



Hot topics and frontier evolution of strength training for physical health in older adults research: a bibliometric mapping from 2012 to 2021

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Abstract. We investigated the hotspots and research trends of foreign strength training to provide a reference for the practice of strength training in China. Methods: Cite Space and VOSviewer software was used to visualize and analyze the research hotspots and cutting-edge areas of 4827 foreign papers in the field of strength training research from 2012 to 2021. The results show that in the past 10 years, the number of research articles has shown exponential growth, and the research field has gone through the initial germination, rapid development, and in recent years, the combination of sports science and medicine has been proposed, entering the stage of disciplinary integration and development. Secondly, the research focus of strength training on the health of the elderly is mainly concentrated on the methods of strength training for the elderly, the effects of chronic diseases in the elderly, and the factors affecting the health of the elderly. The methods of strength training for the elderly include resistance training, skeletal muscle strength training, and handgrip strength training; the chronic diseases of the elderly mainly include sarcopenia, hypertension, and diabetes mellitus; and the main factors affecting the health of the elderly are balance, accidental falls, and obesity.

Keywords: strength training; older adults; health field; frontier hot studies

1 INTRODUCTION

With the intensification of population aging, the number of older adults is also increasing. As a special group, the physical function and immune ability of older adults gradually decline with age, greatly affecting the quality of life of older adults. The report of the 20th National Congress of the Communist Party of China also mentioned the need

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A. Haldorai et al. (eds.), *Proceedings of the 2024 3rd International Conference on Artificial Intelligence, Internet and Digital Economy (ICAID 2024)*, Atlantis Highlights in Intelligent Systems 11,

https://doi.org/10.2991/978-94-6463-490-7_19

to build a strong sports country and a healthy China, and the need to thoroughly implement the people-centered development concept, continue to make efforts to provide for the elderly, and other aspects, as well as the implementation of the national strategy to actively respond to the aging of the population, and the development of old-age care and the elderly care industry. In recent years, under the influence of novel coronavirus, the elderly have become vulnerable to infection due to the decline of their resistance and immunity. Therefore, it is particularly important to improve the health of older adults. Strength quality is an important part of the physical quality of older adults, which can effectively enhance the body's sports ability, prevent muscle atrophy, reduce the risk of weakness, and also benefit some cognitive functions, especially in the aspect of executive function¹. Long-term strength training can effectively lower cholesterol, lower blood pressure, reduce the risk of coronary heart disease, improve the balance ability and exercise ability of older adults, reduce the injury caused by falls, and make them energetic².

To sum up, this paper summarizes the research literature on strength training to promote the health of older adults, reveals the frontier hot studies of strength training to promote the health of older adults, so that people can more intuitively understand the current research results and shortcomings of the field of strength training for older adults' physical health.

2 KEYWORD CO-OCCURRENCE ANALYSIS

Keywords are extracted from the core information of the document title and text and are the main content of the document research³. The steps of visual analysis are as follows: first, create a map database, then select the data source, import 4827 documents into VOSviewer software, select All keywords as the analysis type, and the minimum frequency of keyword co-occurrence is 10, with a total of 744 keywords. Click Visualization to generate a knowledge map.

From the keyword co-occurrence map in Figure 1, it is found that the higher the frequency of keywords, the larger the matching nodes, so it can be determined that there is a positive correlation between the two. The smaller the node area, the lower the word frequency of this keyword. It is concluded that node size is the decisive factor affecting the frequency of keywords. The words co-occurrence knowledge map can help us understand the research direction of strength training on the health of older adults as a whole, and its visual analysis is also of certain representative significance for grasping the focus and trend of strength training on the health of older adults as a whole.

