

Review on Effects of Regular Exercise on Prevention of Falls in the Elderly

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Abstract

Falls in the elderly are a public issue in China and even in the world. This paper gives a comprehensive review on study of falls among senior citizens over the past decades and recommends some sports for the elderly. Through such channels as CNKI and foreign database, the author has selected and read 43 papers regarding the effects of regular exercise on the falls in the elderly. By inputting key words “regular exercise” and “falls in the elderly”, the author has found 31,297 papers on regular exercise and 29,039 papers on falls in the elderly, and thus read 31 domestic papers, 18 Taiwanese papers, 1 foreign paper, and some latest papers. By making a summary of all the papers, this paper draws an important conclusion that regular exercise plays a positive role in prevention of falls in the elderly. We should actively explore fitness programs suitable for the elderly and guide them to do exercises on a regular basis. And the elderly are recommended to exercise Taijiquan, Mulan Quan, yoga, walking and race walking, Yijinjing, and social dance, and conduct aerobic exercise, balanced capacity and myodynamia training, vibration and aquatic training, which is of great significance in preventing falls in the elderly and improving their life quality. In view of this, this paper provides significant application and reference value for future research fellows and health care workers.

Keywords

Falls, Regular Exercise, Influence effect .

1. Introduction

Tumble is the greatest fear of the elderly, for it not only physically and psychologically does harm to the elderly, but also brings a heavy burden to families, society and medical system. From the perspective of families, falls in the elderly will cost families a lot in care and medical treatment, which will increase their financial burden and leave trauma on them. In terms of society, falls among older people will bring negative effects on society like change in demographic structure and condemn in moral conscience and other unhealthy social ethos, which are not conducive to social harmony. Furthermore, the cost in prevention of falls among older people will greatly improve, since the government has to make changes in policies, invest a large amount of money, and develop relevant technologies. Therefore, actively exploring the influence of regular exercise on falls in the elderly are of positive effects and targeted study and discussions based on different persons and various situations have important methodology significance. And we should find fitness programs suitable for the elderly to effectively improve their life quality and make them live independently and dignifiedly in the later years.

2. Status quo of falls in the elderly

2.1 Definition of Falls in the Elderly

Currently, there is no unified standard on definition of older people. As early as 1989, Xu Lizhong put forward that the age of the elderly should be defined from three respects: 1) physiological age; it is defined by the form and strength of the body based on natural inheritance and maintenance and health care in the later stage; 2) mental age; it refers to the difference in mental feeling and emotion, which influences one's confidence and perseverance in life and work; 3) social age; it refers to the age on the calendar and be it physical age or mental age, the one recognized by society shall prevail. According

to WHO, people aged 65 or older are defined as older people, but such a standard cannot be applicable to African countries where people aged 50 (55) or above are the elderly. However, people aged 60 or above are defined as older people by the United Nations.

Definition of falls in the elderly can basically fall into the following two types: 1) according to generalized definition, older people tumble accidentally not because of heavy blow or loss of consciousness or sudden stroke-like limb paralysis or epileptic seizure; 2) from the perspective of body structure and functions and balanced capacity, falls refer to the situation in which older people's arms, knees, hip or body touch or hit the ground and floor due to loss of balance.

2.2 Status Quo of Falls in the Elderly

Nowadays, China is faced with a tough situation in which the number of older people increases and many of them have few children. With the progress made in science and technology and improvement in medical conditions, people's life expectancy has risen and older people aged 65 or above are increasing. According to the definition of UNESCO, a society, in which older people aged 65 above account for 7% of the total population or people older than 60 make up more than 10% of the total, has stepped into the so-called aging society. In Taiwan region, aging society has officially come since 1993. According to the *Report on Development and Study of Aging population in China* issued in February 2009, China entered aging society in 1999 and it is also the country that has the largest population as well as aging population in the world. China's aging population makes up 11.7% of the total population if people aged above 60 are regarded as the elderly, from which we can see that China's aging phenomenon is serious. That will lead to a range of major issues related to older people. And families, society, medical treatment, and psychological guidance will meet with unprecedented challenges arising from falls of ever-increasing older people.

