

# MANAGEMENT OF FRAILTY AT INDIVIDUAL LEVEL: NARRATIVE REVIEW OF PHYSICAL ACTIVITY FROM THE EUROPEAN PERSPECTIVE OF JOINT ACTION ON FRAILTY - JA ADVANTAGE

## MANAGEMENT KRHKOSTI NA RAVNI POSAMEZNIKA: PREGLED LITERATURE IZ EVROPSKE PERSPEKTIVE PROJEKTA SKUPNEGA UKREPANJA ADVANTAGE

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Review

### ABSTRACT

**Introduction:** This paper aimed to review the effect of physical activity and exercise in frail older persons. As the process which leads to frailty and disability can be slowed down or even completely reversed, it can be appropriate for early interventions.

### Keywords:

physical activity, exercise, frailty

**Methodology:** A literature search was conducted in the following databases: PubMed, Cochrane, Embase, Cinahl and UpToDate. The criterion in selecting the literature was that articles were published from 2002 to 2017. From 620,043 initial hits, 25 publications were selected.

**Results:** Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty.

**Conclusion:** Different exercise interventions in frail elderly persons can increase strength and power, improve balance and reduce fall incidence resulting in greater quality of life. From this perspective, physical exercise interventions should become daily routine in frail elderly persons.

### IZVLEČEK

**Uvod:** Namen tega prispevka je pregledati učinek fizične aktivnosti in telovadbe pri krhkih starostnikih. Ker se lahko proces, ki vodi h krhkosti in odvisnosti od drugih upočasni ali popolnoma zavre, je primeren za zgodnje intervencije.

### Ključne besede:

telesna aktivnost, vadba, krhkost

**Metode:** Za to raziskavo je bil uporabljen pregled literature v naslednjih podatkovnih bazah: PubMed, Cochrane, Embase, Cinahl in UpToDate. Vključitveni kriterij je bil objava člankov v letih 2002 do 2017. Od 620.043 zadetkov je bilo izbranih 25 publikacij.

**Rezultati:** Fizična aktivnost in vadba starejših krhkih oseb je učinkovita in relativno varna ter lahko odpravlja krhkost.

**Zaključki:** Različne vadbene intervencije pri krhkih starejših osebah lahko povečajo telesno moč, izboljšajo ravnotežje in zmanjšujejo nevarnost padcev, kar izboljšuje kakovost življenja. Iz te perspektive naj intervencije telesne aktivnosti postanejo del dnevne rutine starejših oseb.

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## 1 INTRODUCTION

Sedentary lifestyle is the sole most important factor in the development of chronic diseases (1). Sedentary behaviour has a strong negative impact on health outcomes among older adults, including higher risk of all-cause mortality, metabolic syndrome, high triglycerides, high blood pressure, overweight, abdominal obesity, mental disorders, etc. (2). Maintaining this lifestyle for years may accelerate some aspects of secondary ageing, such as speeding the reduction in bone mineral density, maximal oxygen consumption, and skeletal muscle strength and power (3), which are all used as determinants of frailty. In the elderly population, sedentary lifestyle is even more pronounced (4) which additionally increases the risk of becoming frail in older age.

The number of older persons is increasing, however, the number of the “oldest” old is rising even more rapidly. Older age is related to physical and cognitive decline, which contributes to an increased number of frail persons with increasing age (5). Frailty affects many domains including muscle strength, mobility, balance, endurance, co-ordination and, in general, there is a decrease in the level of physical and functional activity (6).

Reduced physical functioning is the most dominant sign of frailty (7, 8). The ageing associated loss of muscle mass seems to be one of the major causes for reduced physical abilities in older age and, consequently, disability and frailty (9). There are many influences contributing to this process, for example, motor neuron death, and hormonal and immunological changes as a normal part of ageing (10). On the other hand, there are additional behavioural influences such as poor nutrition and reduced physical activity that affect muscle mass reduction and are more pronounced with ageing. This is a very important observation since nutrition and physical activity can be changed by adopting an active and healthy lifestyle.

Frailty among older persons is a dynamic process (11). During the observed period (51 months), transitions to states of greater frailty were more common (rates up to 43.3%) than transitions to states of lesser frailty (rates up to 23.0%), and the probability of transitioning from being frail to non-frail was very low (rates between 0%-0.9%). With shorter observation intervals, the transition rates are even higher (12). Disability lasting only 1 or 2 months is strongly associated with the development of future disability and death (13). This strongly suggests that preventing frailty is a key factor for maintaining an active and healthy lifestyle in older age. However, even if frailty occurs, it can still be reversed. In the above-mentioned studies no specific treatments were performed to reverse frailty.

