frequently studied interventions for preventing falls in older people (Gillespie et al., 2012), and economic analyses indicate its significant impact on reducing the costs of possible treatment (Davis et al., 2010).

In recent years, there has been growing interest in exercises inspired by martial arts, adapted to the abilities and needs of older people. These forms, classified as three-dimensional (3D) exercises according to the ProFaNE classification (Lamb et al., 2011), combine elements of balance, coordination, strength, postural control and response to stability disturbances training. An additional advantage is learning how to react safely to loss of balance, including elements of safe falling, which can be important in reducing fall-related injuries.

Properly designed and supervised exercise programmes, including exercises derived from martial arts, can be performed both individually and in group classes, which show comparable effectiveness in reducing the risk of falls (Gillespie et al., 2012). However, it is important to emphasise the need to monitor adverse events, as balance exercises are associated with a temporary increase in the risk of loss of stability, especially in people at high risk of falls (Sherrington et al., 2017; Skelton et al., 2001).

Given that most fractures in older adults are directly related to falls, physical exercise – including martial arts-inspired training – has the potential not only to prevent falls, but also to reduce the risk of fractures and injuries (Gillespie et al., 2012; Robertson et al., 2002).

The aim of this publication is to present the importance of introducing physical activity through martial arts as a multidimensional strategy for preventing falls in older people, with particular emphasis on the mechanisms of their action, functional benefits and practical implications for health promotion and active ageing.

Hand-to-Hand Combat as Part of Physical Activity and Lifestyle

In the context of contemporary forms of physical activity, the concept of hand-to-hand combat encompasses both combat sports, characteristic mainly of Western culture, and martial arts, derived from Far Eastern traditions. Although they differ historically and culturally in terms of their origins, value systems and organisational forms, in practice they often overlap, using common movement components, defensive techniques, elements of physical training and psychological influences. In terms of health, hand-to-hand combat – understood as a consciously designed and socially accepted form of physical activity – can be an important element of a healthy lifestyle, provided that it meets the criteria of a balanced impact on all dimensions of health (Kruszewski, 2023).

An analysis of scientific literature indicates that hand-to-hand combat training, conducted in accordance with the principles of safety and adequacy of stimuli, promotes the development of a number of psychophysical characteristics, such as strength, endurance, coordination, reaction speed, concentration and the ability to cope with stress (Kruszewski et al., 2024). Of particular importance here is the fact that many martial arts systems are based on multi-plane movements, dynamic changes in body position and centre of gravity control, which makes them potentially useful in terms of injury and fall prevention.

The impact of selected, clearly defined martial arts systems – consistent with multidimensional health criteria – on personality development and character formation is widely described in the literature on sports pedagogy and educational psychology (Boguszewski et al., 2024). Contemporary research on combat sports and martial arts, conducted with a critical distance from their commercialisation and the phenomenon of neogladiatorism (Piepiora & Witkowski, 2020; Kalina & Kruszewski, 2023), emphasises their multidimensional impact on the body and mind, which places them

in an important trend in physical culture and sports philosophy (Gutmann, 1992).

From a public health perspective, hand-to-hand combat can therefore be seen not only as a form of sporting competition, but also as a tool for promoting a healthy lifestyle, active ageing and maintaining functional fitness throughout the life cycle. Its historical, cultural and health significance makes it an important area of interdisciplinary research, including sports science, medicine, gerontology, neurorehabilitation and social sciences.

Interventions Based on Forms of Hand-to-Hand Combat in Fall Prevention

Contemporary preventive medicine increasingly emphasises the importance of non-pharmacological interventions, including appropriately selected physical activity, as a key element in the prevention of chronic diseases, loss of independence and fall-related injuries. In this context, exercises inspired by martial arts fit into the model of primary, secondary and tertiary prevention, offering physical, cognitive and behavioural stimuli simultaneously.

A characteristic feature of many forms of hand-to-hand combat is the integration of motor and cognitive components, which makes them particularly valuable in preventing falls, which often occur in situations requiring simultaneous information processing, posture control and motor adaptation to changing environmental conditions.

Exercise forms inspired by selected hand-to-hand combat systems are increasingly being analysed as an effective tool for reducing the negative effects of unintentional falls, especially in the elderly population and patients with neurological diseases such as Parkinson's disease. Research indicates that an important predictor of falls is a deficit in the ability to perform cognitive and motor tasks simultaneously, including maintaining balance or gait while under cognitive load (Klimczak et al., 2024).

These difficulties are particularly acute in people with Parkinson's disease, which is associated with dysfunction of the basal ganglia responsible for automatic movement control, posture regulation and switching attention between tasks. Posture in patients with a history of falls deteriorates most significantly under dual-task conditions, confirming the key role of cognitive and motor integration in maintaining stability (Shearin et al., 2021; Staniszewski et al., 2025).

Specially designed exercise programmes, based on multi-segmental full-body movements characteristic of hand-to-hand combat systems, include tasks requiring rapid selection, sequencing and modification of motor programmes. These include postural transitions (e.g., from lying to standing), rolling, getting up from the ground, and elements of working in low positions. The inclusion of simplified boxing elements in memorised movement sequences promotes the development of the ability to quickly select and organise complex motor actions (Liang, 2025).