Falls in the elderly are a global concern. A report from Centers for Disease Control and Prevention suggested that annual incidence rate of falls among older people aged above 65 was 33%, of which, 16.5% of them would fall again. Among the elderly who fell, people aged above 80 accounted for 50%. The female, with incidence rate of falls of up to 50%, were twice more likely to fall than men, which was mainly because the former usually took care of the latter. Another report indicated that there were at least 20 million older people who suffered from 25 million falls every year and the direct medical cost incurred thereof was higher than RMB 5 billion and the social cost was about RMB 16-18 billion. Thus it can be seen that falls in the elderly are currently the most troublesome, serious, and complicated issues. In addition, falls, to some degree, may physiologically and psychologically do damage to the elderly and seriously influence their health and families, and social harmony. Physiologically, falls may make most of older people break bones and suffer from cerebral trauma, serious laceration, stroke and even cardiac sudden death, as well as lead to loss of independence in daily life. That will influence the life quality and add the risks of going long-term health care agencies. It has reported that falls rank the third place of unexpected injury in Taiwan and second in America. Falls and complication incurred therefrom make older people hardly bear the psychological strike. Also, psychological pain and shadow may result in the elderly's depression, phobia, abnormal cognitive functions, and impairment of balanced capacity and myodynamia. A great many older people are afraid of falling again after experiencing once and they lose confidence and are seemingly powerless, so they dare not to walk alone or get close to sports venues. In this way, the frequency of falls among older people may increase and they may age faster.

3. Regular Exercise's Effects on Prevention of Falls in the Elderly

Regular exercise does benefit the elderly, and correct regular exercise can not only reduce the diseases of older people, but also mitigate the aging process and prevent such diseases as high blood pressure, heart disease, acute disease, chronic disease, nephropathy, osteoporosis, and dementia resulting from lack of exercises. In fact, more than half of the aging processes arise from the lack of exercises. According to the suggestion from Centers for Disease Control and Prevention, regular exercise may delay aging process, prolong life span, reduce occurrence of cardiovascular diseases

(CVD), decline melancholy and worries, improve mental health, control weight, and promote the functions of bones, muscles, and joints as well as hand-eye coordination, and thus avoid falls. Through regular exercise, the elderly can avoid falls while boosting myodynamia and muscular endurance, promoting neural adaption, and improving balance and coordination ability. Researches showed that whether older people with favorable or weak functions, they can get improved in cardiorespiratory endurance, myodynamia and muscular endurance, flexibility, agility and balance and coordination, etc. In addition, regular exercise can improve balanced capacity and myodynamia to some extent. Aside from that, regular exercise (trainings in balance, resistance, flexibility, and aerobic exercise) can improve the elderly's abilities in balance, myodynamia, flexibility, and cardio-pulmonary functions. All told, regular exercise plays a positive role in prevention of falls in the elderly.

According to the study of Du Lijuan[1] et al., regular exercise can dramatically reduce the mortality and rehospitalization rate of patients suffering from chronic cardiac failure and older people doing regular exercise are 8.654 times and 3.590 times lower than those who have no exercise or irregular exercise in mortality and rehospitalization rate. In conclusion, studies revealed that regular exercise could not only exert positive effects on physical and psychological health of the elderly, but also reduce peripheral vascular resistance, increase blood flow volume of limb muscles, and improve skeletal muscle's abilities in uptake and utilization of oxygen. Besides, regular exercise can lower the activity of sympathetic nerve and renin-angiotensin system, alleviate left atrioventricular reconstruction, and reduce many hazards of cardiovascular system; for example, it can decrease blood pressure, lighten body mass, and improve insulin resistance conditions, in addition to controlling primary diseases of cardiac failure, etc.