There is abundant evidence from prospective and clinical studies that physical activity not only delays but

also prevents or reverses frailty. For instance, a recent observational study (14) showed that physical activity might attenuate frailty. Mild physical activity was insufficient to significantly slow the progression of frailty, moderate physical activity reduced the progression of frailty in some age groups (particularly ages 65 and above) and vigorous activity significantly reduced the trajectory of frailty progression in all older adults.

A dose-response relationship has been shown in several studies. Higher cardiorespiratory fitness showed improved survival with higher function of metabolic equivalents (METs) across all age groups (15).

## 2 METHODS

Descriptive research methodology was used to review peer-reviewed medical literature. A narrative literature review was conducted as it enables the obtainment of data from various sources and ensures a holistic understanding of the research subject. The literature search was conducted using the following databases: PubMed, The Cochrane Library, Embase, UpToDate, Cumulative Index of Nursing and Allied Health Literature (CINAHL), by means of several combinations of selected search words in the English language and their synonyms were prepared and used with Boolean operators AND or: Frail Muscle strength \*() OR Frailty Activity \*() OR Elderly Exercise \*() OR Older adult Functional ability \*() OR Aged functional decline \*() OR Older person Mobility \*() OR Geriatric Disability \*() OR Inactivity Vulnerable Elderly \*() OR Physical activity Aged Function \*() OR Training Aged \*() OR Functional outcomes Geriatric \*() OR Physical interventions Vulnerable \*() OR Sports Older person \*() OR Patterns of activity Older adult \*() OR Leisure activity Elderly \*(); searching in title, key words and in abstract.

The selection criterion for articles to be included in the review was that they were published during the last 15 years, i.e. between 2002 and 2017. Key words were selected from a proposal of key words that was prepared by the task leader and the working group focusing on Physical activity as part of the European Commission project “Joint Action on Frailty prevention - JA ADVANTAGE”, Work Package 6 - Management of Frailty at Individual Level. Final paper selection was also performed by the working group focusing on Physical activity.

The inclusion criteria were based on scientific facts, contextual relevance and full-text availability. Articles regarding current policies and guidelines on frailty prevention in older people that were published in peer-reviewed scientific journals. Information from editorials, letters, interviews, posters and articles with no access to full text were not included in the study. The total number of all search results was 620,043. After excluding

duplicates and taking inclusion criteria into account, a total of 25 articles/sources remained for analysis (Table 1). Initial selection using database search engines was performed by the Joint Action Advantage Work package 6 working group (selection of 119 sources). Further selection and analysis was performed by authors.

The process of the Literature Review is displayed in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) diagram, as shown in Figure 1.

With our approach, we found papers of different evidence levels of research. Between selected papers of different evidence levels of research, we included 4 qualitative and 21 quantitative researches. Data synthesis was conducted using the descriptive method.