In addition, exercises such as lunges, changes of direction and agility tasks support adaptation to dynamic movement conditions, improving the ability to stop and initiate movement, modulate stride length and adjust locomotor

strategies (Domingos et al., 2019). These skills have a direct impact on reducing the risk of falls in everyday situations.

The Importance of Cognitive-Behavioural Stimuli and Learning of Safe Fall

The effectiveness of interventions based on hand-to-hand combat depends heavily on their adaptation to the somatic and intellectual development level of participants. The greater the recipient's ability to process and integrate cognitive stimuli, the greater the effectiveness of motor adaptation and reaction control in situations of postural destabilisation. Mastering the appropriate motor techniques, including elements of safe falling, enables a more conscious response even in conditions of sudden loss of balance.

The results of the study confirm with high certainty that exercise programmes significantly reduce both the frequency of falls and the number of people experiencing falls, regardless of the initial level of risk. At the same time, a comparative analysis of intervention types indicates that the effectiveness of exercise is not solely due to improved physical parameters, but largely to the quality of cognitive-behavioural stimuli generated during training (Shearin et al., 2021; Klimczak et al., 2024).

The strongest preventive effects were observed in balance and functional exercises. Their advantage over resistance training or walking programmes suggests that the key mechanism of action is learning adaptive strategies for responding to stability disturbances. Exercises of this type engage processes of attention, movement planning, prediction and rapid motor correction, which promotes improved sensory-motor integration and the ability to cope with sudden postural destabilisation (Domingos et al., 2019; Shearin et al., 2021). In contrast, interventions with low cognitive load, such as walking programmes or classic strength training, despite their beneficial effects on overall fitness, show limited transfer to real-life situations leading to falls.

Three-dimensional exercises, particularly Tai Chi, occupy an intermediate position between functional training and strictly fitness-oriented activities. Their effectiveness in reducing the number of people experiencing falls can be linked to the development of body awareness, postural control and fluidity of movement, but the lack of exposure to sudden balance disturbances may limit their impact on reducing the serious consequences of falls, such as fractures or hospitalisations (Gutmann, 1992; Domingos et al., 2019).

A significant limitation of most of the exercise programmes analysed is the lack of a component on learning how to fall safely. Despite a significant reduction in the frequency of falls, these events are not completely eliminated, and the data on injuries remain less clear. From the perspective of secondary and tertiary prevention, this indicates the need to supplement interventions with training in protective responses, muscle tension control and fall energy dissipation. Learning how to fall safely is a specific cognitive-behavioural stimulus that can reduce the severity of injuries even when the fall itself cannot be prevented (Kalina, 1997; Kalina et al., 2022).

According to the results of epidemiological studies and analyses of the effects of falls, learning safe falling techniques – regardless of age, gender or fitness level – is an important part of reducing the severity of injuries

(Kalina et al., 2022). In this context, the quality of cognitive and behavioural stimuli provided by the training and social environment, which shape motor response patterns and attitudes towards one's own body, plays a key role.

The importance of cognitive-behavioural stimuli is also emphasised by observations indicating that interventions are more effective when conducted by personnel with clinical and pedagogical competences. This suggests that not only the selection of exercises, but also the way they are taught, the degree of cognitive control and conscious processing of motor stimuli are important for preventive effects (Kruszewski, 2023; Kalina & Kruszewski, 2023).

In light of the above findings, it can be concluded that the effectiveness of exercises in fall prevention depends more on their cognitive and motor complexity than on the volume or intensity of the effort itself. Programmes that integrate balance exercises with elements of response to sudden destabilisation and safe falling techniques – including solutions inspired by appropriately modified elements of martial arts – may be a promising direction for the development of comprehensive interventions aimed at reducing both the frequency and consequences of falls in older people.

CONCLUSION

Scientific evidence clearly shows that physical exercise programmes significantly reduce the incidence of falls and the number of people experiencing falls in the elderly population, regardless of their initial risk level. Interventions focused on balance and functionality, especially those with high cognitive and motor complexity, are the most effective. This means that the reduction in fall risk is not solely due to improved strength or fitness, but largely to the quality of cognitive-behavioural stimuli that engage attention, postural control, spatial orientation and the ability to adapt to sudden disturbances in stability.

It is important to point out a significant gap in current fall prevention programmes, namely the marginalisation of learning of safe fall. Including this component can reduce the severity of injuries and the risk of fractures in situations where a fall is unavoidable. In this context, appropriately modified elements of combat sports and hand-to-hand combat systems – devoid of competition and injury – are a promising tool for supporting primary and secondary fall prevention. However, the effectiveness of such programmes depends on their competent implementation and individual adaptation to the capabilities of the participants.

Guidelines for Practice

- Fall prevention programmes should integrate balance exercises with cognitive tasks (dual-task).
- It is worth systematically introducing safe falling techniques as part of injury prevention.
- Elements of combat sports should be modified for safety, pace control and non-competitiveness.

- Interventions should be conducted by individuals with motor and pedagogical skills.
- It is recommended to individually scale the difficulty of exercises depending on age, fitness and comorbidities.

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