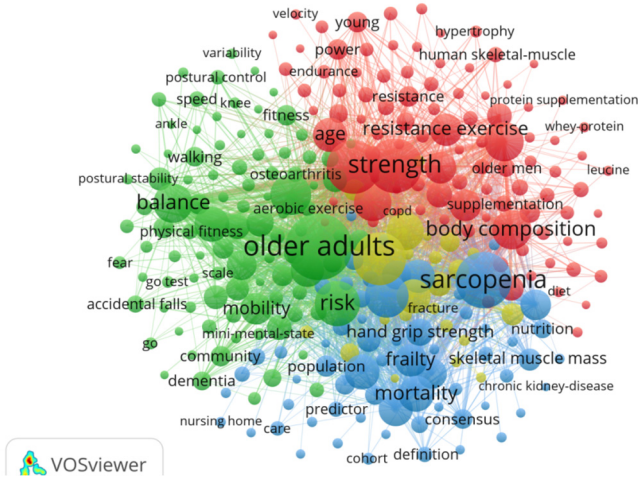


Fig. 1. Keywords co-occurrence map of strength training for older adults

The higher the frequency of the keywords, the higher the heat of the theme they represent, which is also the hot topic of strength training for older adults' health research. In this article, "older adults" has appeared 1720 times, which is the first high-frequency keyword. Because the theme of this article is to analyze older adults, the ranking is unquestionable. The second highest frequency keyword is sarcopenia, which has reached 1213 times, which fully shows the importance of sarcopenia symptoms in the older adult population and is also an important problem to be solved at present. Then comes strength, muscle strength, and exercise, with the frequency reaching more than 1000, which shows that strength training and exercise can play a certain role in the health of older adults.

Table 1. Top 10 keywords of strength training for older adult

| Serial number | Keyword | Frequency |
|---------------|------------------|-----------|
| 1 | older adults | 1720 |
| 2 | sarcopenia | 1213 |
| 3 | strength | 1143 |
| 4 | exercise | 1081 |
| 5 | muscle strength | 1042 |
| 6 | risk | 765 |
| 7 | healthy | 718 |
| 8 | performance | 634 |
| 9 | balance | 578 |
| 10 | body composition | 561 |

It can be seen from Table 1 and Figure 1 that the hot topics of strength training on the health of older adults can be roughly classified into three categories, namely, the methods of strength training for older adults, the impact of chronic diseases of older adults and the factors affecting the health of older adults.

3 METHODS OF STRENGTH TRAINING FOR OLDER ADULTS

Strength quality is an important part of the physical quality of older adults, and the method of strength training is the most important for older adults. In this cluster, resistance training, skeletal muscle strength training, and hand grip strength training are research hotspots. Resistance training is a process of increasing strength through resistance training. Resistance training for older adults also provides an effective solution to chronic diseases faced by clinical medicine. In 2020, many developed countries have recognized the impact of resistance training on the quality of life of older adults, and have published many relevant books. Skeletal muscle strength is the guarantee to maintain the basic activity ability of the human body, but it will degrade with the increase of age, and the degradation will be more obvious with the increase of age. After entering old age, the content of skeletal muscle decreases greatly, which directly affects the healthy life of older adults⁴. Therefore, older adults should strengthen the training of skeletal muscles to maintain muscle performance, slow down the decline, and improve the quality of life. Hand grip training is one of the main methods to test the strength of upper limbs, and is often used to test the strength of older adults. Many pieces of evidence show that the low grip strength of older adults is related to the incidence rate, falls, disability, and higher fracture rate⁵. In terms of grip strength training, intervention, and rehabilitation, many experts and scholars have also paid attention to it.

4 THE IMPACT OF CHRONIC DISEASES IN OLDER ADULTS

Chronic diseases have become a major public health problem that endangers national economic and social development, so it is necessary to understand the impact of chronic diseases on older adults. The chronic diseases mentioned in this cluster mainly focus on sarcopenia, hypertension, and diabetes. Sarcopenia generally refers to the symptom of decreased muscle content, which is mainly manifested in the decline of skeletal muscle quality and strength, and is positively related to the growth of age⁶. At present, many older adults people do not have a comprehensive understanding of the harm prevention and treatment of sarcopenia, but a large number of studies have shown that strength training can effectively reduce the harm of sarcopenia to older adults. Therefore, it is particularly important to strengthen the research and prevention of sarcopenia. Hypertension and diabetes are the most common chronic diseases of older adults, which bring many inconveniences to their daily lives. The research shows that the blood pressure of people who often take part in physical exercise is generally lower than that of people who do not take part in physical exercise. Low-intensity strength training can significantly reduce blood pressure in elderly hypertensive patients and is highly accepted by older adults⁷. Low-intensity strength training can speed up the metabolism of diabetes patients, help improve the control of blood sugar in diabetes patients, and enhance their insulin resistance.