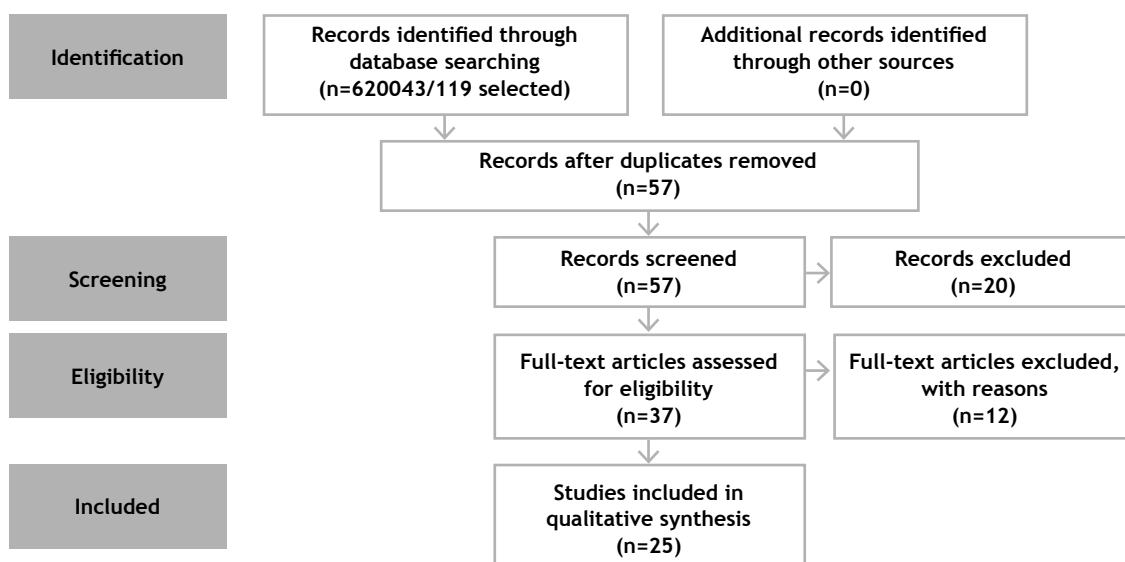


Figure 1. Flowchart of search strategy and literature selection process - PRISMA diagram.

### 3 RESULTS

Table 1. Search table.

	Key word	No. of hits	Chosen hits	Repeated chosen hits	Final selection
<b>PubMed</b>	Frail Muscle strength	627	16	6	1
	Frailty Activity	1261	12	1	1
	Elderly Exercise	119309	11	11	3
	Older adult Functional ability	57636	11	11	2
	Aged functional decline	6779	3	2	1
	Older person Mobility	4694	2	2	1
	Geriatric Disability	4277	4	4	1
	Inactivity Vulnerable Elderly	52	1	1	1
	Physical activity Aged Function	92075	14	11	2
	Training Aged	245729	16	10	3
	Functional outcomes Geriatric	1724	2	1	1
	Physical interventions Vulnerable	741	4	1	1
	Sports Older person	8246	4	4	1
	Patterns of activity Older adult	11744	6	6	1
	Leisure activity Elderly	54789	6	6	1
<b>Cochrane</b>	Frail Muscle strength	171	5	5	1
	Frailty Activity	186	0	0	0
	Elderly Exercise	2321			1
	Older adult Functional ability	229	0	0	0
	Aged functional decline	1279	0	0	0
<b>Embase</b>	Older person Mobility	328	0	0	0
	Geriatric Disability	511	0	0	0
	Inactivity vulnerable Elderly	9	0	0	0
	Physical activity Aged Function	791	0	0	0
<b>UpToDate</b>	Training Aged	2680	1	1	1
	Functional outcomes Geriatric	1180	0	0	0
	Physical interventions Vulnerable	101	0	0	0
	Sports Older person	483	0	0	0
<b>Cinahl</b>	Patterns of activity Older adult	47	1	1	1
	Leisure activity Elderly	30	0	0	0
	Frail Muscle strength	14	0	0	0
<b>Other sources</b>		620043	119		25

### 4 DISCUSSION

Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty. Most studies researched the effects of interventions on fall prevention and functional outcomes. Different exercise interventions in frail elderly persons can increase strength and power, have the potential to maintain or even slightly increase fat-free mass, and are effective in improving aerobic capacity and balance.

#### 4.1 Strength and Power

The main reason behind strength and power decline is sarcopenia, loss of muscle mass with age due to motor neuron death, immunological factors, hormonal change, increased sedentary lifestyle and malnutrition (10). Supervised centre-based interventions seem to be more effective than home ones in improving strength in frail older persons (16-19) but not in all examples (20-23).

An important parameter of strength gain is exercise load, i.e. intensity, usually expressed in % of 1RM (one repetition maximum). Siegrist et al. (23) reported no strength gains after 16 weeks of a supervised exercise training program (1 hour/week) with strength and power training, challenging balance and gait training with increasing, but in general low, levels of difficulty. Tai-chi based and low-level strength exercise programs (24) produced a small but significant improvement in strength. With fitness machines and loads of 60% of 1RM substantial strength improvements were obtained (about 20% in isometric exercises and about 100% in lifting weights). Similar effects were seen in a study by Binder et al. (17) with exercise loads of 70-80% of 1RM. In the oldest old persons, 70% of 1RM load managed to improve leg press strength by 20% after 8 weeks of hypertrophy type strength training. Weight training with loads between 60-80% of 1RM increases muscle mass even in very old persons (25). The gains in strength and muscle mass may be similar in young and older women (26). These results are consistent with findings in healthy older persons where greater loads are related to greater increases in strength and power parameters (27) supporting a dose-response relationship. Exercise interventions were of different durations, ranging from 8 weeks up to 2 years. Already the shortest trial duration was enough to increase strength (28).