Among the risk factors of falls amongst the elderly in numerous studies and discussions, reduction of compact bone substance and bone mass is the main reason leading to falls of older people. According to the results of random control test of Zhang Jian and Li Lei[2] on regular exercise's influence on older osteopenia women's bone mineral density (BMD) and maximum oxygen uptake in their early stage of menopause, regular exercise can not only effectively prevent osteoporosis and fracture, but also enhance BMD or reduce the loss of bone mass. Also, regular exercise can improve the maximum oxygen uptake, improve physical fitness (including control of body weight, improvement of cardio-pulmonary functions, and enhancement of myodynamia and body coordination abilities) and thus reduce the falls in the elderly. Wang Juan^[3,4] et al. indicated that regular exercise and aerobic endurance exercises can improve the elderly's cardio-pulmonary functions and inhibit the incidence rate and mortality of diabetics. Deficiency of cardiorespiratory endurance and illness are also important risk factors resulting in increase of falls in the elderly. Ai Xianli and Su Guanglu put forward that regular exercise is an important approach guaranteeing longevity of the elderly. According to Louis Ignarro, regular exercise can steadily and constantly produce sufficient nitric oxide, enabling the body to protect itself and to prevent CVD and other diseases. A follow-up survey that lasts 14 years from the University of Michigan Medical School suggested that regular exercise can have people's mortality drop by 38%, because it is the beginning of virtuous circle and can reduce weight, lower blood glucose and pressure and alleviate such diseases as CVD. To sum up, regular exercise plays a positive effect on prevention of falls in the elderly. Chen Xiaofang and Wang Guocheng et al. [5] pointed out that regular exercise could reduce high blood pressure, relieve the incidence rate of high blood pressure, and effectively prevent and influence the falls in the elderly. In the view of Yang Laibao[6], long-term regular exercise is conducive to improve the body shape of the aged, keep in shape, boost and improve cardio-pulmonary functions, reduce blood pressure and fat, delay angiosclerosis and atherosclerosis, enhance vital capacity, maintain the elasticity of lung tissue and thorax activity, and thus improve health and reduce diseases. In addition, regular exercise can better older people's immunologic functions and elevate the content of immune proteins. Doing exercises can also relax the elderly, make them adjust mentally and physically, delight themselves, and improve their happiness and life quality. Qin Lang[7] held that regular exercise had a positive influence on the body's BMD.

Reasons leading to falls in the elderly consist of intrinsic and extrinsic factors, of which, the former accounts for 56%-61% of the reasons resulting in falls of older people, so intrinsic factors are main reasons. Falls of the elderly can be mainly attributed to insufficient balanced capacity and myodynamia. Xia Wenxian, Cai Chongyan and Yan Ke'dian [8] proposed that regular exercise could strengthen balanced capacity and myodynamia, enhance the elderly's life quality, improve cardio-pulmonary functions and reduce falls.

Therefore, regular exercise can improve older people's physiological and psychological factors. From the perspective of physiological factors, regular exercise can increase balanced capacity and myodynamia, strengthen the locomotion stability and cardiorespiratory endurance, improve cognitive functions and sleep quality, delay aging, and thus improve older people's life quality. In addition, regular exercise is of positive significance for the elderly's physical fitness. Aside from that, it can reduce older people's psychological illness, alleviate melancholia, improve social communication abilities, lower the sense of fear, mitigate dysphoria and anxiety, and elevate life quality of the aged. In this way, the elderly can live optimistically and zealously in their later years.

4. Regular Exercise with Active Effects on Prevention of Falls in the Elderly

According to relevant studies [9, 10, 11, 12], regular exercise can delay aging and there are various sports and how to select those suitable for older people is also an important research subject. Given this, the following sports are recommended for the elderly:

4.1 Walking

Aerobic exercise can increase the hemoglobin in the body, enhance the immunity of body, prevent aging, strengthen the cerebral cortex's work efficiency and cardio-pulmonary functions, increase fat consumption, avoid arteriosclerosis, and lower the incidence rate of cardiovascular diseases, which all have been proved effective by domestic and overseas studies. For example, as one type of aerobic exercises, walking is suitable for the elderly and it can increase their balanced capacity and flexibility and thus improve the posture stability and decline the frequency of falls in the elderly. Proper walking can improve the cardio-pulmonary functions of female older people and it is a fitness program which is simple and easy to promote. In addition to that, regular walking can reduce blood pressure and increase cardiorespiratory fitness as well as decrease the occurrence rate of stroke.

4.2 Taijiquan

As an extremely widespread sport, Taijiquan conforms to the rule of physiology and is relaxed and gentle, so it is very suitable for the elderly to practice it frequently. In addition to strengthening cardio-pulmonary functions and increasing myodynamia, Taijiquan can benefit older people a lot. Many literature reveal that ^[13, 14] Taijiquan can improve the balanced capacity and prevent the falls and it also has the effect of slowing bone loss and improving bone health. Those who have practiced Taijiquan will have lower risks of fracture when falling down. This paper has consolidated results of relevant literatures and analytic investigation and provided effective methods in prevention of falls and fracture amongst older people. The findings of Chen Yu'lan et al. [15] showed that 30-minute participation in Taijiquan course twice a week in 3 months can remarkably help the female improve balanced capacity and body movement functions and reduce the fear of falls. Sports suitable for the elderly should feature weak impact force and stable amount of exercise and they should improve cardio-pulmonary functions, muscular endurance, flexibility, and balanced capacity, etc. In traditional sports, Taijiquan is recommended, for it has the said characteristics and lives up to the concept of modern equilibrium movement. Also, Taijiquan is free from the limit of time, weather, and space and there is no need to prepare equipment. It is so economical and convenient that it is worthy of promotion among the elderly.