5 FACTORS AFFECTING THE HEALTH OF OLDER ADULTS

Older adults have become the largest "health vulnerable" group at present, and there are many factors affecting the health of older adults. In this cluster, balance, accidental fall, and obesity are the main influencing factors. Balance ability refers to the ability to independently and timely adjust and maintain the body posture to maintain maximum stability when subjected to external forces. The most direct result of balance disorder is fall, and the probability of older adults falling will increase sharply, and the proportion of physiological tissue injury, fracture, and other injuries after falls will reach 52.6%⁸. For older adults, falling may lead to fractures, concussions, and other physical injuries, and serious cases may also lead to death, which will cause a great burden of disease on the family and society⁹. According to the research, long-term strength training for older adults can improve dynamic balance, enhance the ability to perceive the center of gravity and control the body, and reduce the probability of falling due to balance disorders.

6 FRONTIER ANALYSIS

The Strongest Citation Bursts represents the volatility of a topic in a certain period. The greater the prominence value, the higher the activity of the topic in this period, or the emerging trend of research¹⁰⁻¹³.

Citespace was used to analyze the keywords and draw a map (Figure 2). It can be seen from the map that the research field of strength training on the health of older adults was roughly divided into three stages: the first stage, 2012-2014, was mainly around the accidental fall of older adults, prevention, and randomized controlled trials, while the randomized controlled trials of older adults ran through the whole first stage. The second stage, 2014-2018, focuses on the health of older adults, double-blind test, functional ability, and meta-analysis. At this stage, the research on postmenopausal women is also mentioned. It can be seen that the depth of the integration of sports and medicine is increasing. In the third stage, 2018-2021, the research was carried out around the themes of osteoporosis, obesity, and resistance training for older adults. This shows that after the exploration of strength training on the health of older adults in the past years, we finally return to how strength training can solve the diseases of older adults.

Recent frontier hotspots and trends mainly focus on the analysis and research of strength training methods and solvable diseases that affect the health of older adults, which indicates that the research hotspots in the next few years may be based on different strength training methods to solve the chronic diseases of older adults, and jointly promote the physical health of older adults through different strength training methods and new medical technologies.

Top 20 Keywords with the Strongest Citation Bursts

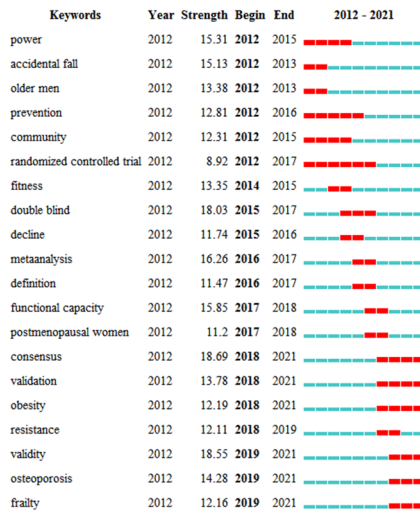


Fig. 2. Top 20 Keywords with the Strongest Citation Bursts

7 CONCLUSION

(1) In the past 10 years, the number of papers published on the research of strength training on the health of older adults has generally increased, and the policy of integration of sports science and medicine has been put forward in recent years. According to the trend curve, the research of strength training on the health of older adults will also continue to become a hot spot in the following years.

(2) The research focus of strength training on the health of older adults mainly focuses on the methods of strength training for older adults, the impact of chronic diseases on older adults, and the factors affecting the health of older adults. The methods of strength training for older adults include resistance training, skeletal muscle strength training, and hand grip strength training; The chronic diseases of older adults mainly include sarcopenia, hypertension, diabetes, etc; The main factors affecting the health of older adults are balance ability, accidental fall and obesity.

ACKNOWLEDGEMENT

This work was supported by The National Social Science Fund of China (No. 19BTQ074), Natural Science Foundation of Guangdong Province of China (No.2023A1515011435). Xinjin Fu And Xiaoqi Xu are corresponding authors. Xinjin Fu And Yao Wang have contributed equally to this work and share first authorship.

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