One interesting exercise principle is integrating exercise into everyday routines; however, high levels of improvisation and motivation are required. Results from the LiFE project (20) showed a limited effect of this approach on strength improvement. Its major limitation seemed to be low exercise loads, as high loads were hard to achieve in everyday routines.

Amino acid supplementation (AAS) may promote muscle growth but does not necessarily improve strength and power in healthy older adults (29). In older sarcopenic women, knee strength was improved in the exercise + AAS group but not in the exercise only group (30). This implies that AAS may augment muscle strength in this population. In another study (31) supplementation with milk fat globule membrane had no effect on muscle mass and strength gains. Similarly, supplementing vitamin D did not show any effect on strength (32). Supplementation with iron, folate, vitamin B6 and B12, calcium and Vitamin D (33) showed no additional improvement in strength, however, it increased overall physical activity and energy.

#### 4.2 Endurance

Loss of aerobic capacity may be due to decreased muscle mass or lower cardiac output (35). Ehsani et al. (36) studied cardiovascular adaptation in older mild-to-moderate frail subjects after endurance exercise at 78% of peak heart rate. They found 14% increase in peak VO<sub>2</sub> after 9 months of intervention and that the main adaptation was increase

in heart rate and probably stroke volume. It is not possible to draw conclusions on the optimal regime to improve endurance and VO<sub>2</sub> max.

#### 4.3 Balance and Risk of Falling

Exercise programs are effective in reducing falls and fall-related injuries in healthy older persons (37, 38). El-Khoury et al. (39) showed that exercise can reduce fall risk (including for serious falls) by 19% in older women already at risk of falls. Similar results (22% reduction) were seen in a study by Lord et al. (40) where, in the group with a previous fall, the incidence was reduced by 31%. Tai-chi and low-level exercise (24) reduced fall incident rate ratio by 58% overall. In a study by Siegrist et al. (23), the fall incidence in the exercise group was roughly half compared to the control group which received no treatment. This shows that fall prevention interventions in frail older persons are effective, however, they generally have a smaller effect on fall prevention compared to healthy older persons (37). Additionally, exercise reduced fear of falling (23, 41). Faber et al. (22) showed that frail persons, compared to pre-frail, benefit more from exercise intervention in terms of fall reduction. The opposite was found for improving balance and mobility.

There is abundant evidence that exercise intervention improves balance in frail elderly persons (19, 20, 22-24, 36, 39, 41-43), even in very old persons. A combination of strength and balance training further improves balance outcomes (17, 42, 43, 45). When strength and balance were complemented with gait and functional exercises (23, 39, 42) no additional effect on balance outcomes was observed.

Lifestyle integrated exercise was similarly effective as structured strength and balance training in promoting balance (20). This makes it possible to integrate balance exercises into daily activities.

#### 4.4 Adverse Effects and Risks

Although exercise is generally safe for older people (46), this may not be valid for frail older persons. Some studies reported adverse effects, including falls during exercise sessions (36); groin strain and pelvic stress fracture (20); a wrist fracture, a twisted ankle, and two bruises (39); two reports of back pains (45); 9 (not identified) reported events related to intervention or testing (19); 23 reports of knee and back pain (32); 107 (5.0%) adverse events including IADL-ADL dependency, hospitalization or any fall (33); 11 reports of non-specified aches and pains (24). There was no pattern observed in adverse events related to interventions. However, there are some concerns that high-intensity exercise might pose a greater risk of injury than a program of lower intensity (32).

## 5 CONCLUSION

Physical activity and exercise in frail elderly are effective and relatively safe and may reverse frailty. Different exercise interventions in frail elderly persons can increase strength and power, have the potential to maintain or even slightly increase fat-free mass, are effective in improving aerobic capacity and balance, reduce fall incidence and improve quality of life. From this perspective, physical exercise interventions should become daily routine in frail elderly persons and supported by long-term care legislation.

The aim of this research was to present the results of a narrative literature review and data analysis focusing on physical activity in the context of managing frailty at an individual level. For the purposes of this research, a literature review method was used. The method proved to be appropriate and the aim was achieved.

## CONFLICTS OF INTEREST

None.

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## ETHICAL APPROVAL

Not applicable.

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