4.3 Yoga

Yoga is suitable for modern people living a sedentary life. It can help improve such symptoms as poor physical appearance, overweight, reduction of physiological functions and immunity, backache, and

vertebra ache, in addition to relieving stress and stabilizing emotions. So, Yoga is a good choice for modern people who stay in high-pressure state for a long time. Studies revealed that sedentary older people have notably higher risks of falls than those who do exercises on a regular basis. Yoga can effectively reduce the frequency of falls in the elderly.

4.4 Yijinjing

Yijinjing is a classical method which improves physical strength and body functions through particular exercising ways. With profound history and numerous participants, Yijinjing is one of the important traditional bodybuilding and health maintenance methods in China and it plays a crucial role in Chinese gymnastic exercise. The movements of Yijinjing are integrated with a great many input elements in strengthening proprioception, vision and vestibular sensation, for example, coordination between head and eyes, change in supporting surface, and rise, fall, and shift of weight. Yijinjing is flexible in change and moderate in difficulty. Zhang Boxin^[16] held that Yijinjing could effectively elevate balanced capacities of the elderly and exercise of Yijinjing plays an important and positive role in delaying the decline of balanced capacities among older people. Meanwhile, Yijinjing provides a safe, simple and effective training method in prevention of falls in the elderly.

4.5 Mulan Quan

According to Yin Xiaowang and Li Hongming [17], Mulan Quan can effectively enhance older people's physical and psychological health, delight them physically and psychologically and improve interpersonal communications. The conclusions of control test indicated that Mulan Quan could invigorate physical conditions, elevate the body's disease resistance and improve subjective feeling of good health, making the elderly win favorable physical self-respect, general self-esteem and satisfaction of life.

4.6 Aerobic Dancing

Aerobic dancing refers to a multiple-combination aerobic exercise in which one dances rhythmically to music. The main reason why aerobic dancing can be widely promoted among general public is that it has the benefit of increasing physiological functions such as improvement of cardiovascular system functions and reduction of blood fat and fat density of the body. The studies of Du Jie et al. showed that [18] social dance and sports dance could delay the decline of static balance functions of female older people, enhance the control ability to static balance functions, increase myodynamia of lower limb, and effectively delay senescence and prevent falls in the elderly.

4.7 Vibration Training

Vibration training can greatly improve myodynamia and cardio-pulmonary functions, promote the reduction of sclerotin and prevention of falls, and play a positive role in prevention of osteoporosis. Studies suggested that vibration training cannot only prevent osteoporosis and falls in the elderly, but also improve myodynamia and balanced capacities which play an important role in falls among older people. Thus, studies on vibration training are of great significance in falls among older people. In future studies, vibration training will be frequently used to conduct exercise training and prevent falls in the elderly.

4.8 Exercises in Water

Exercises in water are an ideal exercise mode for the elderly, which can effectively improve balanced capacities and cardio-pulmonary functions. By doing so, the elderly can effectively get their sensibility trained and reduce the psychological fear. Exercises in water can reduce older people's injury resulting from falls. Studies show that energy consumed in exercises in water is almost the same as that consumed on the land, but pressure on joints in the water is higher than that on the land. Also, pressure on the heart in the water exercises is 8 times as high as that on the land. In this way, older people's myodynamia and heart can be effectively trained.

5. Conclusions

Falls in the elderly are beginnings of diseases and death. Currently, there is no study that can provide proper methods for prevention of falls among older people, but training of balanced capacity, gait exercises, and improvement and maintenance of muscle fitness can be conducive to reduce the risks of falls in the elderly. Developing the habit of regular exercise can also be helpful to improve older people's fitness, body functions, life quality and individual independence. Exercises suitable for the elderly should be simple, practical and feasible, and complicated plans and expensive facility and equipment should be avoided as much as possible. In addition, we should make efforts in studies on relevant mechanisms of falls in the elderly and scientifically guide them to participate in physical fitness activities, and thus improve their quality of life.

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